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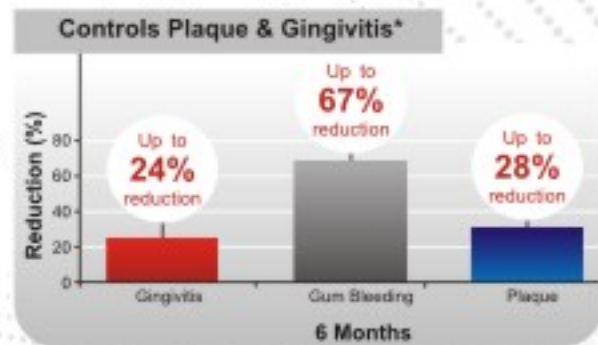


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* Vs a control mouth rinse, Donald R Allen et al, Compend, 19: 20-26, 1998.

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To Err is Human

We have tried our best in designing and printing to provide you correct information.
But any omission error is highly regretted.

-Printer

With the opening up of economy for different sectors, there has been a tremendous growth in education sector and especially medical education but as per Govt. figures the patient. Doctor ratio gap is still a matter of concern. The good news is that things are taking shape and Govt. has realized the importance of health and education as indicators of a healthy economy.

Doctors are one important agent through which that scientific understanding of the application of scientific knowledge to human health is expressed. The health system is undergoing enormous change. The entry of multiple health providers, the wish for more equal engagement between patients and professionals and the ever-greater contribution of science to advances in clinical practice all demand a clear statement of medicine's unifying purpose and doctor's common values. What is medical professionalism and does it matter to patients. The evidence is lacking that more robust professionalism will inevitably lead to better health outcomes, patients certainly understand the meaning of poor professionalism and associate it harmful to their interests.

Public health policies and organization are scarcely endorsed in locally generated clinical or public health knowledge. Postgraduate training programs, needed to increase the academic human resources with a consistent scientific potential. Recent governmental initiatives would certainly contribute to optimize and promote the revival of our impoverished scenarios in clinical research.



(Prof. Rajinder Singh Chuhan)
Director, IIHS/Dean-cum-Director
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On the quality front, Accreditation of degrees and institutions must acquire special relevance for the habilitation of professional practice, considering the proliferation of teaching institutions, the variety of training programs and the increasing amount of professionals requiring accreditation or revalidation of their titles.

Quality has a central role in medical care. The satisfaction of the rights of people to medical care, presupposes good quality medical acts. The meaning of quality goes further than a good attention based on scientific evidence and with competent skills. It comprises patient physician relationship where professional behavior is evaluated, based on the fundamental principles of bioethics. These principles sustain the measures to control quality of medical actions to comply with the rights of patients to have access to a good professional care.

A growing body of evidence suggests that the quality and safety of the clinical setting in which future physicians are trained reflect the quality of their future independent practice. Hospitals and other clinical settings currently publicly report hundreds of measures that demonstrate the quality and safety of their institutions and each teaching college / hospital must meet standards.

The conditions of medical practice are critical determinants for the future of professionalism. The doctors have a responsibility to act according to the values set by their professional medical ethics. Equally, other members of the healthcare team have a reciprocal duty to help create an organizational infrastructure to support doctors in the exercise of their professional responsibilities. Just as the patient doctor partnership is a pivotal therapeutic relationship in medicine.

There is every possibility that commercial interest of entrepreneurs may drive out the basis motto of this education system to a point where the medical education requires a consensus across the political spectrum as well. Any shifts in the status which makes direct client in entrepreneurs pocket will be bitterly opposed by the vested interests. But the government has the right to act as the acute shortage in human resources is the main barrier to achieving universal health coverage. The more the delay in addressing the critical challenges facing human resources for health on grounds of political expediency, the greater the social, political and financial costs this country will have to bear in the years ahead. Prudence lies in stemming the not by decisive action for the betterment of this medical education sector.

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A Comparative Study Of Retentive Strengths Of Zinc Phosphate, Resin Modified Gic And Adhesive Resin Cement With Stainless Steel Crowns - An In Vitro Study

Abstract

An in vitro study was conducted to compare the Retentive strengths of Zinc phosphate, Rely X Luting II (RMGIC) and Rely X ARC (Adhesive resin cement). Sixty freshly extracted human primary molars were selected for the study. Pretrimmed and Precontoured stainless steel crowns were adapted on these teeth. These teeth were divided into three groups of 20 teeth each. Out of 20 samples cemented with a particular cement group, 10 were kept in Artificial saliva for 1 day and the other 10 samples for 7 days. Thereafter the Retentive strength was tested in Instron Universal Testing Machine. The force required to dislodge the crowns was noted and was expressed in Newtons. The area was calculated by graphical method. The retentive strength values were calculated by the formula Force/Area. The readings were expressed in MPa's. The data was subjected to ANOVA Analysis of Variance and Student 't' test. The results showed that Group C cement Rely X ARC possessed the maximum strength followed in decreasing order by Rely X Luting II and Zinc phosphate cement both at 1 Day and 7 Days interval. It was seen that the duration of storage of samples in artificial saliva had an effect on the retentive strength of different cement. When 1day and 7 days results were compared only zinc phosphate cement had significant decrease in the retentive strength values. Among the other two cement groups Rely X Luting II and Rely X ARC showed no significant decrease in the retentive strength values. ARC can be recommended for cementation of stainless steel crowns.

Key Words

Stainless steel crowns, luting cements, retentive strength

Introduction

The restoration of grossly decayed primary and young permanent teeth has always remained a challenge for the dentist. This problem was overcome by Humphrey who introduced Stainless steel crown in 1950. They are considered superior to large multisurface amalgam restorations with respect to both life-span and replacement rate^[1]. The 8-year survival rate of 89% for stainless steel crowns is similar to the values of 88% reported by Messler and Levering^[12]. They have proved efficacious and are relatively easy to use. They have been used for restoring hypoplastic, endodontically treated, malformed teeth and fractured teeth to perform their normal function. The success of Stainless steel crown depends on the quality of the tooth preparation together with selection and adaptation of an appropriate crown and luting cement^{[18],[19],[9]}. The luting cements play an important role in the retention of Stainless steel crowns^{[19],[9]}.

A wide range of luting cements have been

used for cementing the stainless steel crowns in the past which includes Zinc Phosphate, Zinc Polycarboxylate and Glass Ionomer cement. In recent years newer classes of cements such as Resin Modified Glass Ionomer and Resins are formulated with adhesive properties. The addition of resin to the cement formulation has allowed light curing, a snap set and rapid strength development. In addition they have better physical and mechanical features than the conventional GICs^[17].

The present study aims to compare the mean retentive strengths of luting cements like Zinc Phosphate cement (Harvard), Resin Modified Glass Ionomer cements (Rely X Luting) and Adhesive resin cement (Rely X ARC) used for the cementation of stainless steel crowns.

Material and Methods

This study was undertaken in the Department of Pedodontics and Preventive Dentistry, Sardar Patel

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Institute of Dental and Medical Sciences, Lucknow in collaboration with the Department of Plastic and Composite Technology, Research Designs and Standard Organization, Lucknow using following materials and methods:

Methodology

A total of 60 extracted intact primary molars were selected for the study (12 maxillary primary first molars, 12 maxillary primary second molars, 12 mandibular primary first molars, 24 mandibular primary second molars).

The selected teeth were without caries or restorations and with root resorption rate lower than 2/3 rd. All the teeth were hand scaled and cleaned to remove debris. After that all the teeth were mounted in self-cure acrylic resin exposing complete crown.

The occlusal surfaces of the teeth were reduced uniformly to a depth of 1.0-1.5 mm with a 69 L and 169L bur. The mesial and the distal undercuts were removed with a tapering fissure diamond bur. All the sharp line angles were rounded.

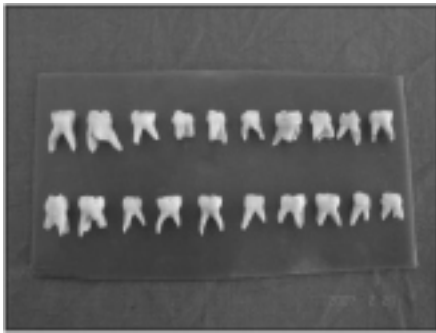


Figure 1: Sample Collected



Figure 4: Incubator

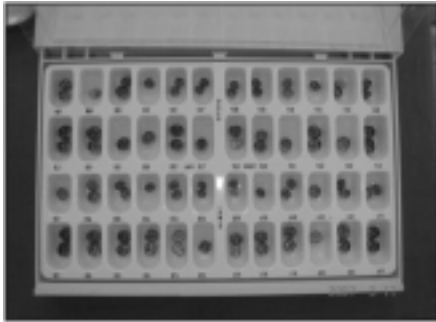


Figure 2: Stainless Steel Crowns (3M)

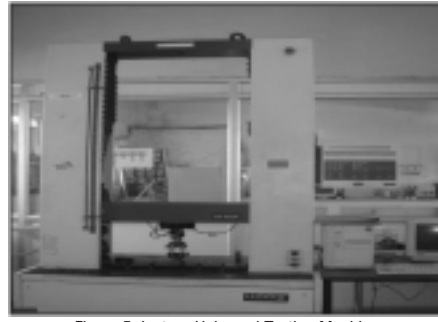


Figure 5: Instron Universal Testing Machine

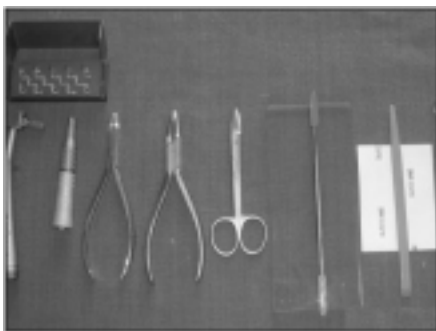


Figure 3: Armamentarium

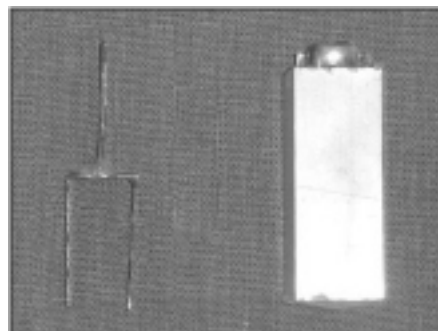


Figure 6: Specially Designed Apparatus

After that pre-trimmed and pre-contoured stainless steel crowns (3M ESPE Dental Co. St. Paul Mn) were adapted on the prepared teeth. The crowns had two opposing orthodontic attachments (Begg's Brackets) spot welded to facilitate its easy removal.

60 teeth were equally assigned to three groups of 20 teeth each.

Group A – Cementation with Zinc phosphate cement

Group B– Cementation with Resin modified glass ionomer cement

Group C – Cementation with Adhesive resin cement

All the teeth were rinsed with water and then dried. After mixing each cement, they were loaded into the crown and then

the crown was seated on the selected teeth with hand pressure. Excess cement was removed after 10 min the mixing began using hand instruments. After waiting for 10 min all the samples were transferred to artificial saliva in an Incubator at 37° C. Half of the specimens from each group were stored in artificial saliva for 1 day and another half for 7 days.

The Retentive strength was tested after 1 day and 7 days using an Instron Universal Testing Machine (Figure) in tensile mode. Each mounted tooth was clamped to the inferior vise grip of the UTM (Figure). A specially designed apparatus was attached to the superior grip of the universal testing machine to remove the cemented crowns.

Applied force was directed parallel to the long axis of the tooth during crown removal. The load was applied from zero

and then gradually increased. The force required to initially dislodge the crown was used as a measure of cement retention. Cross head speed of Instron was 0.05 inch/ min. Retentive strength values were recorded and expressed in terms of MPa which was calculated as:

$$\text{Retentive strength} = \frac{\text{Force}}{\text{Surface Area}}$$

The surface areas of crowns have been determined by cut opening the crowns and developing their surfaces on graph papers. The areas of these developed surfaces have been determined by counting the number of squares on the graph sheet.

Results

The aim of the present study was to compare the retentive strengths of different luting agents and to know the effect of storage of samples in artificial saliva on the retentive strength of different luting cements.

ANOVA analysis of variance was used to compare the retentive strengths among different groups. Student 't' test was used to compare the retentive strengths among same groups at different time intervals. The ANOVA analysis revealed that there were significant differences in the retentive strengths of different cement groups.

The Retentive strength values of Zinc Phosphate cement, Rely X Luting II cement and Rely X ARC when tested at 1 day interval ranged from 1.8 – 2.6 MPa, 4.8 – 5.4 MPa and 7.5 – 8.6 MPa respectively.

The retentive strengths values of Zinc phosphate cement, Rely X Luting II and Rely X ARC when tested after 7 days interval ranged from 1.7 – 2.3 MPa, 4.8 – 5.3 MPa and 7.5 – 8.5 MPa respectively. The results showed that there was a significant decrease in the retentive strength values of zinc phosphate cement after 7 days of storage in artificial saliva (Table-6 & Bar Graph-6). The decrease in the retentive strength values of Rely X luting II and Rely X ARC after 7 days of storage were not significant.

Discussion

The introduction of Stainless steel crowns was a major breakthrough in the

Table – 1 Retentive Strengths Of Different Groups At 1 Day And 7 Days Interval Inmpa

Samples	Group A (ZnPO4)		Group B (Rely X Luting)		Group C (Rely X ARC)	
	1 Day	7 Days	1 Day	7 Days	1 Day	7 Days
1.	2.2	2.1	5.1	5.0	8.2	8.0
2.	1.8	1.7	5.3	5.2	7.9	7.8
3.	2.1	1.9	4.8	4.8	7.5	7.5
4.	2.6	2.3	5.4	5.3	8.4	8.2
5.	1.9	1.8	5.1	5.1	8.6	8.5
6.	2.2	1.9	4.9	4.9	7.9	7.8
7.	2.3	2.0	5.4	5.3	8.4	8.3
8.	1.9	1.8	5.2	5.2	7.7	7.6
9.	2.3	2.0	4.9	4.9	8.0	7.8
10.	2.1	1.8	5.0	4.9	8.2	8.1
Mean	2.14	1.93	5.11	5.06	8.08	7.96
S.D	0.2366	0.1769	0.2132	0.1838	0.3425	0.3167

Table – 2 Analysis Of Variance Among Different Groups At 1 Day Interval. Anova Table For Retentive Strength At 1 - Day

Source of Variation	Degree of the Freedom	Sum of Square	Mean sum of Squares	Variance Ratio
Between the groups	2	176.418	88.209	F=1209.51
Within the Groups	27	1.969	0.079	P< 0.001
Total	29	178.387		

Table – 3 Analysis Of Variance Among Different Group At 7 - Days Interval. Anova Table For Retentive Strength At 7 Days Interval

Source of Variation	Degree of the Freedom	Sum of Square	Mean sum of Squares	Variance Ratio
Between the groups	2	181.893	90.946	F=1653.6
Within the Groups	27	1.489	0.055	P< 0.001
Total	29	183.382		

field of pediatric restorative dentistry. Its use has provided an effective and practical method of restoring teeth that otherwise could not have been retained. Many investigators have reported that stainless steel crowns are the most effective solution in restorations of primary molars with three or more caries affected surfaces^{[13],[11],[11]}.

The retention required for the clinical success of a stainless steel crown is unknown. It has been suggested by many clinicians that dental cement alone is responsible for the retention of stainless steel crowns on primary molars^{[9],[19]}. Others believe that the significant retentive feature is the close adaptation of the metal crown margin to the tooth surfaces in the undercut areas of the prepared teeth^{[5],[2],[14]}.

Traditionally Zinc phosphate cement was used for luting stainless steel crowns. It is not an adhesive cement and has limited mechanical properties. Its retention is purely mechanical in nature. The mixing

technique is critical in developing the optimal cement because the strength is almost linearly dependent on the powder liquid ratio. Pulp reactions to zinc phosphate have also been reported. This cement has been historically successful but clinical failures are often evident. So there was a need to select stronger luting agent than zinc phosphate cement.

Then emerged the era of Zinc polycarboxylate and Glass ionomer cements. These cements adhere chemically to tooth enamel and dentin as well as to stainless steel^{[6],[10]}. Conventional luting GICs have shown satisfactory results^{[3],[4]}. The main advantage of glass ionomer cement is that they release fluoride from the set cement^[15]. The fluoride can be eluted as a simple ion or as a complex such as fluorophosphates and is considered to be of clinical benefit^[20]. Two inherent drawbacks of Glass ionomer cements viz. Moisture sensitivity and low early strength are the result of slow acid-base setting reactions^[16]. Therefore these cements are more susceptible to hydrolytic degradation. Isolation and protection of unset cement may be more critical. So polymerizable functional groups can be added to GICs to impart rapid curing when activated by light or chemicals to overcome these two drawbacks.

Today materials which are gaining popularity include the Resin modified glass ionomer cements (Hybrid Ionomers), the Compomers and the Adhesive resin cements. Due to the importance of this research area and the scarcity of studies that evaluate the clinical success of these newer materials with stainless steel crowns, the purpose of the present study was to compare the retentive strengths of these newer adhesive cements with that of the conventional zinc phosphate cement. Primary molars were selected for the study as stainless steel crowns are more widely used in primary molars to prevent premature tooth loss and development of further malocclusion.

Pretrimmed and precontoured stainless steel crowns were used in this study to standardize the surface area of the crowns as in case of other type of crowns trimming is necessary which gives an intra clinician variation in surface area.

Instron Universal Testing Machine (UTM) was used in this study to measure the retentive strength of the cements because of its easy availability. Instron Tensometer and Hounsfield tensometer can also be used to measure the retentive strength of cements. The specimens were stored in prepared artificial saliva because it simulates human saliva.

The present study reveals that there was a statistically significant difference between the retentive strengths of three different groups of luting agents. The Adhesive resin cement Rely X ARC (Group C) possessed the maximum value of retentive strength followed by RMGIC Rely X Luting II (Group B) cement and zinc phosphate cement (Group C).

The adhesive cements do not have a long clinical track record as zinc phosphate cement. There are very few studies that have compared these new classes of adhesive cements. They were selected for the present study because they are relatively newer in the field of Pedodontics, although they have been used more widely in fixed prosthodontics.

To improve the physical and mechanical features of conventional GICs, RMGICs combining both the resin and glass ionomer technologies have been developed. These RMGICs harden by an acid-base reaction between fluoroaluminosilicate glass powder and an aqueous solution of polyalkenoic acids. These materials have early moisture sensitivity which has been related to the presence of poly HEMA and unconverted monomer in the set cement^[7]. One noted change from conventional GICs is the improvement of translucency because the inclusion of monomer brings the refractive index of the liquid close to that of the particle. In vitro testing of RMGIC indicates a fluoride release at the same level as conventional GICs.

The mechanism of bonding to tooth structure is the same as that of conventional GICs. These have greater compressive and diametrical strengths as compared to zinc phosphate cement and Glass ionomer cements^[60]. This increase in strength is mainly attributable to their lower elastic modulus and the greater amount of plastic deformation that can be sustained before fracture occurs. The retentive strength values of RMGIC were

significantly higher than zinc phosphate cement both at 1 day and 7 days interval.

Besides RMGIC, another class of luting agent used in this study was Adhesive Resin cement (Rely X ARC) which is a dual cure adhesive resin cement. Resin cements are essentially flowable composites of low viscosity. The dual cure cements are two-component systems and require mixing in a manner similar to that used for chemically activated systems. Chemical activation is very slow and provides extended working time until the cement is exposed to the curing light, at which point the cement hardens rapidly.

Some advantages of resin cements are insolubility in the oral environment, adequate consistency and film thickness, superior mechanical properties^{[18],[21]}, optimal bonding to dental structures and restoring materials by adhesive systems and reduced micro-leakage. These cements exhibit highest retentive strength values.

In the present study Rely X ARC i.e. Group C cement possessed the maximum retentive strength values when compared to Group B cement RMGIC and Group A cement Zinc phosphate both at 1 day and 7 days interval. Similar results were observed by William D Browning et al.

Another important point of discussion is the effect of duration of storage of teeth samples in artificial saliva on the retentive strength of different luting cements.

When the 1 day and 7 days results were compared, only zinc phosphate cement had significant decrease in the retentive strength values. Among the other cements i.e. Rely X luting and Rely X ARC no statistically significant differences ($p < 0.05$) were established using the student 't' test. This can be

explained on the basis that the solubility of zinc phosphate cement in saliva and other oral fluids is more as compared to other materials. So its strength decreased after a storage period of 7 days in artificial saliva.

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Oral Health Status And Treatment Needs Among Apple Farm Workers In Shimla (Rural), Himachal Pradesh

Abstract

Introduction: Fruits like apples and pears, blueberries, mango, cantaloupe, and banana are all fibrous in nature, but among them apples have been regarded as nature's toothbrush. They are assumed to be good for dental health as they have condensed tannins that may help prevent periodontal or gum disease. These seasonal fruits are picked by the farmers, who remain one of the most economically disadvantaged working people. In spite of this, they might have good oral hygiene, due to the fact they consume a lot of apples during the picking season.

Objective: The objective of the study was to assess the oral health status and treatment needs of apple orchard workers in Shimla District (Rural)

Methodology: Data was collected from 900 farmers, working in the apple orchards, by using a specially prepared proforma, WHO 1997 'Oral health Assessment Form' and Silness and Loe plaque index.

Result: Subjects with bleeding, calculus were 6.6%; 65.4% respectively; subjects with shallow pockets (4-5mm) were 22.4% and with deep pockets (> 6mm) were 2.0%. The mean number of decayed permanent teeth per person was 5.01+ 3.31. The plaque score for this study population was 0.9.

Conclusion: The findings of this study clearly indicate the relatively low prevalence of severe form of periodontal disease, high prevalence of dental caries, and good plaque score among this population.

Key Words

Apple Orchard Workers, Farmers, Migrant Workers, Periodontal Disease, Oral Health, Fibrous Fruits, Apples

Introduction:

Every human in this world wants to lead a healthy life. The amount of well being which an individual enjoys is governed by the standard of living which includes income, occupation, and sanitation, and education, level of provision of health, recreation and nutrition.^[1]

Throughout life, nutrition and oral health are interdependent. Nutrition plays two quite different roles in oral health, i.e. protective and preventive. The preventive effect of food has been recognized since the 18th century when James Lind advocated the intake of fresh fruits and vegetables for the prevention of scurvy.^[1]

Apples, pears, mango, banana and cantaloupe are all examples of fibrous fruits and can have a beneficial effect on both general and oral health.^[2] Apples have been regarded as nature's tooth brush as they are likely to contain condensed tannins which have anti-adhesion properties that may help prevent periodontal or gum disease

because they inhibit some bacteria from bonding to each other and producing dental plaque.^[3]

Most of the farmers and migrant workers help in the harvesting of apples during the picking season in Himachal Pradesh, as its geographical location favors its cultivation.^{[4],[5]} Despite the fact that they help reach apples in different parts of the country, they remain one of the poorest, most economically disadvantaged working people throughout the world. In spite of being struck with Poverty and not having access to information that could prevent oral health problems, these farmers might still be seen with good oral hygiene. This could be due to the fact that they consume a lot of apples during the picking season.^[6]

Till date very few studies are available on the oral health status of the farmers working in apple orchards and the literature available on the other farm workers in different parts of the world show high level of untreated dental

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caries, missing teeth and gingivitis.^[6] Hence this study was taken up to assess the oral health status and the treatment needs of farmers working in the apple orchards of Shimla.

Materials And Methods:

After getting the ethical clearance from review board of The Oxford College and permission from Panchayat or village head and owner of the orchards a pilot study was conducted to estimate the sample size and to identify any organizational and technical problems. The sample size was derived with the help of the following formula:

$$n = \frac{2pq}{E^2}$$

If $p = 18\%$, $q = 82\%$, $E = 3.6$, then by applying the above formula, the sample size was 892. This was rounded off to 900. Himachal Pradesh has a total of 113357 apple orchards, out of which 44251 are in Shimla. As each orchard had 2 permanent workers, 450 apple orchards were selected.

Before the start of the study, the investigator was standardized and calibrated in the department of Public Health Dentistry, first by practicing the on a group of 10 subjects with a the full range of conditions expected to be assessed in the survey. The result so

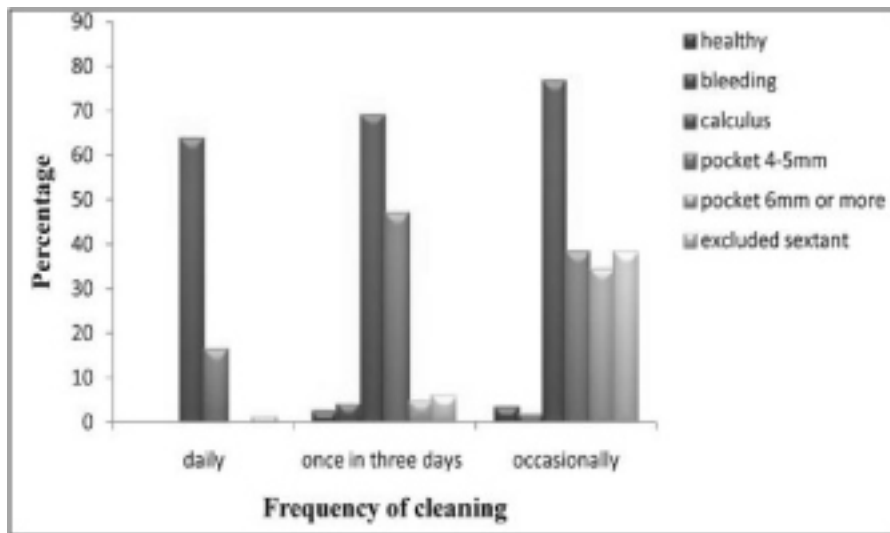


Figure 1: Distribution Of Study Population According To CPI And Frequency Of Cleaning

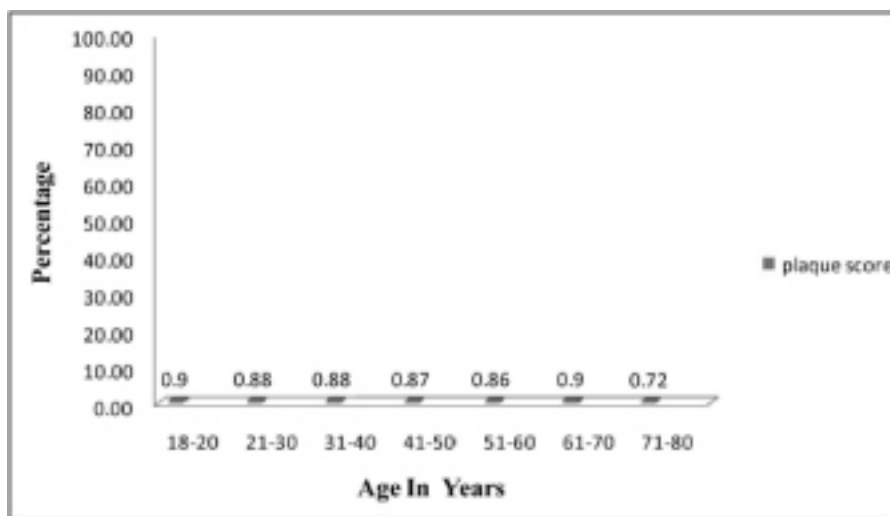


Figure 2: Distribution Of Population According To Plaque Score

obtained was subjected to kappa statistics. The Kappa co-efficient value (0.80) showed substantial agreement for intra-examiner reliability.

The subjects who were permanent workers in the orchards and gave consent were invited to take part in the study. The farmers who were suffering from systemic problem or were under medication which could affect the oral health were excluded from the study. The data was collected with help of specially prepared proforma (demographic details, personal habits, oral hygiene, dietary practices and plaque index by Silness P. and Loe H.) and WHO 1997 proforma. The study was systematically scheduled to spread over a period of 2 month. A weekly and monthly schedule was prepared well in advance and on an average 20 subjects were examined per day

The examination was carried under natural light in the apple orchards with the subjects sitting comfortably on an ordinary chair with back rest and with the examiner standing behind or at the side of the chair. The recorder was made to sit close to the examiner so that instructions and codes could be easily heard and the examiner could see that the findings were being recorded correctly. Any dental observations requiring treatment were informed to the subjects and proper disinfection of the instruments were done after clinical examination.

Statistical Procedure:

Analysis of the data was done according to the guidelines given by WHO oral health surveys, basic methods. Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD and results on categorical measurements are presented

Table 1: Distribution Of Study Population According To Of Prevalence Of Caries And Consumption Of Apples Per Day During Picking Season

Consumption Of Apples /Day	Number Of Subjects (n=900)	Number Of Subjects With Caries	Prevalence
None	-	-	-
1-4	717	707	98.6
5-8	175	175	100.0
>8	8	8	100.0

Table 2: Distribution Of Study Population According To Prevalence Of Leukoplakia And Duration Of Use Of Tobacco Products

Smoking Tobacco Duration	Number (N=271)	Prevalence Of Leukoplakia	%
<10 Years	52	0	0.0
10-19 Years	93	4	4.3
20-29 Years	66	26	39.4
30-39 Years	39	18	46.2
40 Or More	21	13	61.9

Table 3: Distribution Of Study Population According To Prevalence Of Leukoplakia With Frequency Of Tobacco Products

Frequency	Number (n=271)	Prevalence Of Leukoplakia	%
<10	210	11	5.2
10-19	6	2	33.3
20-29	27	23	85.2
30-39	23	22	95.6
40 or more	4	3	75.0

in Number (%). The Statistical software namely SPSS 15.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data. Microsoft word and Excel have been used to generate graphs, tables etc.

Result:

The total study population was 900, comprising of 660 males and 240 females in the age group of 18-80 years with the mean age of 41.91 ± 12.94 .

64 subjects (7.1%) belonged to lower and 836 (92.9%) belonged to upper lower socioeconomic class.

Out of the total population around 399 subjects (44.3%) had visited the dentist and 501 subjects (55.7%) had never visited a dentist.

The number and percentage of subjects with healthy oral mucosa were found to be 794 (88.2%); subjects with leukoplakia were found to be 80(8.8%), ulceration 15(1.6%) and 11(1.2%) other condition. Leukoplakia was mainly found on the buccal mucosa with one

having on the hard palate.

The mean number of sextant with healthy periodontal tissue was found to be 0.25 ± 0.95 , that of bleeding 0.28 ± 0.90 , calculus 4.69 ± 1.99 , shallow pockets (4-5mm) 0.31 ± 0.63 and deep pockets (>6mm) 0.02 ± 0.15 .

The mean number of sextant with the loss of attachment by score is as follows: loss of attachment 0-3 mm was 4.99 ± 1.88 , 4-5mm was 0.34 ± 0.8 , 6-8mm was 0.04 ± 0.25 and 9-11mm was 0.001 ± 0.03 .

The mean number of decayed permanent teeth per person was 5.01 ± 3.31 . The mean number of filled and missing permanent teeth per person was 1.48 ± 2.95 and 0.03 ± 0.26 .

Treatment needs among workers showed that 31.9% of the subjects needed one surface filling, 12.4% of the subjects needed two surface filling, 4.4% of the subjects needed pulp care and restoration 9.6% of the subjects needed extraction and 40.4% of the subjects needed some other care.

Number and percentage of subjects requiring prosthesis, by type of prosthesis and by jaw shows that 119 (13.2%) and 105(11.6%) needed one unit prosthesis, 141(15.6%) and 121(13.4%) needed multi unit prosthesis, 49(5.4%) and 40(4.4%) needed a combination of one or multiple prosthesis and 35(3.8%) and 33(3.6%) needed full prosthesis in the upper and lower jaw respectively.

Percentage of subjects with crowding, spacing, and diastema 9.4 %, 6.1 %, 3.0 % and anterior maxillary or mandibular irregularities was, 8.6% and 6.0% respectively 85% of the subjects had no abnormality or minor malocclusion, which need no or slight treatment .

The information regarding their usage of oral hygiene aids showed that 88.5% of the subjects cleaned their teeth with the help of toothbrush and dentifrice. 5.6% used to clean their teeth with finger and walnut leaves or tooth powder while 5.9% used to clean it with timber stick.

Subjects with good oral hygiene recorded low CPI scores and comparatively less loss of attachment Figure 1 represents the loss of attachment according to the frequency of cleaning.

The plaque scores of the whole group was 0.9, which was a good score. **Figure 2** shows the distribution of the population according to the plaque score

Persons who use to brush their teeth daily had a mean DMFT score of 5.32 ± 3.93 and the persons who used to brush the teeth once in three days and occasionally had mean DMFT score of 10.27 ± 5.90 and 17.12 ± 8.47 .

The prevalence of caries with respect to the consumption of apples is presented in **Table 1**. It was seen that the prevalence of caries increased as the consumption of apples increased per day.

The prevalence of leukoplakia showed a linear relationship with the duration and frequency of the use of smoking tobacco. **Table 2 and 3** presents the distribution of study population having leukoplakia along with the usage of tobacco products.

Discussion:

Apples are one of the most popular fruits in the world. Almost 92000 hectares of land in the state Himachal Pradesh) is under apple production, producing 40,000 metric tonesapples per year and involving 80% of the people in the state directly or indirectly with this business In spite the hard work the apple farm workers put to cultivate them, they remain the most disadvantage group due to there low wages. Upon this they have very limited access to the health services which make them a highly vulnerable to various diseases.

Till date very few studies are available on the oral health status of the farm workers working in apple orchards, so the present study was compared with the available literature and data available from the National Oral Health Survey & Fluoride mapping 2002-2003 of Himachal Pradesh State (Rural)

Out of the total sample 55.7% had never visited the dentist. They made the minimal utilization of Preventive services and health education and visited the dentist only in case of emergency. This result was similar to the study conducted by George M. in the Puerto Rican migrant workers.^[7] The various obstacles which prevented them to seek dental care were availability of appointments, transportation.

The study population used to consume 1-8 apples during the picking season, which was similar to the study conducted by the South Africian researchers amongst the apple, grape and grain farm workers. They were seen to consume around 8 apples and 8 bunch of grapes daily during the picking season.^[9]

Timber sticks and walnut leaves were mostly used by the old people, while the tooth brush and paste were used by the younger generation. This showed that there is a tremendous increase in the modernization of the rural people who are leaving their traditional ways to just move with the society.

Concerning the prevalence of leukoplakia, 80 subjects had leukoplakia on the buccal mucosa and 1 person had it on the hard palate. The subjects who had signs of leukoplakia used to consume large amount of tobacco in form of cigarette and bidi. But interestingly no body in the study population showed any signs of oral cancer. This may be due to the fact that Quercetine in apples help to reduce the risk of cancer. This finding is in contrast to the findings observed in the National Oral Health survey conducted in the year 2002 were 2% of the subjects in the age group of 65- 74 years had oral cancer.^[8]

The present study shows that 73.4% of the male had various form of periodontal disease as compared to 98.8% in females. These findings were different from the results recorded by Bagramin RA in Amish population were men had high prevalence of periodontal disease.[10] In the present study only 65.4% of the subjects had calculus which was comparatively low when compared to the study conducted by Bagramin RA, where 84% of the subjects had calculus.^[10] This finding was also less when compared to the National Oral Health Survey conducted in Himachal Pradesh, where 89.9% of the subjects had calculus.^[8]

When the pocket depth were recorded it was seen that 22.4 % of the subjects had 4-5mm pocket depth 2.0% of the subjects had pocket depth upto 6 mm or more. This findings were comparatively low when compared to the study conducted by Bagramian RA in an Amish population were 97% of the Amish had pocket depth equal to or greater than 4 mm and 27% of the subjects had pocket

depth about 6mm and more.^[27] The various pocket depths recordings in the present study was also less when compared to the National Oral Health Survey, 39.3% of the subjects had 4-5mm pocket depth and 28.0% of the subjects had pocket depth upto 6 mm or more.^[8] In the present study 18.8% subjects had 4-5 mm loss of attachment and 3.3% subjects had 6- 8 mm loss of attachment. These findings were comparatively less when compared to the study done by Bagramian RA. They reported that 57.1% of the subjects had 4mm or greater loss of attachment and 16.7% of the subjects had 6mm or greater attachment loss.^[9]

When the mean DMFT scores of the present study was compared with the other studies, it was seen that the total mean DMFT of the present study was 6.51 ± 5.21 which was comparatively less than the studies conducted by George M. in the Puerto Rican migrant workers^[7] and by Grobler SR in apples or grapes workers⁹. The former study recorded a mean DMFT score of 54.8 and the latter recoded a mean DMFT score of 24.2 in the apple group, 17.4 in the grapes group and 9.9 in the control group.

The prevalence of dental caries in the present study population was 98.9%. The subjects who used to consume around 5-8 apples or more than 8 apples per day during picking season exhibited 100% prevalence. The subjects who never consumed sweets or used to consume fewer amounts of sweets also showed high prevalence of about 88.4% and 97.1%. This could be due to the fact that apples have high sugar content, despite being good for periodontal condition

The subjects in the present study

recorded high unmet treatment needs which was in accordance to the study conducted by George M. in the Puerto Rican migrant workers.^[7]

The plaque score of the subjects participating in the study was 0.9. This finding is in accordance to the study conducted in the Amish workers were 30% of teeth didn't had plaque.^[10] The less plaque score in the present study was due to the fact that the study was conducted at the time of the picking season during which they consumed high numbers of apples which are believed to inhibit plaque formation. The fact that apples have intrinsic sugar and consumption of these and dental caries was proportional. In this view also further research is required.

As plaque plays a crucial role in the development of periodontal problems, we can derive a hypothesis that apples are beneficial for periodontal health but this requires further studies to be carried out for finding out the exact association of the variables.

Conclusion:

The less plaque scores may be due to inhibition of plaque formation due to consumption of the apples just during the picking season. As apples are available to them just during the picking season and they have poor oral hygiene further research on the beneficial effect of apples needed to be carried out. This study also brought to notice the high demand of treatment need amongst the population. Further research is required to get the insight of the cultural practices and taboos related to oral health and practices prevalent among the farmers. Hence a program to increase the presence of

appropriate dental personal in the remote villages to implement educational and preventive dental programmes and improvement in the physical infrastructure in the remote villages offer the best opportunity for improving the oral health of the farmers

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Perception Of Pain And Discomfort From Three Types Of Orthodontic Separators

Abstract

Aim: To examine three types of orthodontic separators, focusing on the patients' perception of pain and discomfort.

Materials and Method: The separators tested were elastomerics, Kesling's wire separators and brass wire separators. Ninety subjects participated who were scheduled for treatment with fixed orthodontic mechanotherapy. Informed consent was obtained prior to the completion of Questionnaire forms. Visual analogue scales and questions with fixed answers were used to register the patient perceptions.

Results: Brass separators were considered to be the most painful of all three. For all three types of separators, the pain was worst at day 2 and subsided almost completely by day 4. Due to pain, 75 of the 90 patients changed their food habits, and 62 took analgesics.

Conclusions: Since pain of moderate intensity occurs during the separation period, analgesics and soft food need be recommended.

Key Words

Perception, Pain, Separators, Elastomeric, Kesling, Visual Analogue Scale

Introduction:

Approximately 90% of the Orthodontic patients report pain^[1], making it the most commonly reported detrimental effect of Orthodontic treatment and the greatest reason for wanting to discontinue or avoid orthodontic care^[2]. Despite numerous studies detailing discomfort as a discouraging aspect of Orthodontia^[3], it has been noted that both pain and discomfort decrease after third day^{[1],[4]}.

For orthodontic treatment with fixed mechanotherapy, separation of teeth is invariably required to place bands, accomplish interproximal stripping, etc. Many studies regarding the separation effect have been undertaken, but, few have evaluated the patients' perception of the pain and discomfort related to the same^[5]. The aim of this study was to examine three types of orthodontic separators, (elastomerics, Kesling's wire separators and brass wire separators) focusing on the patients' perception of pain and discomfort.

One of the biggest problems in assessing pain is that it is subjective. Many scales and scores have been devised to assess pain like visual analogue scale (VAS), McGill's questionnaire etc.^{[6],[7]}. By far the most popular scale is VAS. It contains digits from 1 to 10. The person is asked to

compare the severity of current pain when compared to worst pain he has ever faced in life (like labour pain, surgical pain, fracture pain). Having known the current pain at the beginning of the treatment, when patient comes for follow up, the pain relief can be assessed by asking him to compare his pre-treatment pain with post-treatment one^[8]. By far, this is the easiest both to administer and score, and also is the simplest type^[8] as shown in Fig. 1.

Materials and Method:

90 patients, 45 boys and 45 girls, aged between 15-18y (mean age: 16.7y), none of whom had undergone an orthodontic treatment earlier, participated in the study. To be included in the study, they had to sign an informed consent and undergo fixed orthodontic mechanotherapy. They were explained that the procedure was a part of their treatment. At baseline, i.e., on the day of the procedure, prior to separator placement, any dental pain was ruled out while chewing. The three types of separators used were:

- elastomeric separators
- Kesling's wire separators, and
- brass wire separators.

These were placed mesial and distal to the permanent first molars as shown in

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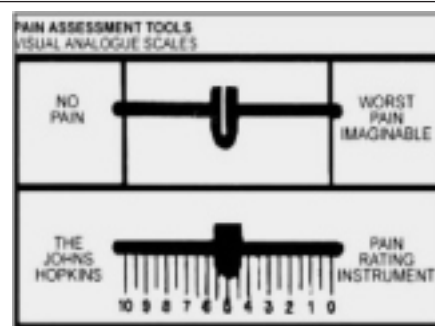


Fig.1: Types of Visual analogue scales



Fig 2: Elastomeric separators

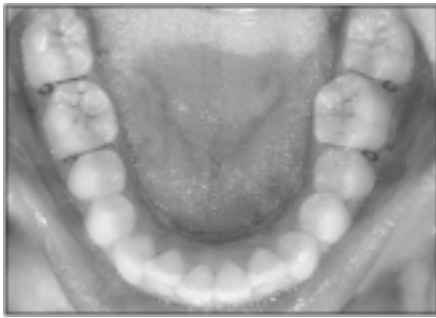


Fig 3: Kesling's separators



Fig 4: Brass wire separators

figures 2 through 4. The perception of pain and discomfort was then assessed by a questionnaire (attached alongwith) and visual analogue scale over a period of four days, when the patient was recalled for removal of separators and placement of bands.

Results:

All 90 patients completed the study. Response rate was excellent since all patients responded to all questions on all questionnaires. The baseline survey before separator placement revealed that none of the patients had any pain from the molars at rest or even while chewing. More number of patients in the group with brass separators perceived pain as compared to the other two groups, i.e., Kesling's wire separators and elastomeric separators (p value E/K 0.0575*, p value E/B 0.2857, p value K/B 0.0032**).

62 of the ninety patients were in such severe pain that they needed analgesics to relieve it (P < .05), and significantly more girls than boys had used analgesics (P < .05). 75 patients had to change their food habits (P < .05) and this also applied to significantly more girls than boys (P < .05).

Discussion:

It was found that mild to moderate pain was associated with the separators. Brass wire separators caused most pain and discomfort. The pain was perceived as worst at day 2 while it subsided almost completely by day 4. The varying degree of individual pain/discomfort response to application of orthodontic forces has previously been reported^{[4], [9]} as established in this study also.

Another important predictor of pain is gender^{[10], [11]}. In this study, no significant difference was found between boys' and girls' pain discomfort experience during the separation. Although a few studies have claimed that girls report more pain / discomfort than boys^{[11], [12]}, the literature seldom points to any correlation between gender and perception of pain / discomfort during orthodontic treatment^{[11], [4], [9]}. Nevertheless, in this study, it was found that significantly more girls (37) than boys (25) had used analgesics in spite of similar perception of pain. It has been reported earlier that orthodontic patients use analgesics fairly often^{[11], [5]}.

Among daily activities, eating was most affected during the separation period, and the influence on food choices was reasonably considerable, since 75 of 90 patients had changed the dietary pattern to soft food. These findings are in accordance with other previous studies^{[11], [5]}.

VAS (Visual Analogue Scale) was used considering its simplicity^{[11], [5]} and lack of failures under the age of 5y^[13]. It has also been found that VAS is a useful tool when patients have to discriminate between pain / discomfort in the posterior and anterior teeth after initial placement of an archwire^[14]. Bondemark et al found that patients had no problems in discriminating between pain / discomfort between right and left posterior teeth when two different separators were placed between right and left side, respectively^[5].

Conclusion:

All the three types of separators caused pain of mild to moderate intensity with elastomeric and Kesling wire separators considered less painful than the brass ones, though the difference was not statistically significant. Pain was worst after 2 days and had almost completely subsided by day 4. Therefore, molar band placement should be done at least 4 days after separator insertion. Also, analgesics and soft food must be recommended for patients' comfort.

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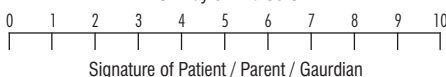
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Questionnaire Used

Type Of Separator Used (To Be Filled By Treating Doctor)		
Elastomeric	Kesling	Brass Wire

S No.	Question	Yes	No
1.	pain during placement of separators		
2. (day 0)	pain 6h after placement of separators		
3. (day 1)	(a) pain 1d after placement of separator		
(day 2)	(b) Pain 2d after placement of separator		
(day 3)	(c) pain 3rd after placement of separator		
4. (day 4)	Next appointment		
5.	Pain during chewing of food		
6.	Whether had to modify dietary pattern		
7.	Whether had to take analgesics		
8. quality of sensation	Pain		
	Discomfort		
	Feeling of pressure		
	Tenderness		
	localized		
	Generalized		
	Radiating		
9. (day 4)	Alleviation of pain on removal of separators		
10. Visual Analogue Scale			

Example : Pt Would Encircle The Digit 7 And Write Day 1 Below It; Encircle Digit 9 Writing Day 2 Below, Encircle Digit 4 On Day 3 And So On



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In Vitro Evaluation Of The Enamel Shear Bond Strength Of A Resin And Ormocer Based Sealant, Pretreated With An Antibacterial, A Total Etch And A Self-etch Adhesive

Abstract

AIM: To evaluate the in vitro enamel shear bond strength of a resin and an ormocer based sealant, pretreated with an antibacterial, a total etch and a self-etch adhesive.

Methodology: Forty extracted human mandibular molars were taken. The teeth were sectioned bucco-lingually into two halves (n=80) and then embedded in methyl methacrylate blocks with proximal surface parallel to the horizontal plane. The samples were cleaned using pumice slurry and a rubber cup and ground to a flat surface with an extra fine diamond bur. The samples were divided into five groups with 16 sections each, depending on the bonding agent applied. The five groups consisted of Single Bond, Clearfil Protect Bond, Clearfil SE Bond, Admira Bond and lastly the control with no bonding agent application. Each group was further subdivided into two (A & B) with 8 samples each according to the two sealants used (Admira Seal and Clinpro Sealant). The sealants were filled with the help of a polymeric cylindrical mold 4mm in Height and 4mm in diameter placed on the bonded surfaces. The samples were then mounted on a Universal testing machine for shear bond strength evaluation. The debonded specimens were examined using a 6x magnifying glass for the type of failure and the data was statistically analyzed.

Results: Single Bond with Admira Seal showed the highest shear bond strength values followed by Clearfil SE Bond, Clearfil Protect Bond, Admira Bond and lastly the control group. Examination of bond failure showed maximum amount of cohesive failure in Group I, II, mixed failures in group III, whereas Group VI and V showed more of adhesive failures.

Key Words

Shear Bond Strength, Sealants, Bonding Agents

Introduction

Pit and fissure sealants isolate the occlusal fissures from the oral surroundings and act as a physical and antibacterial barrier. These materials are either self cured or light cured glass ionomer sealants, filled or unfilled resin systems bonded to etched enamel. The key consideration to success of resin sealants is adequate penetration of the material into the etched surfaces. The use of bonding agents prior to a resin sealant on ground surfaces can yield greater bond strength than when using sealant alone.

Contemporary adhesives can be divided into two systems in terms of clinical application- Etch and rinse adhesives and the self-etch adhesives. The self-etching adhesives use hydrophilic, acidic monomers which are able to demineralize and penetrate enamel and dentin simultaneously. This system is a simplification of the bonding procedure

and a potential decrease in technique sensitivity. With self-etching /priming systems in which the smear layer is not washed away, residual bacteria can be anticipated. Therefore, adhesive systems that possess antibacterial activity may contribute to better prognosis for minimal restorative treatments of dental caries.

Although a new restorative system exhibiting superior physical and mechanical properties has Ormocer based Admira Bond (bonding agent) and Admira Seal (pit and fissure sealant), but still the bond strength of the etched enamel and sealants with an intermediate layer of a total-etch or self-etch bonding agent remains controversial.

Therefore the purpose of this in vitro study was to evaluate the enamel shear bond strength and the mode of bond failure of an unfilled resin and an ormocer based sealant after pre-

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treatment with an Ormocer based adhesive, a total etch, a conventional self-etch and an antibacterial self etch adhesive.

Materials And Methods

Forty extracted human mandibular molars were taken. The teeth were sectioned bucco-lingually into two halves (n=80) using a diamond disc and then embedded in methyl methacrylate blocks with proximal surface parallel to the horizontal plane. The samples were then cleaned using pumice slurry and a rubber cup and ground to a flat surface with an extra fine diamond bur (20-30µm grit). The samples were divided into five groups with 16 sections each, depending on the bonding agent applied. The five groups consisted of Single Bond, Clearfil Protect Bond, Clearfil SE Bond, Admira Bond and lastly the control with no bonding agent application. Each group was further subdivided into two (A & B) with 8 samples each according to the two sealants used (Admira Seal and Clinpro Sealant).

The sealants were filled using a needle tip provided by the manufacturer with the help of a polymeric cylindrical mold

NPar Tests		ADMIRA SEAL ONEWAY	
Kruskal-Wallis Test		Ranks	
GROUP		N	Mean Rank
SHEAR BOND STRENGTH	SINGLE BOND	8	30.13
	CLEARFIL	8	24.50
	PROTECT BOND	8	25.13
	CLEARFIL SE BOND	8	18.25
	ADMIRA BOND	8	4.50
	CONTROL (NO BONDING AGENT)	8	
Total		40	

Test Statistics ^{a,b}	
	SHEAR BOND STRENGTH
Chi-Square	22.921
df	4
Asymp. Sig.	.000

a. Kruskal Wallis Test
b. Grouping Variable: GROUP

Admira Seal Oneway

NPar Tests		CLINPRO SEAL ONEWAY	
Kruskal-Wallis Test		Ranks	
GROUP		N	Mean Rank
SHEAR BOND STRENGTH	SINGLE BOND	8	27.06
	CLEARFIL	8	26.94
	PROTECT BOND	8	24.00
	CLEARFIL SE BOND	8	20.00
	ADMIRA BOND	8	4.50
	CONTROL (NO BONDING AGENT)	8	
Total		40	

Test Statistics ^{a,b}	
	SHEAR BOND STRENGTH
Chi-Square	20.709
df	4
Asymp. Sig.	.000

a. Kruskal Wallis Test
b. Grouping Variable: GROUP

Clinpro Sealant Oneway

4mm in Height and 4mm in diameter placed on the bonded surfaces. The samples were then mounted on a Universal testing machine for shear bond strength evaluation. The debonded specimens were then examined using a 6x magnifying glass for the type of

failure. The data obtained was then statistically analyzed using SPSS software version 10 for windows with Oneway Anova, Post hoc, Kruskal Wallis and Mann-Whitney tests . The type of failure values were analyzed using Pearson-Chi square test.

Results

The results showed that Single Bond with Admira Seal showed the highest shear bond strength values followed by Clearfil SE Bond, Clearfil Protect Bond, Admira Bond and lastly the control group .There was no statistically significant difference amongst groups I, II and III. Group IV and V were statistically different from all the other groups. No statistical difference was obtained between the two sealants used. Examination of the bond failure showed maximum amount of cohesive failures in Group I, II, mixed failures in group III, whereas Group VI and V showed more of adhesive failures.

Discussion

Sealing of pit and fissures with low viscous materials such as dental adhesives and pit and fissure sealants could be an alternative approach to the widely used modalities of restorative treatment. The white spot lesion is characterized by a loss of mineral in enamel, whereas the surface of the lesion remains relatively intact. The tiny pores within the lesion act as a diffusion pathway for acids and minerals and therefore enable the dissolution of enamel at the advancing front of the lesion. The aim of the sealing regimen is to occlude these pores with low viscous materials by penetration into the lesion via the prism cores and fill the interprismatic areas. After curing, the fragile enamel also gets a mechanical support. The sealing prevents biofilm accumulation and migration of bacteria. Effective sealing of the fissures is obtained through formation of a strong bond of the sealant to enamel. A good bond to enamel requires the standard clinical procedure of etching with phosphoric acid of cleaned enamel, rinsing with water spray, establishing of a dry field followed by application and curing of the sealant.

Various pretreatment methods have been investigated with the intention of enhancing the effectiveness of sealants. The use of air-polishing system was introduced in 1977, then the air abrasion system and nowadays the most widely accepted method is the usage of pumice slurry to clean the tooth. Therefore in this study the enamel surfaces were cleaned with pumice slurry and a rubber cup.

Enamel that is ground also provides a more receptive substrate for bonding.

Statistical analysis for Bond Failure

Crosstabs **GROUP * BOND FAILURE Crosstabulation**

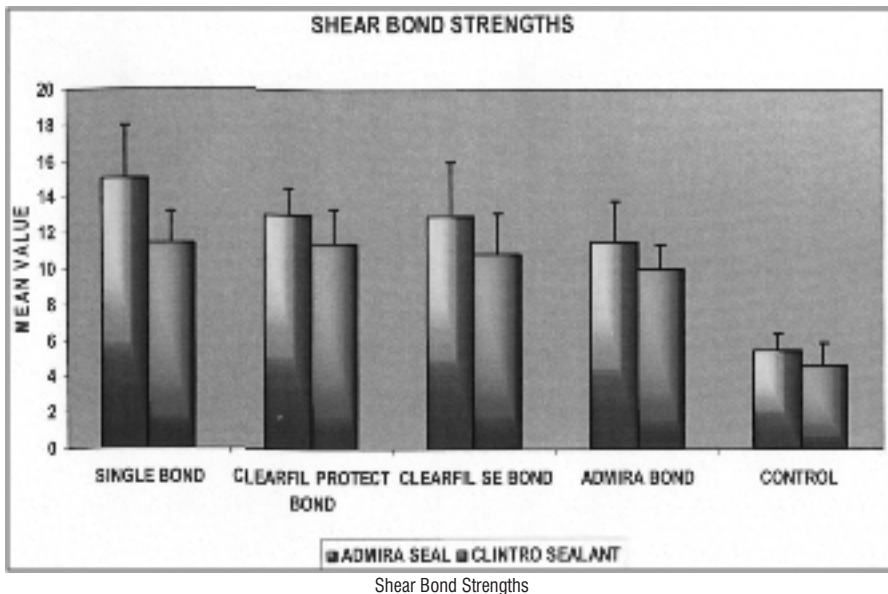
GROUP	BOND FAILURE	Count	BOND FAILURE				Total
			ADHESIVE	COHESIVE (IN ENAMEL)	COHESIVE (IN RESIN)	MIXED	
SINGLE BOND	Count	3	4	2	3	12	
	% within GROUP	25.0%	33.3%	16.7%	25.0%	100.0%	
CLEARFIL PROTECT BOND	Count	3	3	2	4	12	
	% within GROUP	25.0%	25.0%	16.7%	33.3%	100.0%	
CLEARFIL SE BOND	Count	2	4	1	5	12	
	% within GROUP	16.7%	33.3%	8.3%	41.7%	100.0%	
ADMIRA BOND	Count	5	2	2	3	12	
	% within GROUP	41.7%	16.7%	16.7%	25.0%	100.0%	
CONTROL (NO BONDING AGENT)	Count	6		2	4	12	
	% within GROUP	50.0%		16.7%	33.3%	100.0%	
Total	Count	19	13	9	19	60	
	% within GROUP	31.7%	21.7%	15.0%	31.7%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.351 ^a	12	.759
Likelihood Ratio	10.762	12	.549
Linear-by-Linear Association	.186	1	.669
N of Valid Cases	60		

^a 20 cells (100.0%) have expected count less than 5. The minimum expected count is 1.80.

Statistical Analysis Bond Failure



When the enamel is ground to a flat surface, a more homogeneous structure of enamel prisms is produced, compared to the less well-defined aprismatic structure associated with surface enamel. The degree of calcification and fluoride content of the surface enamel might limit the depth of acid etching unlike the subsurface enamel that is less resistant to acid etching. Thus in this study the enamel was ground using an extra fine diamond burs (20-30µm grit) to obtain a flat surface.

Etching or conditioning enamel removes the surface contaminants and creates an irregular surface topography of

micropores and micprojections. The resin then penetrates and polymerizes in the enamel micropores and forms a mechanical bond with the tooth. It increases the surface wettability and the approximation between the sealant and substrate.

Apart from conditioning, it is proposed that the use of a bonding agent as an intermediate layer prior to the application of a sealant can provide better flow of the sealant to increase the bond strength. The bonding agents serve as low-viscosity flowable wetting agents for the interface between etched enamel and sealant, so that the viscous sealant spreads better and

properly wets the surface of the fissures. The layer of bonding agent applied provides better flow of the thick highly filled sealant. This could be one of the reasons that could be responsible for the similar values of bond strength obtained with the two sealants. Also the surface evaluated was a relatively flat enamel surface where the effect of the viscosity of the sealant was of no significance unlike incase of pit and fissures where better penetration would be seen with the use of unfilled sealants. The sealant also is found to be more resistant to thermal and mechanical stresses in combination with the adhesive than when applied alone.

Bond strength tests are the most common way of evaluating the effectiveness of an adhesive system. Since the shear strength testing method is not applicable to the morphology of occlusal surfaces, the bonding performance of the adhesives underneath the sealants can be evaluated on flat ground enamel surfaces. A shear bond test using chisel on iris design is preferred as this technique directs the force more evenly on the bonded area and parallel to the bonded surface. It causes less of pretesting failures and allows ease of preparation and handling of the samples.

Contemporary adhesives can be divided into two systems in terms of clinical applications: etch and rinse adhesives and self-etch adhesives. In the self-etch adhesives, the acidic part of the primer dissolves the smear layer and incorporates it into the mixture as it demineralizes the tooth substrate and encapsulates the collagen fibers and hydroxyapatite crystals. An antibacterial adhesive used underneath the sealant will also exhibit antibacterial action on the cariogenic microflora of the pits and fissures and on the caries formation that may occur after microleakage or a partial loss of the sealant. Self-etch adhesive system containing antibacterial monomer 12-Methacryloxydodecyl pyridinium bromide (MDPB) has been introduced, which are more effective in antibacterial activity than cavity disinfectant solutions. Clearfil Protect Bond is one such adhesive used in the current study and tested for its shear bond strength to enamel.

Self etching primers have an acidic monomer in the priming agent, which

partially dissolves the smear layer and etches the enamel. They have higher pH resulting in shallow enamel demineralization compared to phosphoric acid. The acidic components of the self-etching primers do not create an enamel etching pattern as deep as phosphoric acid. This could be due to less demineralization of enamel by the priming agent compared to the total-etch system. In the current study the enamel was ground using Extra fine diamond burs (20-30µm grit) to a flat surface which could have also enhanced the bond strength of the self-etch groups equivalent to the single bond total-etch adhesive system.

In this study statistically significant difference was seen between the ormocer based total etch adhesive Admira bond and the rest of the groups. Due to the one-component nature of the all-in-one adhesive, it produces very thin hybrid and bonding layer which could lead to lower bond strengths.

Increased filler loading increases the viscosity of the bonding system may reduce its flow thereby preventing the adhesive from adapting properly and penetrating the etched enamel surface. This may in turn compromise the bond strength and marginal integrity. This could be the reason for the low bond strengths obtained with Admira Bond.

In the current study Clearfil Protect Bond, the antibacterial self-etch adhesive also gave high shear strength values, which was not statistically significant from that of Single Bond and Clearfil SE Bond. The high bond strength values could also be attributed to the fact that it is less technique sensitive and could form a homogeneous hybrid layer resulting in equal and constant bond strength.

It is seen that higher bond strengths normally produce more cohesive failures and fewer adhesive failures. This was due to the more effective depth of resin penetration in case of Single Bond, Clearfil SE Bond that not only produced greater bond strength but also increased the cohesive strength of the regions near to the interface. Thus the cohesive failure in the fissure sealant or enamel surface

showed that the adhesion forces between the enamel and the adhesives in Groups I, II, III were stronger than the cohesive forces of the fissure sealant or tooth surface themselves. A shallow resin tag formation in enamel lead to lower bond strengths and there by adhesive failures in case of Groups IV and V.

Conclusion

Within the limitations of this study, it was found that the use of bonding agents beneath the pit and fissure sealants increases the shear bond strength and would increase the clinical success rate. Total-etch adhesive was superior to the conventional self-etch, an ormocer based adhesive and an antibacterial self-etch adhesive. Amongst the type of failures examined, more of cohesive failures in enamel were seen with increasing bond strength values. The sealants in the experimental groups showed 8.3% to 16.3% cohesive failure in the resin, 25% to 41.7% mixed failures, 16.7% to 33.3% structural failures in enamel and 16.7% to 50% adhesive failures.

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The Risk Of Bleeding During Dental Extractions In Patients Receiving Antiplatelet Therapy

Abstract

Antiplatelet therapy has significantly reduced the mortality and morbidity associated with cardiovascular disease. Of concern to the dentist is the risk of excessive oral bleeding during or after invasive dental procedures. Current guidelines recommend the continuation of antiplatelet in dental procedure. 60 patients on single or dual antiplatelet, requiring tooth extraction were enrolled in the study with the mean age 63.48±10.67 years. Dental extractions were performed with mean extraction rate of 1.65±0.55 per patient. Pressure pack was the most common modality to stop bleeding 32(53.33%). Primary suturing was required in 21 patients with 1 patient requiring suturing after 24 hours. Patients in PCI group (52%) and on dual antiplatelet (56.3%) require suturing more as compared to patients on single antiplatelet therapy. Antiplatelets are cornerstone of preventing stent thrombosis and this study enforces their usage during dental procedure.

Key Words

Antiplatelet, oral bleed, dental extraction, local haemostasis.

Introduction

The use of antiplatelet therapy has reduced the mortality and morbidity of cardiovascular disease significantly. A considerable number of patients presenting to dentist give a history of antiplatelet therapy. When patients have to undergo invasive dental or maxillofacial treatment, dentists, oral and maxillofacial surgeons, physicians, and patients have to decide whether to continue the use of the antiplatelet or to stop it temporarily to minimize the bleeding risk associated with the surgical procedure. However, stopping this medication may lead thromboembolic events to recur, thus creating potentially hazardous situations, such as myocardial infarction, stroke, or even death. Although the recent shift from practice-based dentistry toward evidence-based dentistry has led to the development of numerous practice guidelines to improve the delivery of health care, unfortunately this has not resulted in a practice guideline for the dental management of patients using antiplatelet medication.

Current indications for dual antiplatelet are twelve month post drug-eluting stent (DES) and post myocardial infarction. Risk benefit ratio is skewed toward stent thrombosis as compared to bleeding risk. In a pooled analysis of 6 trials and

registries from the 1990s, the incidence of death or MI associated with angiographically documented stent thrombosis was found to be 64.4%.^{[1],[2]} Mortality rates due to presumed or documented stent thrombosis range from 20% to 45%.^{[3],[4],[5]} In a large observational cohort study of patients treated with DES, stent thrombosis occurred in a striking 29% of patients in whom antiplatelet therapy was discontinued prematurely.^[6] In a single-site study of 652 patients treated with sirolimus DES, premature discontinuation of clopidogrel was associated with an 30-fold greater risk of stent thrombosis, with >25% of patients who discontinued clopidogrel therapy within the first month suffering stent thrombosis.^[7] Park et al^[8] reported on 1911 consecutive patients with DES followed up for a median of 19.4 months. Five (7.8%) of 64 patients with premature interruption of aspirin, clopidogrel, or both experienced stent thrombosis.

Despite the risk of stent thrombosis, there is still apprehension about using antiplatelet in dental procedure. In our own survey physician and dentist disapproved of using antiplatelet during surgery. Despite general recommendation of continuing with

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antiplatelet in dental procedure, risk of bleeding prelude their usage. Thus, our study aims to explore bleeding risk in patients on antiplatelet.

Material And Method

Ours was a prospective study involving 60 consecutive patients who were using single or dual antiplatelet, requiring tooth extraction. The exclusion criteria included:

1. multiple number of teeth (> 3 teeth were excluded)
2. patients with renal, haematological or liver disease
3. patients on oral anticoagulants, NSAIDs

The mean age was 63.48±10.67 years. 41 patients were male (68.33). A complete dental and medical history, clinical & radiographical examination were recorded. Indications for extractions

Table 1. Pathology or post-procedure for which the patients were taking antiplatelet therapy.

Pathology/Procedure	Number(% Of Patients)
Hypertension	36(60%)
Diabetes Mellitus	25(41.67%)
Cabg	18(30%)
Pci	25(41.67%)
Myocardial Infarction	19(31.67%)
Angina	21(35%)

Table 2. Single/Dual Antiplatelet Usage

Single Antiplatelet	Dual Antiplatelet
32(53.33%)	28(46.67%)

Table 3. Method To Stop Bleeding

Pressure Gauze	Medicated Gauze	Suture	Rebleed	Hospitalization	Blood Transfusion
32(53.33%)	12(20.00%)	22(36.67%)	0	0	0

Table 4. Table Showing Whether Pci Subgroup Has More Bleeding Complication

	Number Of Patient	Suture	Percentage
Patient Undergone Pci	25	13	52
Rest Of Patient	35	9	25.71
P Value			0.05

Table 5. Risk Of Excess Bleeding And Usage Of Antiplatelet Single Or Double

	Number Of Patients	Suture Requirement	Percentage
Single Antiplatelet	32	4	12.5
Dual Antiplatelet	28	19	56.3
P Value			0.01

were periodontitis, radicular lesion, pain, mobility and severe decay. Dental extractions were done under local anaesthesia using xylocaine. Local infiltrations and regional blocks were used in the maxilla and mandible as appropriate. Dental extraction for various etiologies were performed in all patients with a mean extraction rate of 1.65 ± 0.55 per patient. The protocol for controlling post-operative bleeding consisted of local pressure pack for 30 minutes, sutures and medicated pressure pack. During extractions, sharp bony edges and granulation tissue were removed to make it as atraumatic as possible. A pressure gauze was then applied to the extraction site and a dry gauze was pressed down on top. The patient was monitored for 10 minutes and was then sent home with a gauze pad on the wound and the usual post-extraction written instructions (hold the gauze in place with firm pressure for ½ an hour, no mouth rinsing, liquid or soft cold diet for the first 24 hours, no spitting, warm saline rinses after 24 hours etc). For

first 24 hours, the patient was asked to contact for progress and a record was made as to whether the patient had experienced any problems and, if so, the particular problems were recorded. If the bleeding did not stop with pressure gauze the decision of using medicated gauze or sutures was left to the discretion of operator.

The following was recorded in the data collection notebook: professional performing the treatment, patient's details; age, gender, medical condition for which the antiplatelet therapy was prescribed, antiplatelet brand name and dose level, number of teeth extracted.

Results

Of the 60 patients enrolled, 41 were male (68.33%), mean age was 63.48 ± 10.67 . Majority of them had co-morbidities. Usage of double antiplatelet was in 28 patients (46.67%) implying higher risk subset.

Number of teeth extracted was 1.65 ± 0.55 . Pressure pack was the most common 32(53.33%) modality to stop bleeding. Primary suturing was done in 21 patients with only one patient requiring suturing after 24 hours. Further analysis showed that dual antiplatelets and PCI(Per cutaneous intervention) was linked to statistically significant use of sutures. No case of re bleed, hospitalization or requiring blood transfusion was reported.

Discussion

Over the last few years, the recommendation has been to continue with the antiplatelet therapy during dental extractions^{[9],[10],[11],[12],[13],[14]} and we have worked along these lines in our study. Patients came to the clinic of their own free will (or were referred by the primary care doctor, or by their private dentist) for a dental extraction for any type of pathology.

Patients in our study had a mean age of 63.48 years. They were having antiplatelet and we did not stop them in view of dental extraction after consultation with their physician and cardiologist. There was significant difference in bleeding that occurred during tooth extraction between the two groups. Pressure pack in most of the cases was more than sufficient to stop bleeding. Suturing was required in 36.67% of patients. Re-bleed, hospitalization and requirement of blood transfusion was nil.

This alleviates our preconceived notion or fear factor for continuation of antiplatelet during operative procedure. Patient in PCI Group (52%) and on dual antiplatelet (56.3%) were more likely to require suturing but subsequent re bleed was nil. Antiplatelet are cornerstone of preventing stent thrombosis or graft occlusion in day to day practice and our study will further enforce their usage during dental procedure. The risk of post-operative bleeding complications in these patients is low, and that use of local perioperative and postoperative measures are sufficient.

Conclusion

Patients on antiplatelets requiring less than 3 tooth extractions can be safely carried out and there is no risk of re-bleed, re-admission and blood transfusion. Invasive dental procedures can be done without altering the dosage or stopping the antiplatelets. If excessive bleeding occurs, it can be controlled by local hemostatic measures. Consultation with the treating physician and cardiologist is a must. Majority of the patients on dual antiplatelets require suturing for better haemostasis to prevent re-bleed. There is a greater need for creating awareness to the dental management of this group of patients to avoid unnecessary and preventable complications.

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Identification Of Viable Bacteria In Dental Calculus Using Fluorescent And Dark Field Microscopy.

Abstract

Background: Dental calculus is a form of calcification in the oral cavity, assembled through interaction with dental plaque which is a community of microorganisms found on the tooth surface. Studies have stated that once the plaque matures to form dental calculus, bacteria residing within channels and lacunae are killed, but still the inflammatory process is going on within the soft tissues. Therefore, the present study was conducted to identify the presence or absence of viable bacteria within dental calculus.

Materials and Methods: Supragingival and subgingival calculus were harvested from 30 subjects having the clinical evidence of chronic inflammatory periodontal disease. Harvested calculus samples were placed immediately in sterile saline and crushed aseptically between two sterile slides and examined using gram stain, fluorescent microscopy using acridine orange and dark field microscopy.

Results: Gram staining revealed the presence of gram -ve bacteria in the form rod shaped bacilli, cocci and filamentous bacteria either singly or in groups within the sample. Acridine orange fluorescent stain showed the presence of viable bacteria which formed 40% of all the microorganisms and dark field microscopic examination revealed the presence of motile bacteria within the sample.

Conclusion: From the result it appears that bacteria are present within dental calculus, specifically within the channels and lacunae. Thus, calculus may serve as a reservoir of viable microorganisms and play a crucial role in the etiology and recurrence of oral infections even after treatment.

Key Words

Calculus, Acridine Orange, Gram Stain, Dark Field Microscopy

Introduction

Oral cavity is colonized by a variety of microorganisms. When these microorganisms adhere to the surface of tooth and grow in the prevailing environment they form bacterial biofilms which are considered to be the primary etiological factor for the initiation and progression of periodontal disease.^{[1],[2]}

Dental calculus is formed by the calcification of plaque.^[3] Plaque is composed of organic, inorganic materials derived from saliva, gingival crevicular fluid and bacterial products. Since calculus is a calcified deposit, it has been stated that dental calculus itself is not harmful, its presence in association with dental plaque may influence the severity and progression of periodontal disease.^[4] Mineralization of calculus has been shown to be highly variable, containing a variety of crystalline forms.^[5] In heavy calculus formers, 40-65 % mineralization can be found in plaque formed during a 3-14 day period while mature calculus may

contain up to 80 % mineral and 20 % of organic matrix.^[3] It has been demonstrated that the environment within the biofilms is able to support viable bacterial communities through molecular diffusion of nutrients through channels. Possibility therefore exists that a favorable environment for oral bacteria may be found within the dental calculus and that such bacteria may remain viable for some time making calculus a possible source of infection.^[6] Various techniques have been used to demonstrate the viability of bacteria including bacterial culture, fluorescent microscopy and confocal laser scanning microscopy.^[4] The aim of the present study, thus, was to investigate the viability of bacteria within dental calculus using fluorescent and dark field microscopy.

Material and Methods

30 subjects in the age group of 35-50 years with clinical evidence of chronic inflammatory periodontal disease were selected. Supra and subgingival calculus

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were harvested from these subjects. Patients with the history of any systemic disease or having undergone any antimicrobial therapy for at least past six months; oral prophylaxis for at least six months prior to harvesting the sample; pregnant, lactating women; and those individual with salivary gland disease and xerostomia were excluded from the study.

Care was taken to obtain large single pieces and to maintain the integrity of the calculus sample. Harvested sample was placed in sterile saline. The calculus sample was then crushed aseptically between two sterile slides and was then divided into three groups for gram staining, fluorescent and dark field microscopy.

Gram staining: One part of crushed sample was stained with gram stain and viewed using bright field microscopy at 100x oil objective to view the presence of gram positive and gram negative bacteria.

Fluorescent microscopy: To the second part of sample, 0.01% acridine orange stain was added and mixed gently with a sterile loop on a slide. A cover slip was placed over the mix. The stained sample was examined using fluorescent microscopy at 40× objective with filter 3A 380-460nm and then at 100x.

Dark field microscopy: The third part of crushed sample was mixed with a drop of saline and cover slipped. The preparation was observed using dark field microscopy at 40x objective and then at 100x.

Nikon Eclipse 80i research microscope was used for all three types of microscopy.

Results

Gram staining was used to visualize and determine the morphology of bacteria. Gram-negative bacteria formed 40% of all microflora in the form of rod shape bacilli and gram-negative cocci formed 30%. The remaining 30% include filamentous microorganisms occur singly or in groups within the sample (**Fig. 1**). No gram-positive microorganisms were seen. Using acridine orange fluorescent stain viable bacteria showed green fluorescence while non-viable bacteria appeared red (**Fig. 2**). The viable bacteria formed 40% of all microorganisms in the sample. Dark field microscopy examination revealed the presence of motile filamentous organisms, spirochetes and motile short bacilli indicating the viability of these microorganisms (**Fig. 3**).

Discussion

Micro radiographic and electron microscopic studies of formed calculus have shown that variety of morphologically different microorganisms both gram-positive and gram-negative species become calcified when immersed in a calcium phosphate solution.^[7] Although there are reports in the literature implying that calculus may be essentially mineralized dead organic material, it has been shown that calcifications can occur in a culture of live bacterial colonies. Therefore, it is possible that some microorganisms may readily calcify while other may not, leading to the creation of pockets of non-mineralized bacteria within calcified plaque sample.^[8] Thus, calculus may act as a major source of infection in the oral

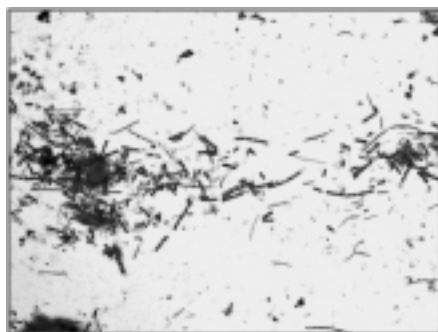


Fig.1: Gram staining showing Gram negative cocci, bacilli and filamentous bacteria

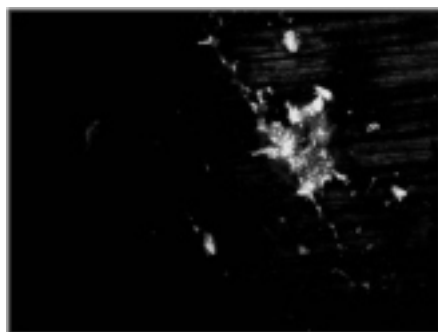


Fig.2: Acridine orange staining showing green colored appearance of bacteria

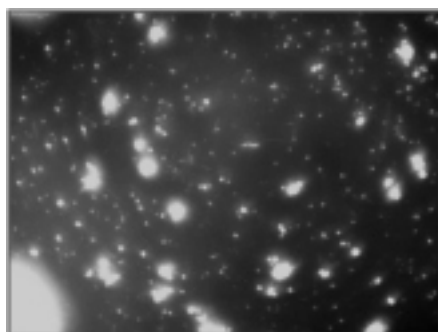


Fig.3: Dark field microscopic showing presence of motile spirochetes and filamentous organisms.

cavity. Few techniques have been used in previous studies to distinguish between viable and nonviable bacteria in biofilms.^[4] Gram stain is used mainly to visualize bacteria and also study the morphological characteristics of all microorganisms.^[9] In present study no gram-positive organisms were seen, only gram-negative bacilli, cocci and filamentous organisms were noticed.

Acridine orange, a fluorochrome stain, is potentially superior to the Gram stain in the direct microscopic examination of clinical specimens because it gives striking differential staining between bacteria and background cells and debris. Lauer assessed its value in clinical laboratories by testing 209 cerebrospinal fluids and 288 other body fluids, tissues,

and exudates using gram stain and acridine orange staining techniques. Overall, acridine orange was found to be slightly more sensitive than the gram stain with acridine orange showing 59.9% sensitivity and gram stain showing 55.8% but both the stains showed a similar specificity in detecting microorganisms.^[10] In the present study, acridine orange staining technique revealed viable green fluorescing bacteria which formed 40% of the total microflora of the sample. Nonviable bacteria were stained red. Acridine orange stain has marked affinity for the nucleic acids and stains both viable and non-viable bacteria. When the sample were stained DNA component of the organisms appeared green.^[2] As acridine orange stain is applied to calculus sample, it binds with the nucleic acid component, DNA, of the bacteria. On fluorescent microscopy acridine orange-DNA complex absorbs incoming radiation and affects the wavelength of emitted radiation, because of the ring structure of acridine orange and the abnormal chemistry of these complexes. This makes the acridine orange-DNA complex to show green fluorescence in viable bacteria.^[10] As viable bacteria become non-viable, DNA gets denatured resulting in increased acridine orange inter-chelating with the phosphate-sugar backbone of DNA.^[11] This lead to change in fluorescence form green to red in non-viable bacteria.^{[12],[13]}

Earlier studies have tried to demonstrate bacterial viability within the calculus sample using bacterial cultures.^[2] Sidaway DA in (1978)^[14] reported successful bacterial cultures from the supragingival and subgingival calculus sample but also found that some microorganisms are difficult to culture but can be easily accessed by dark field microscopy as it shows the presence and motility of filamentous organisms, spirochetes and short bacilli thus confirming their viability. Presence of motile spirochete, filaments and other bacilli in dark field microscope in the present study also indicates that some of bacteria in the calculus remain viable.

Conclusion

This study provides strong evidence indicating that viable micro organisms are contained within the calculus probably within the lacunae and channels. Vital bacteria in calculus may

release toxic antigenic metabolites, which may leach out of this calcified mass and initiate inflammatory responses into the soft tissues. Thus, calculus may serve as a reservoir of viable microorganisms and play a crucial role in the etiology and recurrence of oral infections even after treatment.

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Perceived Barriers To Access Oral Health Care For The Institutionalized Disabled Children.

Abstract

Need for the study: Oral health is an integral part of general health, which has a direct bearing on the quality of life by affecting the physical and mental wellbeing. Maintaining optimal oral health becomes even more important for children with disabilities than their normal counterparts because of their reduced manual dexterity. Oral diseases are alarmingly higher in this segment of the population which is often neglected. Unmet oral health needs unfortunately is also higher. The present study was carried out to evaluate barriers to access oral health care by the disabled children.

Study Design: 149 caregivers were interviewed and 158 dental professionals were interviewed for their perceived barriers to access oral health care through a questionnaire. The caregivers were questioned in institutions and the dental professionals in their clinical setup. A logistic regression model was developed to assess barriers to dental care.

Results: The principal barriers to access care by the caregivers of disabled children were location of the dental clinic (69.79%) and expensive treatment procedure (75.83%). The main constraints faced by the dental professional to treat them are lack of adequate training (68.35%) and shortage of staff (62.02%).

Conclusion: Disabled children are that segment of the population who have limited access to dental care in spite of extensive unmet needs. A collaborative effort by various disciplines coupled by extensive training is the need of the hour to address this urgent issue.

Key Words

barriers, oral health, disabled, children.

Introduction:

“No person should be overlooked for treatment. because of a disability”.

Everyone has the right to a standard of living adequate for the health and well being of himself and his family, including medical care and necessary social services. (The United Nations universal declaration of human rights (1948)). The above declaration makes it very clear that everyone has equal right to good health and well being, including persons with disability.

British Disability Discrimination Act (BDDA) defines Disability as a physical or mental impairment, which has a substantial and long term adverse effect on his/her ability to carry out normal day to day activities.

Children with disabilities often have a high and unmet need for dental treatment^{[1],[2],[3]}. Linked to this need is the inescapable fact that many children with disabilities may live below the poverty margin and also have additional medical impairments that deteriorating oral health can exacerbate, or can exert an effect on the child's quality of life^{[4],[5]}.

For many children with profound disabilities the only option for dental care is when a crisis occurs and they are hospitalized for an in-patient general anaesthetic and dental treatment is carried out^[6]. Oral health care for disabled children is a health care area that has received scant attention. It is estimated that one out of two persons with a significant disability cannot find a professional resource to provide appropriate and necessary dental care. Lack of access to dental services for this growing segment of our population is reaching critical levels and is a national dilemma.^[7]

Prevalence of disabled children is on the rise and is increasing at an alarming rate. In India, there are 21.9 million disabled people, which constitutes about 2.13 percent of the total population.^[8] Data indicate that people who have some or other disability have more untreated caries and a higher prevalence of gingivitis and other periodontal diseases than the general population.^{[9],[10],[11],[12]} Understanding the oral health of children with disabilities, and barriers to access of

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care, is of growing interest because of the significant increase in the population of children. Hence this study was undertaken with the aim of identifying various barriers by the parents which hinders them from seeking oral health care and problems of service providers in providing care to the disabled children.

Methodology:

The study was conducted in Spastics society of India, Bangalore, which is a rehabilitative institution for the disabled children. 484 children of various disabilities are being trained to cope with their disability. The institution has a medical set up to provide basic medical care facilities, but has no dental supervision. Ethical clearance was obtained from the Oxford Dental college and research centre, Bangalore. Informed consent was obtained from the caregivers before participation in the study.

The study was conducted in two parts- collection of oral data on all children was done in the first part. Dental caries were recorded in accordance with the AAPD criteria.^[13] According to the AAPD Caries Risk Assessment Tools (CAT), children with disability/ special needs are considered in the high risk category. Both

cavitated and non-cavitated (white spot) lesions were included. Dental caries was recorded as either present or absent. The presence of even a single carious lesion was also considered as dental caries present. The examiner was trained and calibrated in the department for recording the disease. Intra examiner diagnostic calibrations were performed for 10% of the sample and the kappa score was over 90% which was adequate.

The second part was assessing the barriers to access dental care by the parents of disabled children and dental professionals using questionnaires. A purposive sampling of 150 disabled children and their caregivers were chosen for this. For analysis, dental caries was coded as 1= caries present and 0= caries absent. Caregivers of the children with disability were interviewed on a one to one basis.

In addition, 158 dental professionals were interviewed for their difficulties in providing care to the disabled. A pretested questionnaire was constructed to evaluate the access barriers faced caregivers in getting their children's dental needs fulfilled. The questionnaire was validated prior to the study and was administered by the investigator herself as it had the advantage of clarifying any unclear questions by respondents.

The questionnaire assessing Access problems of the caregivers were elicited, which included variables on location of the dental practice, spatial dimension, affordability, availability, dentist's not accepting to provide treatment, acceptance of services by the parents of child, communication with the dentist and accommodation in terms of opening hours, emergency visits, late night clinics, waiting times and ease of getting an appointment.

The second section of the study encompassed interviewing dental professionals working in the nearby vicinity for their difficulties in providing dental health care to the disabled children. Questions on staff shortage, time pressure, non availability of medical management in the clinics, communication problems/availability of interpreters for them using sign language, consent issues, co-operation of patients, and lack of training during undergraduate or postgraduate courses were asked.

The data obtained was entered in an MS-Excel spreadsheet and analysed using the SPSS version 14.0. A logistic model was

developed to assess this lack of perceived oral health care in the disabled children. All analysis was performed using a level of 0.05 for statistical significance.

Results

Out of 150 caregivers interviewed, responses of 149 were evaluated. 1 caregiver didn't show keen interest in answering few questions and hence had to be excluded. Amongst the barriers to access care by the disabled, 104 (69.79%) of them felt it was very far to travel to the nearest dental practice. 48 (32.21%) of them found it difficult to physically access the clinic premises because of having to climb stairs or had to pass through a busy market area to reach the dental clinic. The social stigma of having to accompany a disabled child made the matter even worse. 113 (75.83%) caregivers experienced that having to pay for dental treatment posed as a greatest barrier to use dental services. That apart from the routine medical consultation and treatment, the dental treatment was a burden to the parents. What was of concern was during the study, caregivers were tensed that apart from the direct costs of dental treatment, there were some indirect costs which parents included in the equation about whether it was worth getting the dental treatment 72% of parents often complained that they had to take time off work regularly and the treatment was not given at single visit. Having to visit the dentist at frequent intervals made it even more difficult to access dental care. Getting them ready on time and to get them at the fixed time was also tedious. Non availability of the dentist made it difficult to access care for 37.58% of the disabled children. Improper communication with the dentist was also expressed as a constraint by 65(43.62%) of the population.

A logistic regression model was developed with disability as the independent variable and taking dental caries, location, place, expenses, availability of dentist, and willingness to treat as the covariates. Location, expensive treatment and availability of the dentist were statistically significant ($p < 0.05$) with disability as depicted in **Table 1**.

158 dentists were questioned about their problems in delivering oral health care to the disabled. All professionals opined that it was very difficult to provide dental care to the disabled child in the clinic.

Table 1 Showing Logistic Regression Model With Disability As Independent Variable Against Other Factors.

Model 1	Standardized Coefficients Beta	T	Sig.	95.0% Confidence Interval	
				Lower Bound	Upper Bound
(Constant)		10.110	.000	4.525	6.725
Dental Caries	.170	6.780	.000	.384	.700
Location	-.305	-5.163	.000	-1.076	-.480
Place	.000	.000	1.000	-.171	.171
Cost	-.295	-8.085	.000	-1.003	-.609
Availability	-.414	-9.108	.000	-1.217	-.783
Satisfaction	.000	.000	1.000	-.159	.159
Willingness	.000	.000	1.000	-.247	.247
Communication Problem	.000	.000	1.000	-.191	.191
Gender	.000	.000	1.000	-.341	.341

Table 2 showing logistic regression model with years of practice of dentist as independent variable against other factors.

Model 2	Std. Error	T	Sig.
(Constant)	.082	-12.251	.000
Time	.196	.000	1.000
Fear	.094	.000	1.000
Socio Economic Status	.314	.000	1.000
Not cooperative	.209	.000	1.000
Consent issue	.287	.000	1.000
Lack of Training	.118	3.395	.001
Medical management	.057	5.840	.000
Staff shortage	.169	3.554	.001
Lack of communication	.187	3.570	.000

Fear of treating uncooperative patients coupled with apprehensive parents was the main reason to not provide dental care to the disabled by most dentists (74.05%). 108 (68.35%) dentists opined that there was no adequate training to treat this section of the population. 98 (62.02%) reported there was staff shortage in managing these children. Non availability of medical management within the clinic or close to the patient's home was another hindrance in rendering dental care, as reported by 52 dental professionals. 84 (53.16%) dentists reported that problems arose during treating disabled children who understood only sign language. Non availability of interpreters with them made it impossible to handle these patients. The Socio economic status of caregivers was another factor which stopped 87 (55.06%) dentists to provide oral health care to the disabled children. **Table 2** depicts a model with years of practice of dentist as an independent variable developed against other variables. Lack of training, need for

hospitalization, shortage of staff and lack of communication was found statistically significant with years of practice. ($p < 0.05$).

There was a statistical difference for treating or not treating disabled children according to the time of practice. The longer the dentist practiced, the likely it was to provide active treatment. ($p < 0.05$).

Discussion:

The study was conducted in Spastics Society of India; Bangalore. 150 caregivers were questioned about the access problems for dental care to the disabled children.

All caregivers expressed their difficulties in accessing dental service which is similar to studies conducted by Vignesh et al, Russell GM et al, Owens J et al^[11,14,15].

Amongst the caregivers interviewed, factors like cost of dental treatment as a constraint was reported in 75.83% which is in accordance to Dinesh Rao et al, Doris J. Stiefel^[16,17]. Difficulty in transportation of the children to the clinic posed as a barrier in 69.79% similar to studies of Doris J. Stiefel^[17,18,19].

Many of the factors identified as barriers in the present study by the caregivers such as inability to take time off employment, difficulty in accessing public transportation for the disabled were reported in previous studies^[19].

Out of the 158 dental professionals who responded to the interview, 108 of them expressed lack of training and experience as a difficulty while rendering dental care to the disabled children which is in accordance to studies of Dinesh Rao,^[20,21,22]. Insufficient time (58.22%) posed as a significant barrier in the study was also reported in Dinesh Rao^[20,21].

Because India is a male dominated society, more male children were found in institutions than their female counterparts. An effort has to be made to get these unfortunate female children to the rehabilitation centre and to provide health and oral health care.

It must be borne in mind that the caregivers of children ranging from 6-15 years were interviewed. A visit to the dentist per se can become traumatic because of different factors such as anxiety related to change in environment; lights, different noises, people, ways of dressing, tactile and sensory issues, a lack of understanding about the purpose of the visit and importance of oral health,

and because of the nature of dental treatment (even if it is only a check up) and invasion of body space even in normal children. These children by the virtue of their disability are even more vulnerable.

What seems to be more important is that the literacy of the caregivers has to be improved through health education efforts^[9]. It has been observed that the literacy is low in low income families with disabled children. These struggle with directions for medications, understanding appointment slips, providing permission for informed consent and navigating health care systems to access care. This can worsen if the individual does not understand the importance of oral health and know that these oral diseases are preventable. Further research needs to be conducted in this context to determine the impact of oral health literacy for accessing oral health care.

To address this forgotten issue, the key principles of health promotion as set out in the World Health Organization's discussion document from the Ottawa Charter^[23] namely advocacy, enabling, and mediation become necessary. In this oral health promotion intervention the issue of advocacy (ensuring the creation of conditions favourable to health) is addressed by training non-dental professionals to give oral health advice, but this fails to address the structural, social, and economic inequalities experienced by neither the caregivers, nor it addresses budgetary constraints and professional role ambiguity.

Enabling (creating supportive environments and giving people the skills and information that they need to make healthy choices) is addressed by introducing oral health promoters and giving an oral health pack. This does not take into account the social determinants of health and assumes that by introducing oral health promoters, and producing a pack then inequalities will be reduced. But the greatest drawback is that the caregivers of children with disabilities were not included in building this initiative and this questions empowerment. The reality is that many caregivers of children with profound disabilities are so firmly entrenched in day-to-day living that an oral health pack will have little impact on their existence whereas a one-to-one approach that supports them and adapts approaches takes their needs and wants into

consideration, and more crucially can recognize when they have the capacity to incorporate more information and alter their daily lives, but this is idealistic and still does not guarantee a reduction in inequalities. Furthermore, it raises the issue of sustainability for the whole programme.

It questions the whole enterprise of oral health promotion for children with disabilities because those most in need are still least able to respond; reflecting the "Inverse Care Law" of Julian Tudor Hart^[24]. The Inverse Care Law (Tudor Hart 1971) states that the availability of good medical care tends to vary inversely with the need for it in the population served. Those who need it the most use it the least. This principle is generally found to apply in oral health services.

A few strategies are proposed here to overcome this shortcomings and to address the oral health needs of these children.

- 1) Enhancing the training of dental professionals: Dental education often does not adequately train dental students to meet the needs of people with disabilities, which affects practicing dentists' confidence and willingness to care for these patients. Appropriate formal training at both the Undergraduate and postgraduate level is necessary to equip them with necessary skills.
- 2) Broadening service delivery sites: Dental offices are not the only place that oral health services can be provided. Some oral health services, particularly preventive services, can be provided in settings that are closer to where people live, work, and learn.
- 3) Training of teachers and caregivers: Caregivers and teachers have to be adequately educated about dental problems, oral hygiene instructions and dietary practice, prevention of oro-facial trauma and first aid.
- 4) Creating barrier free environments: For the People with Disabilities, to be able to access and utilize oral health care services, it is of utmost importance to create barrier free environment both in the private set up as well as in the Hospitals. Recommended are the use of adjustable dental clinic, open space in clinic for maneuvering wheel chair, stabilizing devices and disable friendly toilets and lifts.
- 5) Integrating oral health and overall health: The dental delivery system,

and oral health in general, is poorly integrated with the rest of the health care system, even though oral health is essential to daily functions of life like eating, breathing, and communicating, and there are established links between oral infections and systemic conditions like aspiration pneumonia and diabetes, and emerging links to conditions like cardiovascular disease, and pre-term and low-birth-weight births.

- 6) **Aligning incentives:** Adequate incentives for dental professionals should be provided by the Government who are involved in treatment of these children.

Conclusion:

Children with disabilities are a marginalized group who lack a voice in their own health care. Parents and care givers are children's advocates and enablers; the more profound the impairment the greater the responsibility of care and demand on the individual learning skills and financial and energy resources of parents and paid carers. Unmet treatment need for disabled groups is universally high. Dental caries prevalence, Levels of periodontal disease tends to be higher and oral cleanliness is poorer in disabled children. Certain barriers exist which contribute to the lack of access to delivery of care; such as parental concerns about supervision and transport, financial constraints and also access to buildings. In addition, a further important barrier exists within the profession itself, as dentists are sometimes reluctant to undertake responsibility for these patients because of concerns about behavioural problems. A combination of appropriate training at both undergraduate and postgraduate level as well as the provision of appropriate secondary care facilities for those whose disabilities prevent them being treated in a general dental practice setting is suggested.

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Salivary Amylase, Serum Malondialdehyde, Vitamin - C And Total Proteins In Cases Of Oral Submucous Fibrosis (OSMF) And Diabetes Mellitus With OSMF.

Abstract

Oral Sub mucous Fibrosis (OSMF), has been thought to have some effect on the levels of Salivary Amylase (SA), Serum Malondialdehyde (MDA), Serum Vitamin - C and Total Proteins. Clinically well diagnosed cases of OSMF, Diabetes mellitus (DM) having Oral Sub mucous Fibrosis were included in this study, with view to find out the levels of these parameters. The study was carried out in four phases for every patient, i.e. pre-treatment, post treatment (after 4 - weeks, 6 - weeks and 8 - weeks). The patients were supplemented with "Ala - 100" and "Antoxid" capsules containing antioxidants. Significantly high levels of Serum MDA and total proteins, where as significantly low levels of Salivary Amylase, Serum Vitamin - C were observed in pre - treatment cases in reference to Controls, which were normalized in post treatment i.e. after 8 - weeks. Serum MDA, Serum Vitamin - C and Serum Protein levels were normalized after 6 - weeks in cases of OSMF in comparison with D.M. with OSMF. This observation indicates that out of the three parameters studied in, D.M. with OSMF require more period i.e. 08 - weeks for normalization.

Key Words

Malondialdehyde, Oral Submucous Fibrosis, Antioxidants, Serum.

Introduction:

Oral Sub mucous fibrosis is a chronic progressive, scarring disease of unknown etiology reported mainly in Indians. It has also been reported in Indians living in South Africa, Malaysia, Kenya, Uganda, Fiji and Britain^[1]. In 1952 Schwartz, while examining five Indian women from Kenya first ascribed the descriptive term "atrophia (tropica) mucosae oris"^[2] Later in 1953, Joshi^[3] from Bombay (Mumbai) redesignated the condition as Oral Sub mucous fibrosis, implying predominantly its histological nature. The WHO definition for an oral pre-cancerous condition - "a generalized pathological state of the oral mucosa associated with a significantly increased risk of cancer," accords well with the characteristic of OSF.

Epidemiological studies have shown that the process of carcinogenesis occurs by generation of Reactive Oxygen Species (ROS)^[4], which act by initiating lipid per oxidation (LPO)^[5]. Prevention against LPO mediated damage is done by non-enzymatic antioxidants, especially Beta-carotene and Vitamin - E and C.

Saliva is a complex fluid composed of a wide variety of organic and inorganic constituents that collectively act to modulate the oral environment^[6]. Interest in saliva as a diagnostic fluid has grown exponentially in recent years. Whole saliva can be collected noninvasively. The earliest "sialochemical" studies on oral fluids were conducted by Micheals^[7] and Krik^[8], each of whom examined saliva for specific components that would be diagnostic for various conditions.

Successful treatment with antioxidant supplementation for leukoplakia, an oral pre-malignant condition, has also been reported^[9]. With this understanding the present study was undertaken to ascertain the co-relation between anti-oxidant supplementation and the changes in the levels of Serum MDA, Serum Vitamin - C and Serum Protein in cases only with OSMF, Diabetes mellitus having Oral Sub mucous Fibrosis cases with respect to period.

Material And Methods:

Well diagnosed cases of OSMF (N=100), D.M. with OSMF (N=44), and Healthy Controls (N=50) were studied for

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Salivary Amylase, Serum MDA, Serum Vitamin - C and Serum Protein levels. Random Blood Sugar levels were studied in the cases of D.M. with OSMF.

After the due consent of patient in writing the study was carried out in four phases i.e. pre-treatment and post-treatment (i.e. after 04, 06 and 08 weeks respectively) All the patients were subjected to a thorough history regarding dietary habits and addiction. All the details were taken in the "Case History" proforma.

Collection of Saliva and Blood Sample

With all aseptic precautions subjects were asked to spat out saliva accumulating freely in their mouth as frequently as desired over duration of 2 - minutes, further its was immediately used for Salivary Amylase estimation {Claycomb, (1956)^[10]}. Also 4ml of blood was collected from antecubital vein of each individual into a plain and fluoride bulb and bulb using EDTA as anticoagulant. The plasma and serum was separated and used for the estimation of Serum Malondialdehyde {Satoh, 1978}^[11], Blood Sugar {(GOD - PAP) End - Point Biolab Diagnostics}, Vitamin - C of {Harris and Ray, (1935)^[12]

Observation Table : Table No. :I Serum Mda, Serum Vitamin - C And Serum Protein Levels In Patients With OSMF,D.M. With OSMF, And Controls.

Parameters	Control	Pre-Treatment		4-Weeks		6-Weeks		8-Weeks	
		OSMF	D.M. c OSMF	OSMF	D.M. c OSMF	OSMF	D.M. c OSMF	OSMF	D.M. c OSMF
Salivary Amylase (mg/ml)	2.8 (±0.2)	1.6 (± 0.3)	1.6 (±0.2)	1.8(±0.2)	2.1(±0.4)	2.0(±0.3)	2.7(±0.1)	2.7(±0.1)	2.7(±0.1)
Blood Sugar (mg %)	115.9 (±5.2)	--	122.7 (±16.6)	--	115.9(±13.3)	--	116.6(±14.3)	--	115.0(±13.1)
Serum MDA (nmole/ml)	5.4 (± 0.5)	6.9 (±0.5)	7.3 (±0.9)	6.1(±0.6)	7.1(±0.9)	5.6(±0.3)	6.6(±0.6)	5.3(±0.1)	5.3(±0.4)
Serum Vit. - C (mg/L)	9.8 (± 1.4)	5.9 (±0.6)	5.8 (±0.9)	7.0(±0.7)	6.5(±1.0)	9.9(±0.6)	7.8(±1.0)	10.0(±0.4)	9.3(±1.1)
Total Serum Protein (gm%)	6.2 (± 0.2)	7.6 (±0.2)	8.2 (±0.2)	7.4(±0.3)	7.7(±0.3)	6.9(±0.3)	6.9(±0.3)	6.3(±0.3)	6.6(±0.3)

} and Serum Total Proteins {Lowry} ^[13].

Statistical Analysis:

The data was analyzed with Student's independent 't' test.

Results And Discussion:

Diabetes is the commonest metabolic disease of endocrine origin, characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both, affecting a large number of people in the world. Multiorgan involvement in diabetes as in retina, blood vessels, kidneys and nerves have been well documented.

The history of all the cases included in the study revealed that significant portion of OSMF cases chewed the processed betel quid preparations. It has been shown that Betel quid extract aercoline is more cytotoxic than (+) -catechin and extracts of Inflorescence of piper betel (IPB) and betel nut (Areca catechu). These might act synergistically on the pathogenesis of OSMF ^[14].

In the present study, the levels of Salivary Amylase, Serum MDA, Serum Vitamin - C and Serum total protein were compared between the OSMF group (i.e. OSMF, Diabetes mellitus having Oral Sub mucous Fibrosis) and healthy Controls. OSMF group which was in turn divided as Pre-treatment and Post-treatment (i.e. after 04-weeks, 06-weeks and 08-weeks). Random Blood Sugar levels were analyzed which were normal in the cases of D.M. with OSMF.

A decrease of 75% in the levels of Salivary amylase was observed in Pre - treatment cases of OSMF, D.M. with OSMF with reference to Control. In Post treatment period after 06 - weeks OSMF cases showed an increase in the levels of Salivary amylase i.e. 2.0 mg/ml which was low as compared to DM with OSMF i.e. 2.7mg/ml. The levels were normalized after 08 - weeks with

reference to Control. The decrease in the levels of Salivary Amylase must be due to the reduction in the total salivary secretion seen in fever and other pathologic conditions that affect oral secretions ^[15].

A increase of 35% in the levels of Serum MDA was observed in Pre-treatment cases of D.M. with OSMF with reference to Control. This increase in the level was higher as compared to OSMF cases, which were 28% with reference to Control. The mean Serum MDA level in OSMF Pre-treatment cases was 6.9 (±0.5), which showed the lowest increase in reference to Control i.e. 5.4 (±0.5). A steady decrease in these levels was observed after starting the anti-oxidant supplementation i.e. in Post treatment cases in both the groups. A normal level of 5.6 (±0.3) was observed within the period of 06 - weeks in OSMF cases in reference to Control, as compared to the other group, which required a period of 08 - weeks to reach the normal levels. Increase in MDA levels in OSMF cases has also been reported by Suryakant Metkari et al ^[16]. They have reported that there is increase in the level from OSMF grade-I, grade-II, grade-III and grade-IV. The increase in lipid per oxidation product MDA in OSMF pre-treatment cases as compared to post treatment i.e. after 08-weeks and control group may be due to the poor antioxidant system, excessive free radical formation due to various tissue abuse habits and decomposition of polyunsaturated fatty acid present in membranes.

Diabetes Mellitus with OSMF Pre-treatment cases showed the highest decrease in Serum Vitamin - C levels with reference to the Controls, and this decrease was 41%. The cases of OSMF and D.M. with OSMF also showed a comparable decrease of 40% in each. A steady increase in the levels of Serum Vitamin - C was observed after starting the anti-oxidant supplementation i.e. in Post treatment cases in both groups. A

normal level of 9.9 (±0.6) was observed within the period of 06 - weeks in OSMF cases in reference to Controls i.e. 9.8 (±1.4) as compared to the other group, which required a period of 08 - weeks to reach the normal levels. This clearly shows that the anti - oxidant load for this Vitamin was lowered in all the cases studied and hence the levels of this vitamin showed a steady increase in Post-treatment cases.

A highest of 32% increase in total Serum Protein levels was observed in Diabetes Mellitus with OSMF cases in reference to Controls. A period of 08 - weeks was required for OSMF and Diabetes Mellitus with OSMF cases to achieve normal Serum Protein levels. A value of 6.6 (±0.3) and 6.3 (±0.3) was observed in OSMF and Diabetes Mellitus with OSMF cases respectively.

The increase in total serum protein levels in pre-treatment cases compared to post treatment i.e. after 08-weeks and control group may be due to the increase in globulin fractions and other serum proteins ^[17]. The increase in lipid per oxidation product MDA, Serum total protein and decreased antioxidant Vitamin-C observed in present studies are also supported by similar findings reported in various pathological conditions including OSMF.

The study reveals that a period of 08-weeks is required to normalize the parameters studied in OSMF with diabetes cases after starting the Antioxidant Capsules. Antioxidant is a molecule capable of showing or preventing the oxidation of other molecules. Ascorbic acid is a reducing agent and can reduce, and thereby neutralize, reactive oxygen species (ROS) such as hydrogen peroxide ^[18]. Our studies are supported by similar results observed by Soma Gupta et al ^[19] who reported that the treatment with the "antioxid" capsules showed some improvements and amelioration of the

symptoms along with increased in the level of vitamin – E and beta carotene which are the antioxidants, the period required was 06-weeks in OSMF cases, however present.

Thus the present study shows possibility of ROS playing a part in aetiopathogenesis of the disease and further Salivary amylase, Serum Vitamin C, and MDA levels as the biochemical marker of the disease state. OSMF and administration of antioxidants may have protecting effect with clinical improvement. Long term follow up study of the more number of patients is required with some more antioxidant markers for analysis in saliva and blood, to validate the use of such therapy in OSMF cases and prevent malignant conversion and also the role of any of above studied parameters as a bio-chemical marker.

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A Survey On Attitude Towards Orthodontic Treatment In Rural Area Among Students

Abstract

Objective : To evaluate the attitudes and perceptions of students in rural area towards orthodontic treatment & to determine the problem in perceiving orthodontic treatment.

Methods : A cross sectional questionnaire based survey was conducted among 225 students from a higher secondary school in a village of Rajasthan. 12 items questionnaires were used to collect the data.

Results : Oral hygiene maintainence is a problem emerged as a major perception towards orthodontic treatment in 40% of population; next problem is duration of treatment with 37.3% population reported. 86% subjects reported teeth as a major feature for facial aesthetics. Only 4.5 % of subjects reported orthodontic treatment expensive. There are 12% subjects feel that there is lack of information towards orthodontic treatment still prevailing.

Conclusion : The principal conclusion reported in present study is that people consider smile as a major factor for aesthetics. Reason for other patients not opting for orthodontic treatment is not because this being too expensive but lack of information. There has to be a special campaign towards educating school children towards treatment modalities present and what difference they can bring in someone's life.

Key Words

Malocclusions; orthodontic corrective; facial esthetics

Introduction

Many researchers have shown how attractive person has an added advantage over his or her less attractive counterparts, be it in the social or career context. Enhancing appearance and improving psychosocial status have been considered as important motivating factors behind an adult's decision to initiate orthodontic treatment. However research for initiating orthodontic treatment may vary across cultural and socio-economic backgrounds. Epidemiological studies on caries experience and patient demographic realities have encouraged both general dentists and orthodontists to incorporate adult orthodontic treatment into their practices^[4]. During fixed orthodontic treatment, some problems like poor oral hygiene, carious lesion can occur. With more adults seeking orthodontic treatment practitioners should focus their attention beyond the orthodontic mechano-therapy to the more subjective aspects of patents discomfort and attitude towards treatment^[4]. Patients face many problems to start up with orthodontic treatment; one of the most common reasons may be the lack of information followed by other reasons like fear of pain, embarrassment, expensive and long duration of treatment etc^[6]. Also there

may arise problems in various part of mouth like in tongue, lips, cheeks, etc. Orthodontic treatment resulting in proper alignment of teeth seems to bring about many alterations in the patient's life like in career opportunities, social interaction and confidence^[6]. This study attempts to identify favorable and unfavorable aspects of orthodontic treatment from the patients' point of view and their motivation to accept and continue with treatment. The aim of the present study was to assess the attitude and perception towards orthodontic treatment by students suffering from malocclusion from a localized rural population.

Material And Methods

A cross sectional questionnaire based survey was conducted among 225 students from Government Girls Senior Secondary School, Bagru, Jaipur during the period of 2012. Bagru is located Jaipur District of Rajasthan State, known for Bagru prints on clothes. The reason for selecting girls school was a common perception that girls are more esthetic concern.

All the students with a positive consent were considered in the study and were provided with a questionnaire to be filled by them although they were free to come

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up with queries. A 12-item questionnaire, designed to investigate student's attitudes and perception of orthodontic treatment, was administered to students to get information whether the rural population was aware of orthodontic treatment & what the problems are. The questionnaires were filled by the students and collected by the dentists during their visit to the school. Completed questionnaires were received from 225 patients.

The study group selected was of age group of 17-22 years.

Results

Response rate for the present study was 100%.

Table 1 reveals about the general oral hygiene maintenance methods used in rural students. All the students were aware of maintaining oral hygiene irrespective of the method used for cleaning teeth. 99.5% students used

Table 1: Awareness Of General Oral Hygiene Maintenance

Oral hygiene aids used	Percentage
Toothbrush & Toothpaste	99.5%
Toothpaste with finger	0.0%
Toothpowder	0.44%
Any other	0.0%

Table 2: Awareness of orthodontic treatment

Sources of awareness	Percentage
Parents	16.8%
Peer group	38.2%
Television	13.7%
Dentist	25.7%

Table 3: Need for Orthodontic treatment

Factors	Yes	No
Smile	93.7%	6.25
Willingness	57.7%	42.2%
Personality	96.4%	3.5%

Table 4: Problems in perception of orthodontic treatment

Problems	Yes	No
Difficulty in eating	37.7%	62.2%
Pain	44.4%	55.5%
Peer group reaction	66.6%	33.3%

toothpaste & toothbrush while 0.44% used toothpowder.

Table 2 : reveals the awareness of students towards orthodontic treatment. Interestingly the 5.3% students were unaware of orthodontic treatment. The students who were aware of this treatment got this information from peer group with the percentage of 38.2%. The second most common source of information was their recent visits to the dentist for some other reason & they came across the malocclusion problem when dentist educated them. Some of them got the awareness from parents & television with the percentage of 16.8% & 13.7% respectively.

Table 3 : reveals that 57.7% of the rural students were not willing to get the treatment to get done even if they got chance in future. These were the students who considered smile as important factor in esthetics & were satisfied with their personality. The students who want treatment to be done considered improvement in smile & personality as a criteria.

Table 4 : reveals the problems they can come across while opting orthodontic treatment. Out of three causes the highest percentage was their peer group reaction with 66.6%. 44.4% were concerned about the pain caused by wearing braces & 37.7% complained that it will cause difficulty in chewing food with the percentage of 37.7%.

Discussion

Our results demonstrated that the improvement in self-confidence and physical attractiveness as a result of enhanced “dental” or facial appearance was the most important motivating factor for treatment. Improvement in psychosocial status resulting from orthodontic treatment should therefore be cited as an important factor for treatment, unfortunately, the commonly implemented orthodontic indices use to determine treatment priority do not take this factor into consideration, as psychological testing often requires the use of sophisticated questionnaires and professional evaluation. It was interesting to note that improvement in self-confidence was rated only second to the enhancement in dental aesthetics, when patients were asked for the main reason for them in seeking treatment. Furthermore, improvements in career opportunities, social life and self confidence following orthodontic treatment were seen as motivating factors in of patient’s. Also most of the patients felt that crooked teeth seek long duration of treatment; lack of information was the next most important reason hence they did not go for treatment. Wearing braces among adults in Indian Rural society is still not as accepted as Europe and America^[1]. This was also a discouraging factor. In other studies it has been shown as fear of pain was the main discouraging factor in other countries. With the advent of ceramic labial appliances and lingual orthodontic appliances the task of marketing orthodontics to adult should be less formidable. Orthodontists are capable of changing the arrangement of teeth, jaws and shape of face, which 96.4% of subjects considered “the most important facial feature” this fact high light the important role of the dental profession in determining facial aesthetics. Dentists have a large part to play in recommending orthodontic treatment when indicated. The state health service should also strive to educate the public about dental and orthodontic treatment. This result was similar to study by Breece et al^[4]. It also noted that 15.5% of subjects did not seek treatment earlier because they were unaware, confirming the findings of Breece and Neiberg on 204 Caucasian patients who had completed orthodontic treatment. Our dental health education programmes should put more efforts in making patients aware of dentistry as a

contributing factor to health. With the advancement in orthodontic materials (aesthetics and a better understanding of the histology of tooth moments, the adult to children patient ratio in orthodontic practices has increased dramatically. Unfortunately few studies have been published on the discomfort involved in orthodontic tooth movement in adults^[2]. The discomfort following orthodontic tooth movement is often for about 1-2 days, was found in the present study to affect teeth, cheeks, lips and tongue. The main concern of students regarding treatment was reaction of their friends on wearing braces which was originated due to lack of complete knowledge about treatment. Also our study has shown that perception towards pain caused by orthodontic appliances had a wide range of individual response, reflecting the subjectivity of the pain response. This difficulty could be brought on by the discomfort of foreign attachments on the surface of teeth and the tenderness on activation of the arch wire. Orthodontists should control post adjustment orthodontic pain via several means such as dietary restrictors (soft diet) and non steroidal anti-inflammatory agents such as aspirin and ibuprofen immediately following bending or in patients who experience repeated post-adjustment pain. Difficulty in chewing food was experienced by 38% of patients in our study while several studies on lingual orthodontic patients have implicated tongue soreness as the main contributor to chewing problems^[5]. Our results also showed an almost similar percentage of patients with speech problems and tongue soreness. Several authors have suggested that motivation plays a key role in successful adult orthodontic therapy (16-19). The importance of a dentist educating his patient about the benefits of orthodontic treatment need not be over-emphasized.

Conclusion

The principal conclusion reported in present study is that people consider smile as a major factor for aesthetics. Reason for other patients not opting for orthodontic treatment is not because this being too expensive but lack of information such as peer group reaction, pain & discomfort etc. There has to be a special campaign towards educating school children towards treatment modalities present and what difference they can bring in someone’s life. Also

school dental health programmes should be conducted to educate students about orthodontic treatment in which they should educate about malocclusion, effects of malocclusion, orthodontic treatment as a personality developing factor, about ceramic braces etc so that they can opt for it easily.

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A Comparative Evaluation Of Linear Dimensional Change And Compressive Resistance Of Different Interocclusal Recording Materials – An Invitro Study

Abstract

Background: The introduction of different interocclusal recording materials has put clinicians in dilemma that which material should be used in routine clinical practice for precise recording of occlusal records that helps in the fabrication of a satisfactory prosthesis. In dentistry today, different interocclusal record materials have been introduced with different brand names. So, it is confusing for the dentists to choose a particular material due to lack of invitro or invivo studies.

Purpose of the study: The aim of this research is to evaluate the time and thickness dependent linear dimensional stability and compressive strength of four types of interocclusal recording materials.

Materials and Method: Commercially available Polyether bite registration paste (Ramitec), Polyvinyl siloxane bite registration paste (Occlufast), Aluwax and Zinc oxide eugenol (ZOE) bite registration paste (Superbite) were used in the study. A stainless steel die was made according to modified American dental Associations (ADA) specification no. 19. Each one of the tested materials was manipulated according to manufacturer's instructions. The samples obtained were measured for linear dimensional change and compressive strength using Profile Projector and Universal testing machine respectively.

Observation and Results: Total 120 samples were made for observation and results were subjected to statistical analysis using analysis of variance (ANOVA) and then Tukey's Honestly Significant Difference (HSD) test for comparison among groups at the 0.05 level of significance. After statistical analysis of the data, results were obtained and analyzed for interpretation.

Key Words

interocclusal records, bite registration, properties of interocclusal record materials, accuracy of interocclusal record

Introduction

An interocclusal record is the registration of the positional relationship of the opposing teeth or the jaws to each other (GPT- 8). Inaccurate interarch registration leads to errors in diagnosis and treatment.

The ideal interocclusal recording material should be easy to handle, exhibit minimal dimensional changes during and after setting. It should offer adequate resistance to closure during the mounting of casts^[1]. Interocclusal records help in planning occlusal rehabilitation and determine single positional relationship of lower jaw to upper jaw in various centric and eccentric positions. They are also used to correct occlusal discrepancies on an articulator^[2]. Effect of lateral shift of mandible can be incorporated into the scheme of balanced occlusion^{[3],[4],[5]}.

Plaster^{[6],[7]}, impression compound, wax^[8], zinc oxide eugenol paste, eugenol free zinc oxide paste, acrylic resin and

elastomeric materials are materials routinely used for registration of occlusal relationships. Recently, polyether and polyvinylsiloxane elastomeric materials have been introduced.

The records must be dimensionally stable until articulated else there may occur vertical and horizontal discrepancies in the interocclusal relationships of the casts. So more of occlusal adjustments will have to be made for the prosthesis, crowns or fixed partial dentures, in the mouth. A compressive force is commonly exerted on the recording material during its removal from the patient's mouth and during articulation which causes vertical and horizontal inaccuracies during mounting resulting in faulty restorations. So resistance of these recording materials against compressive forces is important. The material gets deformed when compressed under a load. The deformation may vary with the thickness and properties of recording materials used. Thickness of interocclusal record is

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lesser in fixed partial denture cases. It is more in complete denture cases.

Sometimes, it takes time to carry interocclusal records to distant laboratories or there may be delay in the articulation of casts in the laboratory. This time interval also affects the properties of the recording material used. Some materials can be safely stored for long periods while others cannot be. This study has been undertaken to evaluate the linear dimensional change and compressive resistance of different thicknesses of different interocclusal recording materials over different time intervals.

Materials And Methods

- The materials and method used in the study can be described under following:
- Materials and armamentarium used
- Manipulation of materials

Materials And Armamentarium

- Bite registration wax (Aluwax, Aluwax Dental Products Co., USA) [Fig.1]



Fig.I: Materials used in the study A. Superbite B. Aluwax C. Occlufast D. Ramitec



Fig.II: Hot water bath



Fig.III: Armamentarium

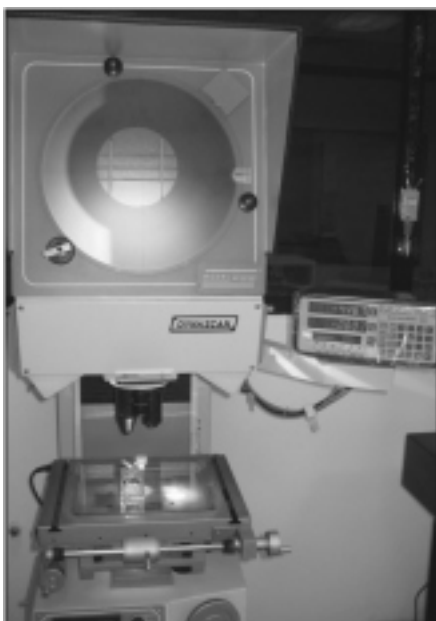


Fig.IV: Sample being measured under Profile Projector

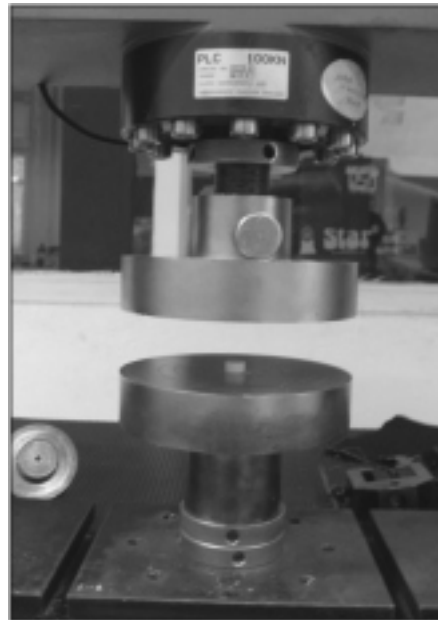


Fig.V: Sample being tested under UTM for compressive resistance



Fig.VI: Split mold assembly A. Master die with reference lines B. Split molds of different heights C. Outer circular ring D. Flat rectangular metal plate

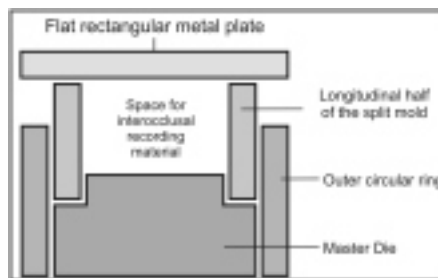


Fig.VII: Diagram of Split mold assembly

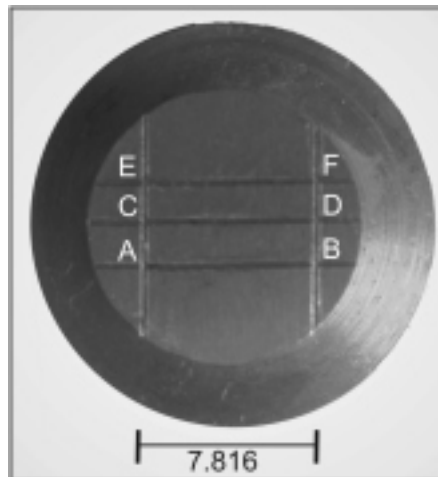


Fig.VIII: Master die with reference lines

- Zinc Oxide Eugenol bite registration paste (Superbite, Bosworth, USA) [Fig.I]
- Polyvinylsiloxane bite registration material (Occlufast, Zhermack, Italy) [Fig.I]
- Polyether bite registration material (Ramitec, 3 M, Germany) [Fig.I]
- Hot water bath [Fig.II]
- Clamp [Fig.III]
- Tweezer, Mixing Pad & Mixing Spatula [Fig.III]
- Automatic mixing syringe and dispensing gun (Haereus Kulzer) [Fig.III]
- Profile Projector (Dynascan, accuracy=0.001 mm) [Fig.IV]
- Universal testing machine (Instron ,accuracy =0.005 mm) [Fig.V]

Split mold assembly(Fig.VI):

Split mold assembly included a master die with reference lines, a split mold, outer circular ring and a flat rectangular metal plate (Fig.VII). Master die was a stainless steel solid cylinder, 10 mm in height, fixed to a stainless steel circular base. Reference lines as per ADA specification no. 19 were engraved on the superior surface of cylinder. Three horizontal lines, in the centre of circle equidistant from each other were intersected by two vertical lines such that distance $AB=CD=EF=7.816$ mm (Fig.VIII).

A split mold consisted of two longitudinal halves of a hollow cylinder (Fig.VII). Three pairs of such hollow cylinders with a height of 12 mm, 14 mm and 16 mm were used so that samples could be obtained in three different thicknesses. Outer circular ring closely fitted around the mold assembly. A rectangular flat metal plate was used to extrude out excess material.

Manipulation Of Materials

The individual materials were manipulated according to manufacturer's instructions. Aluwax was submerged in a hot water bath (40°- 45°C) for 5 min and placed into the mold.

Polyether (Ramitec) and Zinc Oxide Eugenol (Superbite) were available in tubes as base paste and catalyst paste. Polyvinylsiloxane (Occlufast) supplied in automixing cartridges was injected into the mold by dispensing gun.

The mold assembly along with the clamp were submerged in a $32 \pm 1^{\circ}\text{C}$ water bath to simulate oral conditions for a time duration as per manufacturer's

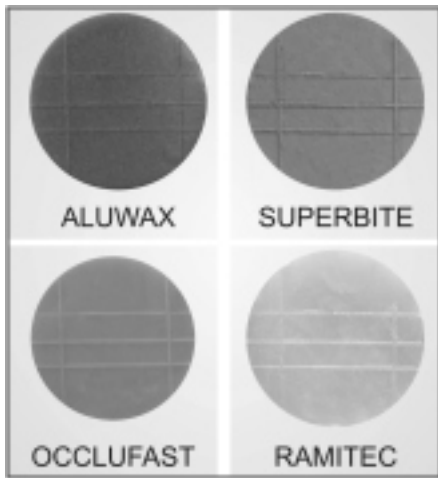


Fig. IX: Samples of different interocclusal recording materials

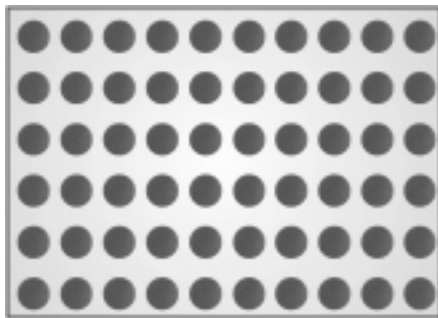


Fig. X : Group A samples

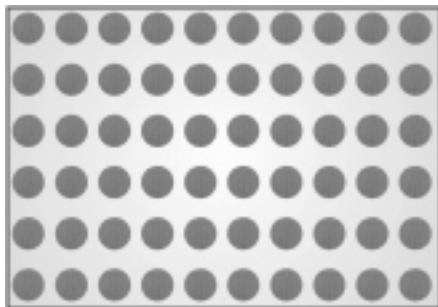


Fig. XI : Group B samples

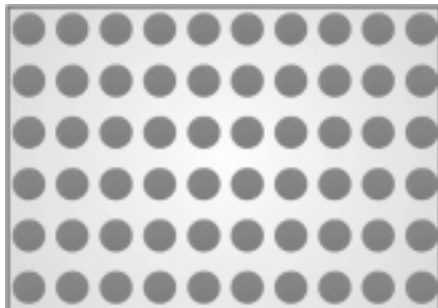


Fig. XII : Group C samples

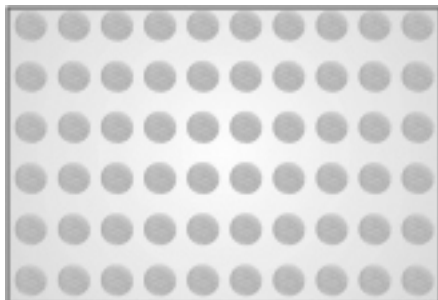


Fig. XIII : Group D samples

recommendations.

The samples were in the form of a disc with the impression of reference lines on the surface (Fig.IX). The samples were obtained in 3 thicknesses of 2 mm, 4 mm and 6 mm using split molds of different heights. The samples were divided into different groups.

Different groups under study:

Total of 120 samples were made from each material. 60 samples were tested for linear dimensional change and 60 samples were evaluated for compressive resistance. Out of each 60 samples, 20 samples each were obtained in thickness of 2mm, 4mm and 6mm respectively. 10 samples were tested after 1 hr and other 10 samples were tested after 24 hrs.

For linear dimensional change:-

The samples were divided into 4 main groups:

Group A: Bite Registration wax (Aluwax) (Fig.VIII)

Group B: Zinc oxide eugenol (Superbite) (Fig.IX)

Group C: Polyvinylsiloxane (Occlufast) (Fig.X)

Group D: Polyether (Ramitec) (Fig.XI)

Each main group has 3 subgroups:

Subgroup I: 20 samples with a thickness of 2 mm

Subgroup II: 20 samples with a thickness of 4 mm

Subgroup III: 20 samples with a thickness of 6 mm.

Within each subgroup, 20 samples were tested after 2 different time intervals i.e. after 1 hr and after 24 hrs. These were subgrouped as follows.

Subgroup 1: 10 samples tested after 1 hr

Subgroup 24: 10 samples tested after 24 hrs.

So different groups may be summarized as follows:

Group A: Subgroup I1 – Samples were denoted as Ai1

Subgroup I24 – Samples were denoted as Ai24

Subgroup III1 – Samples were denoted as AIII1

Subgroup II24 – Samples were denoted as AII24

Subgroup III1 – Samples were denoted as AIII1

Subgroup III24 – Samples were denoted as AIII24

Similarly for groups B, C and D.

For compressive resistance: Similar grouping was done for samples tested for compressive resistance and were denoted as A' I1 , A' I24, A' III1, A' II24 and so on.

The measurements were done using Profile Projector (for linear dimensional change) and Universal testing machine (for compressive resistance). Linear dimensional change was tested by measuring the distance A-B, C-D and E-F and calculating their mean (Fig.IV). Compressive resistance was tested by measuring deflection (mm) on an Instron Universal Testing Machine under a constant compressive force of 25 Newton (Fig.V). Greater the deflection for a particular material, lesser is the compressive resistance of that material. After the readings were obtained, they were compared with the dimensions on the die, tabulated and subjected to analysis by using one-way ANOVA test.

Observations & Results

The observations and results of the study can be summarized in the following tables:

Table I – Distances On Master Die

Distance	A - B	C - D	E - F
Measurement (mm)	7.816	7.816	7.816

This table shows the distances A-B, C-D and E-F (linear dimensions) on the master die as measured by Profile Projector.

Table II – Mean Linear Dimensional Change (In Mm) Among Different Materials.

	N	Mean	Std. Deviation	Std. Error
Aluwax	60	0.1771	0.0168	0.0021
Superbite	60	0.0578	0.0877	0.0113
Ramitec	60	0.0543	0.0167	0.0021
Occlufast	60	0.0143	0.0083	0.0010
Total	240	0.0758	0.0760	0.0049

N = no. of observations

Aluwax shows the maximum linear dimensional change and Occlufast shows the minimum linear dimensional change among all the materials.

Table III – Mean Linear Dimensional Change Among Different Materials After 2 Different Time Intervals.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Aluwax 1hr	0.1640	30	0.0145	0.0026
	Aluwax 24hr	0.1903	30	0.0034	0.0006
Pair 2	Superbite 1hr	-0.0228	30	0.0344	0.0062
	Superbite 24hr	0.1903	30	0.0034	0.0006
Pair 3	Ramitec 1hr	0.0486	30	0.0132	0.0024
	Ramitec 24hr	0.0600	30	0.0181	0.0033
Pair 4	Occlufast 1hr	0.0060	30	0.0019	0.0003
	Occlufast 24hr	0.0218	30	0.0039	0.0007

All the materials except ZOE showed shrinkage at the end of 1hr which increased at the end of 24hrs. ZOE showed initial expansion after 1hr and shrinkage after 24hrs.

Table IV – Comparison Of Linear Dimensional Change Measured Among Different Materials After 2 Different Time Intervals By One – Way Anova.

		Mean	Std. deviation	Std. error mean	t	df	p-value
Pair 1	Aluwax 1hr	0.0263	0.0153	0.0028	9.379	29	.000*
	Aluwax 24hr						
Pair 2	Superbite 1hr	0.2123	0.0339	0.0062	34.234	29	.000*
	Superbite 24hr						
Pair 3	Ramitec 1hr	0.0113	0.0220	0.0040	2.826	29	.008*
	Ramitec 24hr						
Pair 4	Occlufast 1hr	0.0153	0.0443	0.0007	19.242	29	.000*
	Occlufast 24hr						

There is significant linear dimensional change for each material at the end of 1 hr and 24 hrs.

Table V : Mean Linear Dimensional Change Among Different Thicknesses Of Different Materials.

		N	Mean	Std. Deviation	Std. Error
Aluwax	2 mm	20	0.1774	0.0174	0.0039
	4 mm	20	0.1769	0.0170	0.0038
	6 mm	20	0.1770	0.0170	0.0038
	Total	60	0.1771	0.0168	0.0021
Superbite (ZOE)	2 mm	20	0.0443	0.0895	0.0200
	4 mm	20	0.0702	0.1044	0.0233
	6 mm	20	0.0588	0.0681	0.0152
	Total	60	0.0578	0.8776	0.0113
Ramitec (Polyether)	2 mm	20	0.0568	0.0157	0.0035
	4 mm	20	0.0457	0.0196	0.0043
	6 mm	20	0.0604	0.1083	0.0024
	Total	60	0.0543	0.0167	0.0021
Occlufast (Polyvinyl -siloxane)	2 mm	20	0.0145	0.0082	0.0018
	4 mm	20	0.0143	0.0085	0.0019
	6 mm	20	0.0139	0.0086	0.0019
	Total	60	0.0142	0.0083	0.0010

For each material, the compressive resistance decreased (mean deflection increased) as the thickness increased. So, the highest degree of compression resistance for each of the materials tested was seen at 2 mm thickness.

Table VI : Comparison Of Linear Dimensional Change Measured Among Different Thicknesses Of Different Materials By One-way Anova.

		Sum of Squares	df	Mean Square	F	p-value
Aluwax	Between Groups	0.000	2	0.000	0.005	0.995
	Within Groups	0.017	57	0.000		
	Total	0.017	59			
Superbite (ZOE)	Between Groups	0.007	2	0.003	0.429	0.653
	Within Groups	0.448	57	0.008		
	Total	0.454	59			
Ramitec (Polyether)	Between Groups	0.002	2	0.001	2.697	0.113
	Within Groups	0.014	57	0.000		
	Total	0.017	59			
Occlufast (Polyvinyl -siloxane)	Between Groups	0.000	2	0.000	0.026	0.974
	Within Groups	0.004	57	0.000		
	Total	0.004	59			

There is no significant difference in linear dimensional change among different thicknesses of different materials.

Table VII : Mean Deflection (Mm) Measured Among Different Materials.

	N	Mean	Std. Deviation	Std. Error
Aluwax	60	0.0662	0.0270	0.0034
Superbite	60	0.0448	0.0251	0.0032
Ramitec	60	0.1059	0.0394	0.0050
Occlufast	60	0.0850	0.0257	0.0033
Total	240	0.0755	0.0373	0.0024

Aluwax exhibits maximum compressive resistance (minimum mean deflection) followed by Occlufast (polyvinylsiloxane) > Ramitec (polyether) > Superbite (ZOE).

Table VIII : Comparison Of Deflection (Mm) Measured Among Different Materials By One – Way Anova.

	Sum of squares	df	Mean square	F	p-value
Between groups	0.123	3	0.041	45.550	.000*
Within groups	0.212	226	0.001		
Total	0.334	239			

There is significant difference in compressive resistance among different materials.

Table IX : Comparison Of Deflection (Mm) Measured Among Different Thicknesses Of Different Materials By One – Way Anova.

		Sum of squares	df	Mean Square	F	p-value
Aluwax	Between groups	0.029	2	0.014	56.442	.000*
	Within groups	0.014	57	0.000		
	Total	0.043	59			
Superbite (ZOE)	Between groups	0.025	2	0.013	59.379	.000*
	Within groups	0.012	57	0.000		
	Total	0.012	59			
Ramitec (Polyether)	Between groups	0.062	2	0.031	58.903	.000*
	Within groups	0.030	57	0.001		
	Total	0.092	59			
Occlufast (Polyvinyl -siloxane)	Between groups	0.027	2	0.013	63.551	.000*
	Within groups	0.012	57	0.000		
	Total	0.039	59			

There is significant difference in compressive resistance among different thicknesses of each material.

Table X : Mean Deflection (Mm) Measured Among Different Materials After 2 Different Time Intervals.

		N	Std. deviation	Std. error mean
Pair 1	Aluwax 1hr	30	0.0360	0.0065
	Aluwax 24hr	30	0.0128	0.0023
Pair 2	Superbite 1hr	30	0.0268	0.0049
	Superbite 24hr	30	0.0176	0.0032
Pair 3	Ramitec 1hr	30	0.0498	0.0090
	Ramitec 24hr	30	0.0163	0.0029
Pair 4	Occlufast 1hr	30	0.0336	0.0061
	Occlufast 24hr	30	0.0096	0.0017

The compressive resistance of each material increased (mean deflection decreased) at the end of 24 hrs when compared to the compressive resistance at the end of 1 hr.

Table XI : Comparison Of Deflection (Mm) Measured Among Different Materials After 2 Different Time Intervals By One – Way Anova.

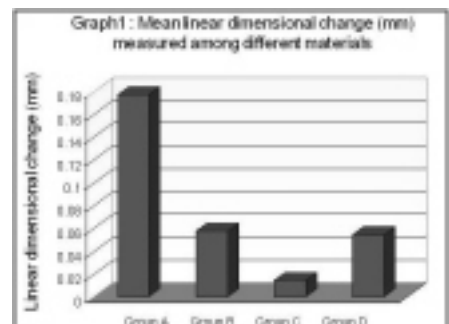
		Mean	Std. deviation	Std.error mean	t	df	p-value
Pair 1	Aluwax 1hr	0.0067	0.0295	0.0053	1.256	29	0.219
	Aluwax 24hr						
Pair 2	Superbite 1hr	0.0002	0.0154	0.0028	7.875	29	0.000*
	Superbite 24hr						
Pair 3	Ramitec 1hr	0.0285	0.0349	0.0063	4.476	29	0.000*
	Ramitec 24hr						
Pair 4	Occlufast 1hr	0.0152	0.0243	0.0044	3.431	29	0.002*
	Occlufast 24hr						

There is a significant difference in compressive resistance at 2 different time intervals for each material except for Aluwax.

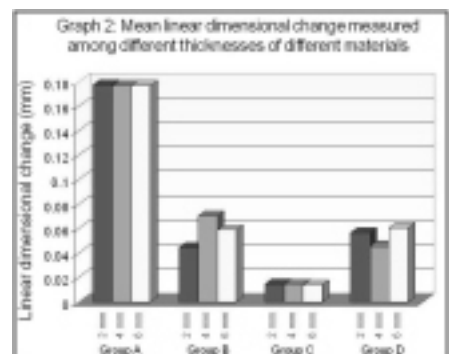
Discussion

When linear dimensional change was evaluated, it was observed that none of the samples obtained from different interocclusal recording materials were exactly similar to the master die in linear dimensions.

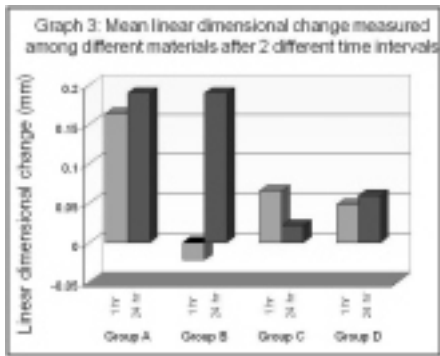
Occlufast (Polyvinylsiloxane) was the most dimensionally stable material (Table – II, Graph 1) because there are



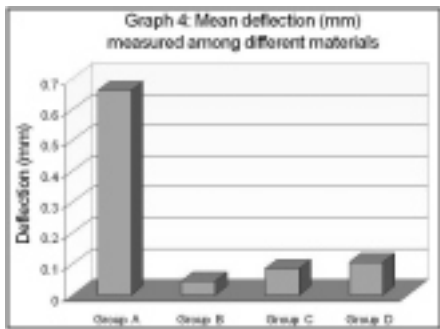
Graph 1: Mean linear dimensional change (mm) measured among different materials



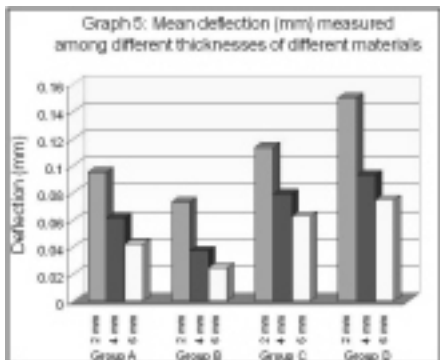
Graph 2: Mean linear dimensional change measured among different thicknesses of different materials



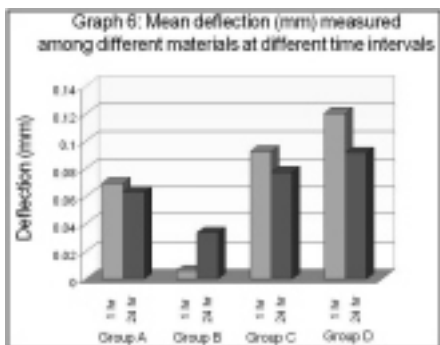
Graph 3: Mean linear dimensional change measured among different materials after two different time intervals



Graph 4: Mean deflection (mm) measured among different materials



Graph 5: Mean deflection (mm) measured among different thicknesses of different materials



Graph 6: Mean deflection (mm) measured among different materials at different time intervals

no byproducts or loss of volatile substances on setting. There was slight but significant shrinkage at the end of 1 hr which progressively increased till 24 hrs (Table – III, IV, Graph 3). This might be due to polymerization shrinkage.

Ramitec (Polyether) stands at second place (Table – II, Graph 1). This might be due to absorption of moisture from the environment by hydrophilic polyether and simultaneous more leaching of the water soluble plasticizer. So significant shrinkage at the end of 1st hr increases at the end of 24 hrs (Table – III, IV, Graph 3).

Superbite (Zinc oxide eugenol), next to Ramitec (Table – VI, Graph 1) undergoes setting via chelation reaction. Initial expansion at the end of 1hr is followed by significant contraction at the end of 24 hrs (Table – III, IV, Graph 3). This might be due to evaporation of water.

Aluwax (Bite registration wax) showed the greatest linear changes of all the materials (Table – II, Graph 1) due to greater coefficient of thermal expansion and distortion due to stress release. The shrinkage was even greater at the end of 24 hrs (Table – III, IV, Graph 3).

None of the materials showed any significant change in linear dimensions for the different thicknesses (Table – V, VI, Graph 2). This concludes that dimensional stability of an interocclusal record material is independent of the thickness of material.

Craig and Peyton^[9] in 1975 stated that there was shrinkage of polyether at the end of 24 hrs. This concurred with the results of the present study.

Dua and Gupta^[10] in 2007 compared the linear dimensional change of polyvinylsiloxane and polyether interocclusal recording materials after 24 hrs of fabrication. They concluded that polyvinylsiloxane exhibited lesser linear dimensional change in the horizontal plane than the polyether recording material.

Compressive resistance of different materials in the descending order: Aluwax > Occlufast (polyvinyl siloxane) > Ramitec (polyether) > Superbite (ZOE) [Table – VII, VIII, Graph 4]. The tables denote the values of deflection (mm) for different materials. Greater the deflection observed in a particular material under a constant load, lesser is the compressive resistance of that material.

Aluwax is difficult to use with maximum compressive resistance. It would not be

easily deformed by the occluding pressure in the mouth. The interocclusal registrations made with Occlufast had a tendency to deform due to compressive forces during mounting of articulator.

Ramitec (polyether) had lesser compressive resistance than Occlufast. However, there is a ‘spring’ to this elastomer that can cause articulated casts to ‘open’ in the centric closure position. If Polyether is not trimmed and carefully seated into the casts, it can be more inaccurate than any other material examined in this study.

Superbite (ZOE) had the minimum compressive resistance as the material is hard and brittle after setting.

It was found that for each material, the compressive resistance decreased as the thickness increased. So, the highest degree of compression resistance was seen at 2 mm thickness (Table – V, IX, Graph 5) because a thicker sample provides a greater volume of material for the deflection as compared to a thinner sample.

Observing the effect of time interval on compressive resistance of each material, it was seen that the compressive resistance of each material increased from 1 hr to 24 hrs (Table – X, XI, Graph 6). This might be because each material became more rigid with time exhibiting lesser deflection and greater compressive resistance.

Veijo Lasilla^[12] in 1985 compared the different interocclusal recording materials and observed that compressive resistance was in the following order: Wax > Polyether > ZOE.

The use of 25 N load simulated a mounting procedure in which rubber band was used to securely approximate the casts during mounting procedure.

Conclusion & Recommendations

Based on the present study, it may be recommended that Occlufast (Polyvinylsiloxane) can be used for occlusal registration of natural teeth, record blocks, removable or fixed restorations. It can be used in case of distant laboratories or delayed mounting of casts.

Superbite has a tendency to break during mounting procedures. It can be used only for occlusal registration of removable dentures or record blocks.

Aluwax is a reliable material only when it is left at the site of registration, for example, remounting of removable dentures.

Interocclusal registrations should be made at a minimal interocclusal distance as compressive resistance decreases with increasing thickness of the material.

Mounting of casts should be done as soon as possible because both linear dimensional change and compressive resistance increase with the passage of time. A very large increase in compressive resistance of interocclusal recording material may lead to improper seating of casts and hence wearing of casts.

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Dental Implants Placed Using Bone Expansion Technique In Anterior Maxilla: A Clinical Study

Abstract

Background: The current definition of success in addition to osseointegration, long-term predictability and function of the implant focuses on esthetic considerations. Survival of implant and its clinical success is demonstrated in numerous studies in relationship to the quantity & quality of the bone available in the implant bed. Standard of implant treatment in aesthetic zone concerned with both function and in achieving aesthetic long term results. The greater the amount of bone and soft tissue loss, the more difficult it becomes to produce an ideal aesthetic result.

AIM: To measure amount of bone expansion and to evaluate the success of the dental implants placed using bone expansion technique in bucco- palatally compromised maxilla, from baseline to twelve months.

Methods: 20 Alfa bio dental implants of diameter ranging between 3.3mm to 3.75 mm and length ranging from 10mm -11.5mm were placed in 13 patients among the general population at the age group between 20-60 years at department of prosthetic dentistry & Oral Implantology, D J College of Dental Sciences, Modinagar. The implants were examined clinically, radiographically and periodically from baseline to 12 months.

Results: In study of 13 subjects; (11 males & 2 females.) and 20 dental implants it was observed that only 1 implant was lost during loading and all other implants were clinically and radiographically stable.

Key Words

implant, osteotomes, bone expansion

Introduction

An adequate amount of bone, in both width and height is required for successful implant placement^[1]. Volume & density of bone are crucial factors for implant success^[2]. One of the most common anatomical limitations in oral implantology is bone atrophy of the upper maxilla^[3]. In maxilla, bone width is lost primarily in facial region because the labial plate is thin as compared to the palatal plate^[4]. Residual ridge shifts palatally in maxilla, at the expense of buccal cortical plate. 25% decrease in facio-palatal width occurs within first year of tooth loss and rapidly evolves into a 30% and 40% decrease within 3 years^[4]. Narrow alveolar crests make implant bed preparation difficult, with the appearance of fenestrations & dehiscence of the cortical layers^[3]. Depending upon the morphology of the defect various procedures for Bone Augmentation can be used like expansion osteotomes, ridge splitting, bone spreading, onlay grafts, interstitial grafts etc^[1].

Expansion technique mainly consists of expanding atrophic bone crests in order to secure sufficient bone width for dental implant placement. Expansion osteotomes are used in atraumatic or

indirect maxillary edentulous situations & they separate the cortical plates. This technique restores bucco-palatal dimensions without the use of grafts, with simultaneous insertion of implant at the same time. The expansion osteotomes exerts lateral compression, thereby increasing bone density and thus primary implant stability. Moreover it affords superior manual control in determining the implant axis there by contributing to avoid fenestrations & dehiscence. There is also less peri implant bone warming & less bone loss is produced during expansion^[3].

The purpose of the study is to evaluate the success of the dental implants placed using bone expansion technique in bucco- palatally compromised maxilla, with the objective of studying the clinical performance of implants from baseline to nine months information in specified population of Modinagar, India.

Aim & Objectives:

To evaluate efficacy and success of implants placed with bone augmentation technique in maxilla. Implants will be evaluated clinically, radiographically and periodically.

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Submission : 21st August 2012

Accepted : 20th July 2013

Quick Response Code



Methodology:

This study was carried out in the department of Prosthodontics and Oral Implantology, D.J. College of Dental Sciences and Research, Modinagar. The study population comprised of total number 13 subjects comprising of 11 males and 2 females subjects aged between 20yrs to 60yrs. Total number of 20 dental implants were placed at different sites in maxilla. The participants were first informed in detail about the study, and a written informed consent was obtained from all the participants.

Subjects free of any pathology or deformities and with good periodontal and dental health status within the above mentioned age group were included in the study. Exclusion criteria consisted of poor oral hygiene, systemic diseases that contraindicate implant placement, chronic tobacco chewers and smokers, parafunctional habits, insufficient occlusal clearance & close proximity to vital anatomic structure. A pre-operative examination was carried out with careful evaluation of the soft and hard tissue. Assessment of interocclusal space,

mesiodistal, faciopalatal, bone height and inter dental papilla was done.

Pretreatment planning included preparation of study and working cast models to record occlusal relationship as well as wax up for proposed prosthesis. All selected patients were subjected to radiographic examination. Imaging modalities used were -Intraoral periapical radiography (IOPA), Panoramic Digital radiography (OPG) and CBCT. Radiographs revealed mesiodistal and apico-coronal dimensions of the available bone at the implant site as well as the trabecular pattern of the bone and diameter and length of the implant.

The various parameters used were as follows: Amount of Expansion achieved, Bone loss & Implant Quality Scale.

Bone expansion: Changes in the bucco-lingual width of the alveolar ridge before osteotomy preparation, at the time of implant insertion, and implant uncover surgery using a surgical caliper were evaluated. Measurement of the width of the edentulous was taken at approximately 1 mm below the crestal margin. to the nearest 0.5mm. Alveolar ridge width measurements were repeated at uncover (e.g. second surgery) The following parameters were evaluated: (a) preoperative width of the edentulous alveolar ridge (time t₀); (b) width of the alveolar ridge at the end of expansion and implant placement (time t₁); (c) width of the alveolar ridge at the time of abutment connection (time t₂); (d) width of the alveolar ridge 3 months after prosthetic loading (time t₃). The measurements were performed with open flaps at times t₀, and t₁. Measurements at t₃ were performed through the mucosa. to avoid reopening of the sites. with minimal patient discomfort. after the application of a local anesthetic.

Bone loss Marginal bone loss around implants after placement and loading at specific defined time intervals was assessed with peri-apical radiographs with grid. The radio graphs were repeated throughout the study and compared to detect the presence or absence of continuous peri-implant radiolucency and to determine the location of alveolar bone levels around the implants.

Implant Quality Scale (Table 1)

Results

The various parameters assessed were - peri implant bone levels, implant quality scale, amount of expansion achieved, an

TABLE 1 : Implant Quality Scale This scale was first presented by James later modified by Misch. Implants were evaluated at baseline, 3 months, 6 months ,9 months & 12 months.

Group	Clinical Conditions	Management
I (Optimum Health)	<ul style="list-style-type: none"> No pain or tenderness on palpation, percussion, or function. Rigid fixation; no horizontal or vertical mobility under 500g load (IM 0). < 1.5mm crestal bone loss from Stage II. < 1.0mm bone loss in preceding 3 years. After 1st year, stable probing (sulcus) depth < 4mm. No exudates history No radiolucency 0 to 1 bleeding index 	<ul style="list-style-type: none"> Normal maintenance
II (Satisfactory Health)	<ul style="list-style-type: none"> No pain or tenderness on palpation, percussion, or function. Rigid fixation; no horizontal or vertical mobility under 500g load (IM 0). To 3mm crestal bone loss. < 1.0mm bone loss in preceding 3 year periods. May be > 4mm probing depth from the original tissue thickness or 1st year bone loss, but stable in last 3-year periods. Past transient exudates history (+) or (-) No radiolucency 0 to 1 bleeding index (may have a transient BOP 2 condition). 	<ul style="list-style-type: none"> Reduce stresses Shorter intervals between hygiene appointments Gingivoplasty. Yearly radiographs.
III (Compromised Health)	<ul style="list-style-type: none"> No pain on palpation, percussion, or function. +/- Slight tenderness Initial rigid fixation; 0 to 0.5 mm horizontal (IM 0 to 2) mobility after prosthesis delivery; no vertical mobility. > 3mm bone loss the 1st year > 1mm crestal bone loss in preceding 3 years, but less than ½ total bone loss (implantitis). > 5mm probing depth and increasing in preceding 3 years. +/- History of exudates 1 to 2 weeks in last 3 years. +/- Slight radiolucency around crestal portion of implant 1 to 3 bleeding index 	<ul style="list-style-type: none"> Reduce stresses. Drug therapy, antibiotics, chlorhexidine. Surgical reentry, revision surgery. Change in prosthesis and/or implants.
IV (Clinical Failure – Any Of The Following Conditions)	<ul style="list-style-type: none"> Pain on palpation, percussion, or function. > 0.5mm mobility horizontally; any vertical mobility (IM 3 to 4). Uncontrolled progressive bone loss. More than ½ loss of bone supporting the implant. Uncontrolled exudates. Generalized radiolucency. "Sleepers". 	<ul style="list-style-type: none"> Removal of implant
V (Absolute Failure)	<ul style="list-style-type: none"> Implants surgically removed Implants exfoliated 	<ul style="list-style-type: none"> Bone graft

Table 2 mean & S.D. Of Different Dental Parameters At Different Time Points

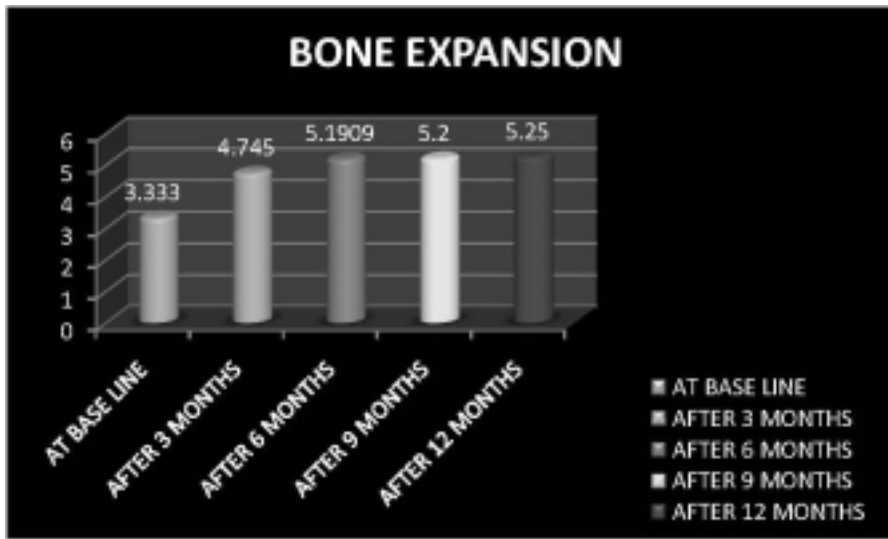
S.No	Parameters	Baseline	3 Months	6 Months	9 Months	12 Months
1	Radiographic Parameter Distal	0±0	.32±9490	.75±5657	.69±9489	.69±1989
2	Radiographic Parameter Mesial	0±0	.34±9488	.77±5533	.67±9600	.67±2366
3	Bone Expansion	3.333±2611	4.745±4344	5.190±3419	5.2±3406	5.250±3298
4	Implant Quality Scale	5	11	15	17	19

All implants were considered for statistical analysis.

All clinical & radiographic parameter values, so obtained, were entered in the Standard performa draw for the study & subjected to statistical analysis. The arithmetic mean & standard deviations were calculated for the requisite assessment intervals & for intra & inter group comparisons. All the values of different dental parameters at different time points are expressed in terms of mean±S.D. respectively (Table 2) (Graph 1, 2A, 2B & 3). The difference from baseline to 3 months, 3 months to 6 months, 6 months to 9 months and 9 to 12 months was measured and its significance was assessed by paired 't' test. It showed that significant improvement /difference was observed

for bone expansion and at 5% level of significance. However all the other parameters were not significant at 5% level of significance (P>.05). The application of one way ANOVA shows a significant difference among all different time points. Further it was observed that bucco-lingual expansion of the ridge was continuously improved for different implant sites in all patients at successive time intervals.

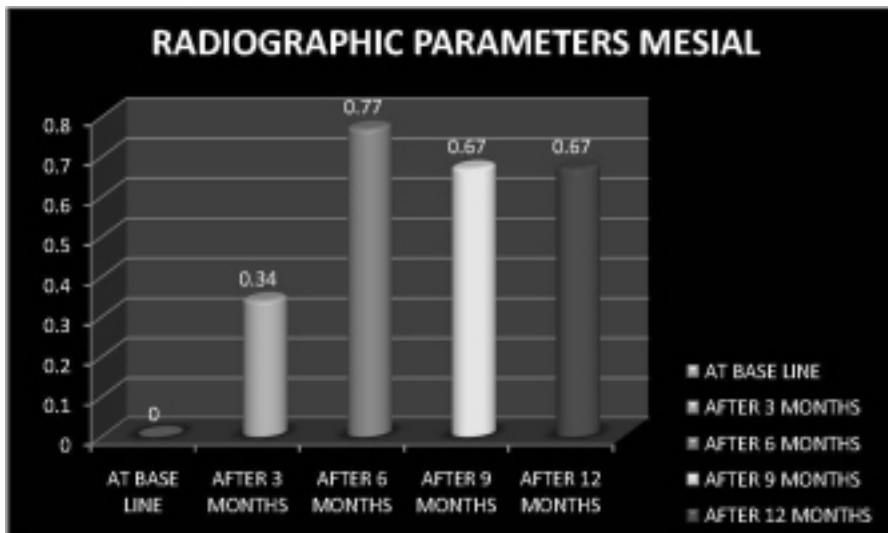
Graph 2A & 2B depicts the average amounts of alveolar marginal bone loss (distal/ mesial) of the implants at defined intervals as measured on peri-apical radiographs. The average marginal bone loss around the implants on distal side was 0±0, . 32±9490, . 75±5657, . 69±9489, . 69±1989 at baseline, 3 months, 6 months 9 months and 12



Graph 1

Table 3(A) - Comparison Of Difference B/W Successive Time Points (By Paired "t" Test) In Radiographic Parameters (Mesial)

S.No.	Time-Difference	Mean ± S.D. of Difference B/W Successive Time Points	% Reduction B/W Successive Time-points	Probability Of Paired "t" Test	P-value / Significance
1	Base Line - 3 Months	- .333 ± 1	-21.59%	.3652	P > .05 (N.S.)
2	3 Months - 6 Months	-0.43 ± 1.148	-17.69%	.2541	P > .05 (N.S.)
3	6 Months - 9 Months	0.075 ± .0808	-10.58%	.2987	P > .05 (N.S.)
4	9 Months - 12 Months	0.025 ± .0789	9.25%	.1234	P > .05 (N.S.)



Graph 2A

Table 3(B) - Comparison Of Difference B/W Successive Time Points (By Paired "t" Test) In Radiographic Parameters (Distal)

S.No.	Time- Difference	Mean ± S.D. Of Difference B/W Successive Time Points	% Reduccion B/W Successive Time-points	Probability Of Paired "t" Test	P-value / Significance
1	Base Line - 3 Months	- .333 ± 1	-25.51%	.3652	P > .05 (N.S.)
2	3 Months - 6 Months	-0.35 ± 1.148	-15.68%	.2541	P > .05 (N.S.)
3	6 Months- 9 Months	-0.02 ± .0808	-9.46%	.2987	P > .05 (N.S.)
4	9 Months- 12months	-0.01 ± .6759	-8.90%	.3425	P > .05 (N.S.)

months respectively The mean differences of bone levels from the baseline to 3rd, 3rd to 6th, 6th to 9th & 9th to 12th months were $-.333 \pm 1$, -0.35 ± 1.148 , $-0.02 \pm .0808$, $-0.01 \pm .6759$ respectively. The respective 'p'-values were .3652, .2541, .2987, .3425 which were statistically not significant ($p > 0.05$). The average marginal bone loss around the implants on mesial side 0 ± 0 , $.34 \pm 9488$, $.77 \pm 5533$, $.67 \pm 9600$, $.67 \pm 2366$ at baseline, 3 months, 6

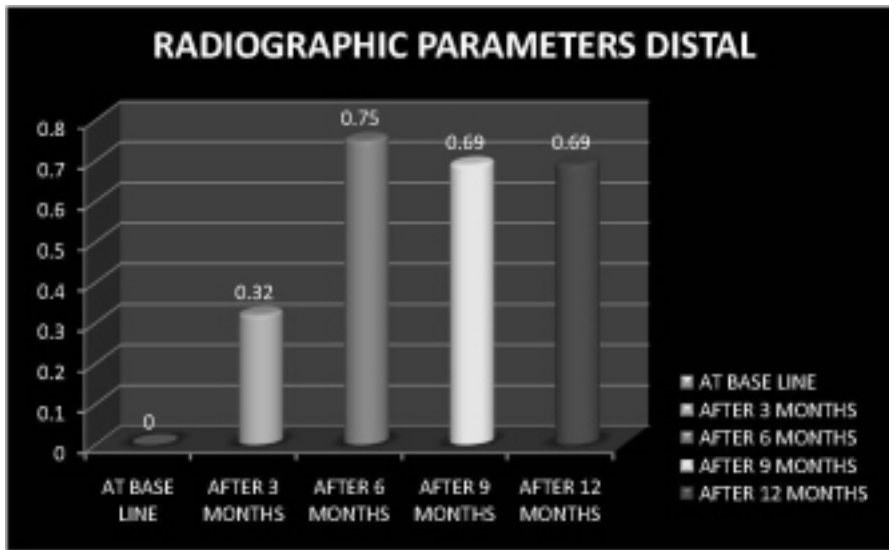
months, 9 months & 12 months respectively The mean differences of bone levels from baseline to 3rd, 3rd to 6th, 6th to 9th & 9th to 12th months were $-.333 \pm 1$, -0.43 ± 1.148 , $0.075 \pm .0808$, $0.025 \pm .0789$ respectively. The respective 'p'-values were .3652, .2541, .2987, .1234 which were statistically not significant ($p > 0.05$). This shows that mean bone loss was almost same on both mesial and distal sides at each time interval except for 6th month in which more amount of bone loss was observed. At all time intervals on mesial side and distal side no statistically significant differences ($p > 0.05$) were apparent between base line and 3 months, 3 months-6 months, 6 months-9 months & 9-12 months. Upto 3 months bone loss was minimal but after loading of implants progression of marginal bone loss was observed but this was not significant.

The pre-operative and immediate post-surgery buccal/lingual width measurements were made using a surgical calliper (Graph 1 depicts mean and S.D of bone expansion at different time points). Table 2 depicts % improvement in bucco-lingual width of ridge b/w successive time points. The average pre-operative buccal/lingual width was 3.333 ± 0.55 mm. The average post-operative buccal/lingual ridge width immediately after the ridge split procedure was 5.250 ± 0.63 mm. There was a mean total gain in buccal/lingual ridge width of 1.917 mm. Maximum expansion of ridge was observed to be 83.33% increase in buccolingual width of ridge between t_0-t_1 , t_0-t_2 , t_0-t_3 , t_0-t_4 . Least amount of ridge expansion was observed to be 42.6% just after implant placement and 57.14% at t_2, t_3, t_4 time interval

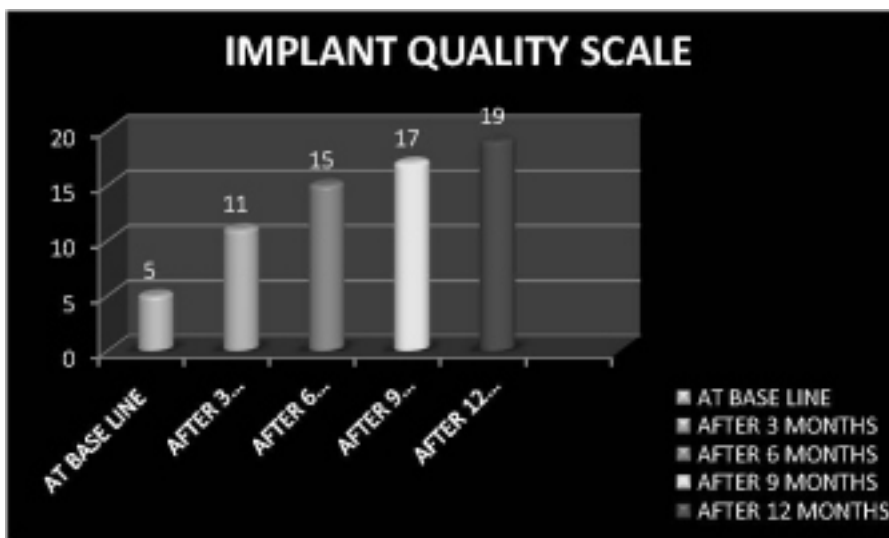
Graph 3 and Table 1 depicts implant quality scale. At baseline 5 implants were in optimal health and by the end of 12 months 19 implants were in optimal. At 6 months 9 implants were in optimal health due to motivation of patient towards oral health but 1 implant was in compromised health i.e slight radiolucency around the crestal portion of implant was seen and implant was lost during abutment tightening and ultimately there was clinical and absolute failure of the implant.

Discussion

Recent longitudinal studies by Behneke et al. 2000^[5], Feloutzis et al 2003^[6] have raised evidence-supported doubts over



Graph 2B



Graph 3

Table 4-Comparison Of Difference B/W Successive Time Points (By Paired "t" Test) In Bone Expansion

S.No.	Time- Difference	Mean ± S.D. Of Difference B/W Succive Time Points	% Reduccion B/W Succive Time-points	Probability Of Paired "t" Test	P-value / Significance
1	Base Line – 3 Months	1.626 ± .0867	32.23%	.0000*	P < .05 (Sig.)
2	3 Months -6 Months	.5007 ± .0463	28.40715	.0000*	P < .05 (Sig.)
3	6 Months- 9 Months	.0091 ± .0065	9.175%	.0024*	P < .05 (Sig.)
4	9 Months-12months	.0085 ± .0071	3.165%	.0000*	P < .05 (Sig.)

*P < .05 Shows A Significant Difference At A = .05 Level Of Significance.

Table 6(A) - Comparison Of Significant Difference Among Different Time Points For – Radiographic Parameters- Distal (One Way Anova)

Source Of Variation	SS	DF	MS	F	P-value	F crit
Between Groups	1.316	4	0.438666667	1.385263158	0.262934254	2.866265557
Within Groups	11.4	95	0.316666667		P > .05 (N.S.)	
Total	12.716	99				

*ss-sum of squares,*df-degree of freedom,ms-mean sum of squares,*f-fisher ratio,f crit-tabulated value of f for 4 and 95 degree of freedom

Table 6(B) - Comparison Of Significant Difference Among Different Time Points For – Radiographic Parameters- Meisal (One Way Anova)

Source Of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1.10475	4	0.36825	1.512492869	0.227814175	2.866265557
Within Groups	8.765	95	0.243472		P > .05 (N.S.)	
Total	9.86975	99				

*ss-sum of squares,*df-degree of freedom,ms-mean sum of squares,*f-fisher ratio,f crit-tabulated value of f for 4 and 95 degree of freedom

established criteria putting forth the observation that crestal bone loss around osseointegrated implants in well-maintained patients may be minimal. Interpretation of intraoral radiographs is one of the most frequently employed diagnostic procedures for monitoring peri-implant conditions. (Fourmouis et al 1994)^[7]. Furthermore, the exploits of digital image analysis has been extended to implant dentistry to monitor peri-implant bone healing (Bragger et al. 1988)^[8]. In this study computer-assisted image analysis Covani U et al^[9] was used for interpreting the intraoral periapical radiographs.

The radiographic bone levels were calculated on mesial and distal sites, according to the method of linear measurements, described by Bragger et al 1988^[8]. This method is reliable for measurements of crestal bone level changes. The implant features with design characteristics of known size facilitate radiographic measurements of crestal bone level at the proximal sites.

In this study, at baseline the mean bone levels on mesial side were 0±0 as the recordings were taken one month after prosthesis placement. The mean bone levels at 3rd, 6th & 9th months were .32±.9487, .74 ±.1853 & .67 ±.1989 respectively. The mean differences of bone levels from baseline to 3rd, 3rd to 6th & 6th to 9th months were -.333±1, -.42 ±1.149 & .07 ±.0707 respectively. The respective 'p'-values were .3434, .8003 & .1934 which were statistically not significant (p>0.05). Overall findings of this present study were very similar to the studies done on SLA surface by Behneke et al 2000^[5]. These results also find agreement with the studies done by Canullo et al 2007.^[10]

The ICOI Pisa Consensus Conference has simplified and updated a Health Scale specific for endosteal implants and included categories of success, survival, and failure. In addition, these categories of health may be related to the prognosis of the existing conditions. At baseline 60% of implants quality scale were in optimal health. 40% of implants were in satisfactory. At 3rd month readings were similar to baseline. At sixth month 90% of the implants were in optimal health due to motivation of patient towards oral health but 10% of the implant was in compromised health i.e. slight radiolucency around crestal portion of implant was seen and implant was lost

Table 5 - % Improvement In Bucco-Lingual Width Of Ridge B/W Successive Time Points

S. No.	Implant Side	T0 -t1 (% Improvement)	T0-t2 (% Improvement)	T0-t3 (% Improvement)	T0-t4 (% Improvement)
1.	11	66.67%	66.67%	66.67%	66.67%
2.	21	66.67%	66.67%	66.67%	66.67%
3.	14	66.67%	66.67%	66.67%	66.67%
4.	21	42.6%	57.14%	57.14%	57.14%
5.	22	42.6%	57.14%	57.14%	57.14%
6.	12	83.33%	83.33%	83.33%	83.33%
7.	22	66.67%	83.33%	83.33%	83.33%
8.	14	50%	66.67%	66.67%	66.67%
9.	15	66.67%	66.67%	66.67%	66.67%
10.	22	83.33%	83.33%	83.33%	83.33%
11.	21	83.33%	83.33%	83.33%	83.33%
12.	11	66.67%	66.67%	66.67%	66.67%
13.	22	66.67%	66.67%	66.67%	66.67%
14.	13	66.67%	66.67%	50%	50%
15.	21	42.6%	57.14%	57.14%	57.14%
16.	12	42.6%	57.14%	57.14%	57.14%
17.	11	83.33%	83.33%	83.33%	83.33%
18.	11	66.67%	83.33%	83.33%	83.33%
19.	22	50%	66.67%	66.67%	66.67%
20.	11	66.67%	66.67%	66.67%	66.67%

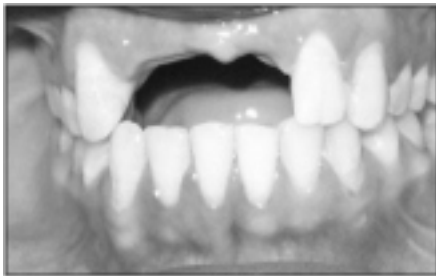


Fig. 1.1: Pre-operative View



Fig. 1.2: Pre-operative Opg

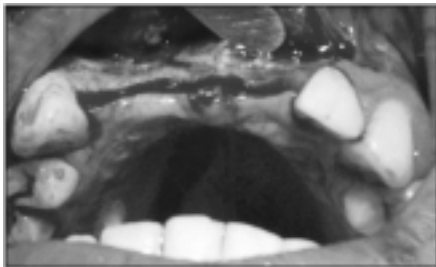


Fig. 1.3: Elevation Of Flap

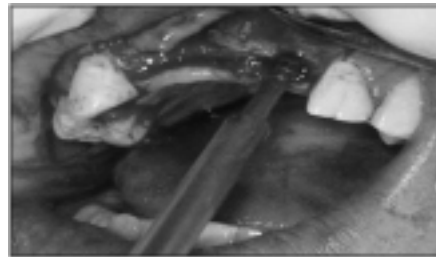


Fig. 1.4: Expansion Of Bone With Osteotome



Fig. 1.5: Implant Placed In 21 Region & Expansion Of Bone With Osteotome In 12 Region

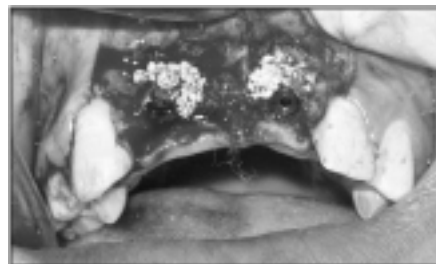


Fig. 1.6: Bio-oss Graft Placed On Labial Cortical Plate

during abutment tightening and ultimately there was clinical and absolute failure of implant.

In the present study the pre-operative and immediate post-surgery buccal/lingual width measurements were made using a surgical caliper. The average pre-

operative buccal/lingual width was 3.333 ± 0.55 mm which was very less for implant placement using conventional technique. The average post-operative buccal/lingual ridge width after the osteotome technique was 5.250 ± 0.63

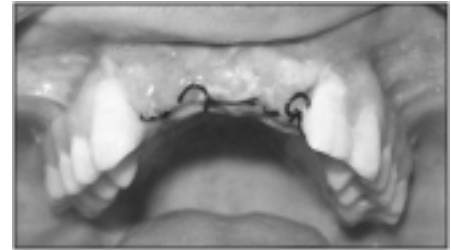


Fig. 1.7: Sutures Placed



Fig. 1.8: Post-operative Opg



Fig. 1.9: Gingival Former Placed

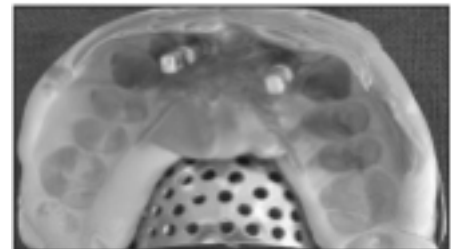


Fig. 1.10: Putty Impression Taken With Transfer Coping



Fig. 1.11: Lab Analog Transferred In Mounted Cast



Fig. 1.12: Final Prosthesis In Mounted Cast



Fig. 1.13: Abutment Placed



Fig. 1.14: Final Prosthesis Cemented

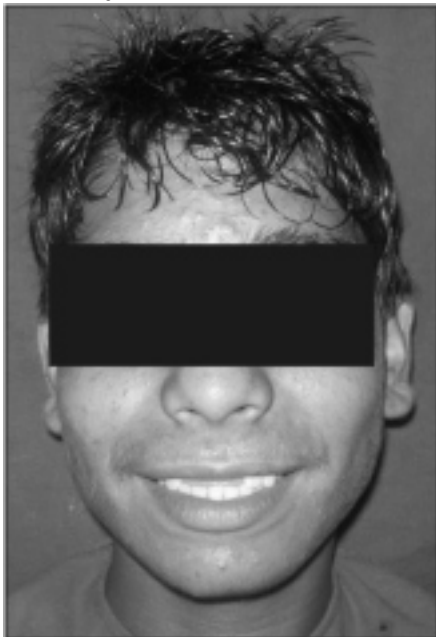


Fig. 1.15: Pre Treatment View

mm. There was a mean total gain in buccal/lingual ridge width of 1.90 mm. Maximum expansion of ridge was observed in 6 subjects with overall 83.33% increase in buccolingual width of ridge between t0-t1, t0-t2, t0-t3, t0-t4. Least amount of ridge expansion was observed in 5 subjects 57.14% at t2, t3, t4 time interval. In subject 14 just after implant placement 66.67% increase in buccolingual width was observed which remained constant up to 3 months but after failure of implant the amount of expansion was reduced to 50%. The mean total gain in ridge width immediately following the osteotome technique procedure was 1.91mm in this investigation. This increase in width correlates well with other published studies. Vercellotti et al^[11] did a similar



Fig. 1.16: Post Treatment View

study and reported averaged a gain of bone width of ~2.0 mm. Blus et al^[12] performed ridge expansion in two hundred thirty implants and reported an increase in bone width ranging from 2.5 – 4.0 mm.

Conclusion:

Within the limitations of this study we concluded that the indications for the use of osteotome technique should be limited to those for which it was introduced, that is, narrow ridge and for bone with less density. More clinical studies with larger samples and longer follow-up are necessary to confirm these findings. A randomized study design would be preferable to compare different augmentation techniques (i.e., guided bone regeneration and the osteotome technique). However, for comparison with conventional implant preparation, a randomized study would be impossible because deficient bone sites are not suitable for conventional implant preparation.

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Comparative Evaluation Of Sealability Of Different Root Canal Perforation Repair Materials By Using A Dye-extraction Leakage Method - An In Vitro Study.

Abstract

Aim:The ability of IRM, Portland cement, Pro root MTA, MTA-Angelus were evaluated to seal furcation perforations using a dye-extraction leakage method.

Materials And Methods:The furcation perforations were repaired with and without the use of internal matrix before placement of repair material. One hundred extracted human mandibular first molars were divided into, positive (n = 10), negative (n = 10), and four experimental groups (n = 20) according to the repair material used. Each experimental group was divided into two subgroups (n = 10) according to whether internal matrix was used or not. Dye leakage was tested from an orthograde direction, and dye extraction was performed using full concentration nitric acid. Dye absorbance was measured at 550 nm using spectrophotometer and results were statistically analyzed.

Results:ProRoot MTA (Maillfer, Dentsply, Switzerland) with and without internal matrix and MTA-Angelus (Angelus, Londrina, PR, Brazil) with internal matrix showed the least dye absorbance. Portland cement with and without internal matrix showed comparable results with MTA angelus with and without internal matrix. IRM (Caulk, Dentsply, Milford, DE) with and without internal matrix showed significant difference when compared with all other groups and has the highest dye absorbance.

Conclusion: Portland cement has the potential to be used as a less expensive material alternative to MTA in the repair of perforation sites.

Key Words

Perforation, Proroot MTA, MTA-Angelus, Portland Cement, IRM, Internal matrix, spectrophotometer, Dye-extraction Leakage Method.

Introduction:

Perforations can be defined as mechanical or pathologic communications between, the root canal system and the external tooth surface^[1]. Root perforation is a communication between the root canal system and periodontal ligament through the floor of the pulp chamber or root canal wall. It can occur as a result of carious lesion, internal or external root resorption during endodontic instrumentation and post space preparation. The prognosis of an endodontic perforation depends on the size and location of the defect, and it will improve when it is sealed immediately with biocompatible and sealable material^{[1],[2],[3],[4]}.

Several materials have been used to repair furcation perforations, including zinc oxide-eugenol cements (IRM and Super-EBA), glass ionomer cement, composite resins, resin-glass ionomer

hybrids, and mineral trioxide aggregate (MTA). MTA was developed at Loma Linda University in the 1990s as a root-end-filling material. Lee et al.^[5] compared the sealing ability of MTA with that of amalgam and IRM in experimentally induced lateral perforations. They found that MTA had significantly less leakage. Torabinejad et al.^[6] compared the sealing ability of MTA with that of amalgam and Super-EBA when used as root-end fillings. They showed that most of the MTA samples had no dye penetration.

The effect of time and moisture on setting, retention, and adaptability are the properties of a material will play important role in repair furcation perforations. The authors noted that the presence of moisture in perforations during the placement of MTA increased its adaptation to perforation wall and concluded that a moistened matrix can be

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used under MTA to prevent over- or underfilling of the material^[7]. MTA showed promise in this respect and could enhance the treatment modality for furcation perforation repair. Studies comparing MTA with Portland cement showed their similarity in composition, properties, and tissue reactions^{[8],[9]}.

Until recently, two commercial forms of MTA have been available; ProRoot MTA (Maillfer, Dentsply, Switzerland) is available in either the gray or white form. In our study we used white form of pro root MTA (in the article pro root MTA refers to white form of pro root MTA). According to the information supplied in the material safety datasheet, ProRoot MTA consists of 75% Portland cement, 20% bismuth oxide, and 5% calcium sulfate dehydrate. Recently, MTA-Angelus (Angelus, Londrina, PR, Brazil) has also become available as an alternative to ProRoot MTA. MTA-

Angelus contains 80% Portland cement and 20% bismuth oxide, with no addition of calcium sulfate in an attempt to reduce setting time (2 hours for ProRoot MTA and 10 minutes for MTA Angelus^[10]). This has generated scientific interest in the evaluation of Portland cement as a low-cost alternative to MTA, with recent studies comparing MTA with Portland cement. Both materials have been demonstrating comparable physical and biologic properties as well as clinical outcomes. However, there are disadvantages when using both MTA and Portland cement, such as the extended setting time and the difficulty of handling^{[11][12][13][14]}.

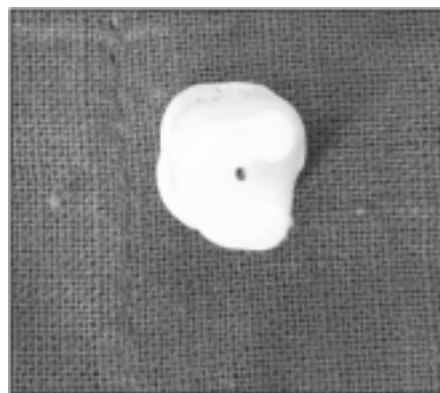
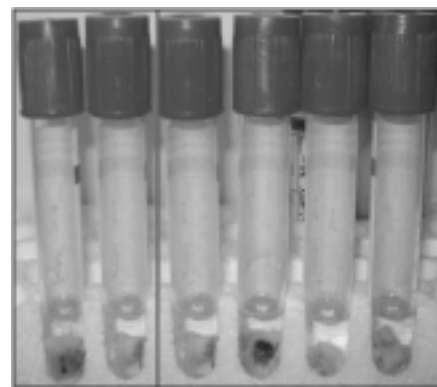


Figure (1): Tooth after creating the perforation



(A) (B)
Fig(2). : Molar placed in vials containing 1mL of concentrated (65 %) nitric acid
(A) +ve control & -ve control group
(B) Experimental groups

Several methods have been used to evaluate leakage of perforation repair materials including dye penetration^[15], bacterial and fluid filtration^[16] etc. A new method for leakage evaluation called the dye-extraction method when compared it with the classic dye penetration and fluid-filtration techniques, a statistically significant correlation was found between the results obtained with the dye extraction and those obtained with the fluid filtration technique^[17].

The aim of this study was to evaluate the sealing ability of ProRoot MTA, MTA-Angelus, Portland cement and IRM when used to repair furcation perforations, with and without the use of internal matrix.

Materials And Methods:

One hundred human permanent lower first molars were used in this study. Collected teeth had minimal caries or restoration, and none had fused roots. Any tooth that had a crack or defect was discarded. Molars were amputated 3 mm below the furcation area by using a tapered diamond stone. Endodontic access cavity was made in every molar by using a high-speed long shank round bur #2 (#2RC; SybronEndo Europe, The Netherlands) for the initial entry followed by Endo-Z (Maillfer, Dentsply, Switzerland) for lateral extension and finishing of cavity walls. A temporary filling material (Cavit, 3M ESPE) was placed over the orifice of each canal. Every molar was covered completely including cavity walls and pulpal floor with two successive layers of clear nail varnish. A perforation was made between the orifices to the furcation area by using a high-speed round bur #2. Care was taken to centralize the perforation

between the mesial and distal orifices (Fig. 1)

Molars were divided into four experimental (Group I- IV) and positive (Group-V) and negative (Group-VI)

Group:

- (1) Group 1, 20 molars in which perforations were repaired with ProRoot MTA;
- (2) Group 2, 20 molars in which perforations were repaired with MTA-Angelus;
- (3) Group 3, 20 molars in which perforations were repaired with Portland cement;
- (4) Group 4, 20 molars in which perforations were repaired with IRM
- (5) Group 5, 10 molars in which perforations were left unsealed (positive control); and
- (6) Group 6, 10 molars without perforation (negative control).

The four experimental groups were further subdivided into the following subgroups: subgroup a, 10 molars in which no internal matrix was used, and subgroup b, 10 molars in which internal matrix (collagen) was used. Molars were placed in Eppendorf tubes containing cotton moistened with saline in an attempt to stimulate clinical conditions. The molars were sealed to the tubes by using cyanoacrylate adhesive. The tubes were fixed in a table vise (PanaVise Products Inc, Reno, NV), and rubber dam (OptraDam, Vivadent, Germany) was placed. The repair procedure was performed under 14 X using surgical microscope (Opmi-Pico; Karl Zeiss, Jena, Germany).

In subgroups b, Internal matrix (ETIK;

Pierre Rolland, Acteon, France) was adapted to interradicular area by using hand pluggers (Buchanan pluggers; SybronEndo Europe, Amersfoort, The Netherlands)^[18]. ProRoot MTA, MTA-Angelus, portland cement and IRM were mixed according to the manufacturer instructions. They were applied to the perforation site in increments by using the microapical placement system (MAP, Produits Dentaires SA, Vevey, Switzerland) and lightly condensed using Buchanan pluggers. Moist cotton pellets were placed over the repair materials, and molars were kept in 100% humidity for 24 hours to allow materials to set. Molars were then placed in Petri dishes according to each group. Methylene blue dye was applied inside the access cavity of all samples for 24 hours. Molars were placed under running tap water for 30 minutes to remove all residues of methylene blue and then varnish was removed with a Parker blade #15 and polishing discs.

Molars were placed in vials containing 1mL of concentrated (65 wt%) nitric acid for 3 days (Fig. 2). Vials were centrifuged (Universal 16R; Hettich Zentrifugen, Tuttlingen, Germany) at 14,000 rpm for 5 minutes. Two hundred microliters of the supernatant from each sample was transferred to a 96-well plate. Sample absorbance was read by an automatic microplate spectrophotometer (E 960, Bioblock, Starsbourg, F) at 550 nm using concentrated nitric acid as the blank.

Statistical Analysis:

Statistical analysis was performed by using one-way analysis of variance. A Duncan post hoc test was used for pair-

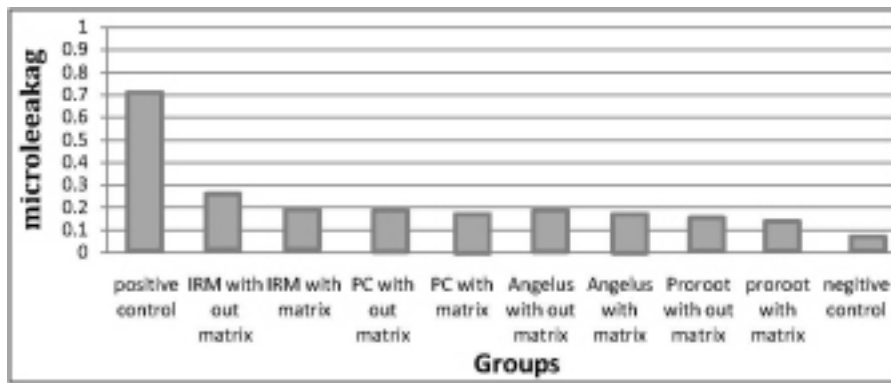


Table 1. A histogram showing the mean dye absorbance values of different groups.

wise comparison between the means when analysis of variance test was significant. The significance level was set at $p < 0.05$. Statistical analysis was performed with SPSS 16.0 (Statistical Package for Scientific Studies, SPSS, Inc., Chicago, IL, USA) for Windows.

Results:

The positive control showed the highest dye absorbance (0.7 ± 0.1). IRM without internal matrix (0.23 ± 0.05) came second with significantly higher dye absorbance than other groups. Portland cement with (0.125 ± 0.06) and without matrix (0.168 ± 0.09) and MTA-Angelus with (0.122 ± 0.06) and without matrix (0.167 ± 0.07) had no significant difference in between them; and IRM with internal matrix (0.169 ± 0.07) was showed significantly higher absorbance than the other remaining groups. ProRoot MTA with (0.112 ± 0.09) and without matrix (0.115 ± 0.07) showed less dye absorbance and there is no significant difference between them. However, they were significantly higher than the negative control group (0.066 ± 0.01) ($p > 0.05$) (Table 1).

Discussion

The dye-penetration technique has long been used in endodontics because of its ease of performance and difficulty of other available techniques. However, it has several drawbacks including the smaller molecular size of the dye molecules than bacteria, which do not measure the actual volume absorbed by the sample but merely measure the deepest point reached by the dye^[17]. It relies on randomly cutting the roots into two pieces, without any clue of the position of the deepest dye penetration^[17]. Despite these drawbacks, Torabinejad et al.^[6] stated that a material that is able to prevent the penetration of small

molecules (dye) should be able to prevent larger substances like bacteria and their byproducts. Based on this, the dye-extraction method seems to be a reliable technique. It takes into account all absorbed dye by the samples. Camps and Pashley^[17] reported that the dye-extraction method gave the same results as the fluid-filtration method and also saved much laboratory time.

Furcation perforations were induced by a #2 long shank carbide round bur from pulpal floor to furcation area. This resulted in perforations of almost 1 mm in diameter^[19]. Internal matrix has been advocated by Lemon^[18] to limit the overextension of the repair material. The collagen matrix used in this study is a soft material, which expands because of moisture and has a hemostatic effect. It seems suitable to be used with MTA and IRM because these materials are pastes and do not require forces of condensation as stated by Bargholz^[20]. Negative control samples had low dye absorbance (0.066) close to that of blank (nitric acid), which showed absorbance of 0.043 . This small difference can be attributed to the yellowish color of teeth, whereas blank is colorless. Positive control samples in which perforations were not repaired had the highest dye absorbance of all groups denoting the accuracy of the technique^[19]. Pro Root MTA has been proven to have less leakage and has produced a better response compared to other materials and our study got similar results as with Lee et al.^[21].

MTA Angelus and Portland cement have comparable sealing ability^[22]. ProRoot MTA with and without matrix showed almost the same dye-absorbance results, so that the use of matrix with ProRoot MTA seems not necessary as previously

mentioned by Arens and Torabinejad^[23]. Being hydrophilic and easily adapted to cavity walls may be the main reasons for this similarity in dye absorbance between the two subgroups. Contrary to ProRoot MTA, MTA-Angelus showed significantly higher dye absorbance when used without matrix. This could be explained by the difference in composition between ProRoot MTA and MTA-Angelus. MTA-Angelus does not contain calcium sulfate and has lower percentage of bismuth oxide as stated by Song et al.^[24]. This resulted, according to the manufacturer, in a reduction of the setting time from 2 hours for ProRoot MTA to 10 minutes for MTA-Angelus^[7]. However, this reduction in the setting time may have prevented MTA-Angelus from having better wetting and adaptation to cavity walls this needs further investigation.

Portland cement with and without matrix had no significant difference in dye absorbance as compared with MTA Angelus. In agreement with the results of the present study, previous reports have demonstrated that MTA Angelus and Portland cement have comparable sealing ability^{[25],[26]}. IRM with & without matrix showed the highest dye absorbance of all experimental groups. The presence of matrix significantly decreased the dye absorbance of IRM. So that the internal matrix will prevent overextension and control moisture, which will lead to more adaptation, resulting in better sealability.

Conclusion

With in the limitations of our present invitro study, the following conclusions can be drawn:

- (1) Neither cement was capable of producing a fluid-tight seal;
- (2) The use of IRM to repair furcation perforations should be limited, and, if used, it must be used with an internal matrix.
- (3) ProRoot MTA has excellent sealing ability and can be used with or without matrix in repair of furcation perforations.
- (4) MTA Angelus and Portland cement has near comparable results in preventing microleakage.
- (5) The present results suggest that Portland cement has the potential to be developed as a furcal repair material, but more studies are

necessary before warranting unlimited clinical use.

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Comparison Of Shear Bond Strengths Of Precoated And Uncoated Brackets Using Led And Halogen Curing Lights.

Abstract

Objectives: The present study was performed to compare the shear bond strength of adhesive precoated and uncoated brackets cured using two different curing units at different exposure times and using different exposure methods and to compare the amount of remnant adhesive on tooth surface after debonding.

Materials And Methods: This in vitro study was carried out on 140 premolar teeth using conventional uncoated and adhesive precoated brackets (Gemini series, 3M Unitek) cured using halogen curing unit (3M ESPE, ELIPAR, 2500) for 40 seconds, 20 seconds on each interproximal side and LED curing unit (3M ESPE, ELIPAR, S10) for 20 seconds, 10 seconds on each interproximal side and single exposure for 20, 15 and 10 seconds respectively. Instron Universal Testing Machine was used in this study to record the shear bond strength. Following the debonding the modified adhesive remnant index (ARI) was used to check the remaining adhesive on enamel surface.

Results: Comparison of mean shear bond strength showed statistically insignificant difference in all groups except group II e which showed lowest value. LED curing for 20 seconds, 10 seconds on each interproximal side provides clinically acceptable bond strength and LED curing for 20, 15 and 10 seconds with single exposure showed maximum chances of failure of bonds. The ARI indicated no significant association between the ARI scores in different groups

Conclusions: LED with a shorter curing time which is half of that used for halogen provides clinically acceptable bond strength. LED with single exposure for 20, 15 and 10 seconds may be inadequate for orthodontic bonding. Shear bond strength is not dependent on type of brackets used whether adhesive precoated or conventional uncoated brackets. In all groups most of the material remained adhered to the tooth surface after the debonding of the brackets which is desirable.

Key Words

APC; Light emitting diode; Halogen; Shear bond strength

Introduction

The introduction of the acid etch technique in 1955 by Buonocore^[1] has made enamel bonding possible in all disciplines of dentistry. One of them is the bonding of orthodontic brackets, either direct or indirect.

One of the most dramatic changes in the orthodontic specialty in the 1970s was the use of composite resin as a bonding material.^[2]

The chemically cured resins were the first systems developed for bracket bonding followed by ultraviolet light-cured materials.^{[3],[4]} Due to safety problems^[5] and limited depth of cure,^{[6],[7]} ultraviolet light curing has been replaced by visible light curing. Blue light generated by conventional halogen light-curing unit has been the most popular method of polymerizing orthodontic adhesives despite its shortcomings like degradation of lamp, filter, reflector, reduced light

intensity, broad spectrum of light, and prolonged curing time which can be uncomfortable to patient.^{[8],[9]} In 1995, LED (light-emitting diode) was proposed as an alternative to the halogen curing light.^[10]

One of the main objectives of the research of bonding procedures is to seek ways of reducing chair side time. Adhesive precoated brackets (APCs) (introduced in 1991) have improved the quality and accuracy of orthodontic bonding by reducing the steps in bonding procedures, owing to the consistent quality and quantity of adhesive used, better asepsis, less wastage, easy flash removal and a better control of inventory.^{[9],[11],[12]} Various studies comparing the bond strengths of APC brackets and conventional uncoated brackets have yielded contradictory results.^{[13],[14],[15],[16],[17]}

Success of a bond can be ascertained by a

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number of ways including measurement of bond strength in vitro, measurement of the failed proportion of brackets in vivo, and ex vivo studies utilizing finite-element analysis. Amongst these, in vitro shear bond strength recording is the easiest method. It has been stated that successful clinical bonding can be achieved with bond strengths from 6-8 MPa and above.^[18] Adhesive remnant index^[19] and modified adhesive remnant index^[20] can be used to determine the nature of bond failure and determine the site of fracture when a bracket debonds.

Several studies have evaluated the clinical efficacy of LED light for bonding orthodontic brackets. They have been unable to demonstrate a significant difference between the bond strength obtained with an LED light curing and a halogen light curing device. Effect of curing at different polymerization times has also been evaluated and bonding brackets with LED at shorter exposure time seems to be a good alternative but further studies are still necessary if its use is to be recommended in orthodontic



Fig 1: Halogen Light Curing Unit (3m Espe, Elipar, 2500)



Fig 2: LED Curing Uni (3m Espe, Elipar, S10)



Fig 3: Instron Universal Testing Machine

practice.

Therefore this study was undertaken to compare the shear bond strength of adhesive precoated and uncoated brackets cured using two different curing units: a conventional halogen light and a light-emitting diode, to evaluate the effect of different exposure times and

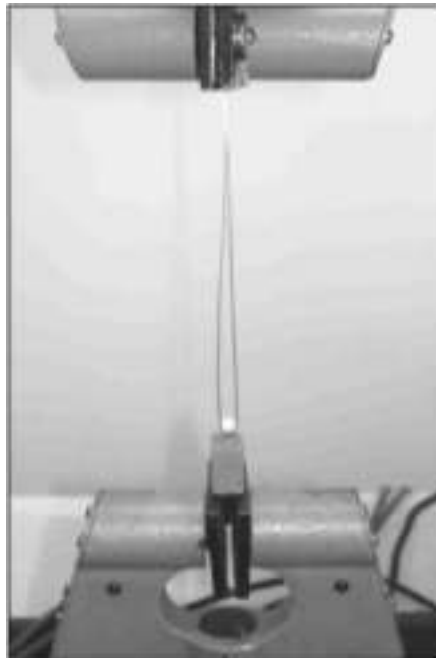


Fig 4: Force Application Parallel To The Labial Surface Of The Tooth



Fig 5: Debonded Bracket From The Labial Surface Of The Tooth

different exposure methods (single exposure and exposure from two sides mesial and distal) on shear bond strength of adhesive precoated brackets cured using light-emitting diode and the amount of remnant adhesive on tooth surface after debonding.

Materials And Methods

This in vitro study was carried out on 140 human premolar teeth without caries or filling that had been extracted for therapeutic purpose in patients undergoing orthodontic treatment in the

Department of Orthodontics, M.R. Ambedkar Dental College, Bangalore.

One hundred adhesive precoated and forty conventional uncoated metal brackets (Gemini series, 3M Unitek) were used for bonding. The adhesive used was Transbondxt (3M Unitek) with conventional primer.

Polymerization sources used were halogen light curing unit (3M ESPE, ELIPAR, 2500) and LED light-emitting diode curing unit (3M ESPE, ELIPAR, S10).

Method Of Collection Of Data

140 premolar teeth were randomly divided into seven groups of twenty each. Brackets were divided into two groups. Group I included 40 conventional uncoated metal brackets and had two subgroups. Group II included 100 adhesive precoated brackets and had 5 subgroups.

Bonding:

Group I

20 conventional uncoated brackets were bonded with Transbond XT adhesive in each subgroup.

I a: curing was done using halogen curing unit for 40 seconds, 20 seconds each interproximal side.

I b: curing was done using LED curing unit for 20 seconds, 10 seconds each interproximal side.

Group II

20 adhesive precoated brackets were bonded in each subgroup.

II a: cured using halogen curing unit for 40 seconds, 20 seconds each interproximal side.

II b. cured using LED curing unit for 20 seconds, 10 seconds each interproximal side.

II c: cured using LED curing unit for 20 seconds with single exposure on buccal surface.

II d: cured using LED curing unit for 15 seconds with single exposure on buccal surface.

II e: cured using LED curing unit for 10 seconds with single exposure on buccal surface.

Preparation Of Bonded Tooth For Shear Bond Strength Test:

Acrylic blocks were used to mount the teeth and were stored in distilled water at room temperature before subjecting to shear bond strength test.

Table 1: Comparison of Mean Shear bond strength (MPa) in groups of samples studied

Group	Shear Bond Strength (MPa)	
	Min-Max	Mean ±SD
Group I a	6.98-14.10	9.48±2.18
Group I b	7.70-15.20	10.46±2.20
Group II a	6.96-15.90	9.73±2.01
Group II b	7.82-15.70	10.99±2.09
Group II c	6.60-15.00	9.13±2.73
Group II d	6.73-13.50	8.91±2.04
Group II e	6.52-12.00	8.09±1.42

Graph-1: Mean shear bond strength recorded in all the groups

Table II: Pair-wise comparison of shear bond strength (MPa) for group I a

Pair wise groups comparison		Difference	P value
Group I a	Group I b	-0.98	0.874
	Group II a	-0.26	1.000
	Group II b	-1.47	0.504
	Group II c	-0.15	1.000
	Group II d	0.46	0.997
	Group II e	1.28	0.665

Table III: Pair-wise comparison of shear bond strength (MPa) for group I b

Pair wise groups comparison		Difference	P value
Group I b	Group II a	0.72	0.969
	Group II b	-0.49	0.996
	Group II c	0.83	0.940
	Group II d	1.45	0.525
	Group II e	2.26	0.069

Table IV: Pair-wise comparison of shear bond strength (MPa) for group II a

Pair wise groups comparison		Difference	P value
Group II a	Group II b	-1.21	0.721
	Group II c	0.11	1.000
	Group II d	0.72	0.968
	Group II e	1.54	0.446

Table V: Pair-wise comparison of shear bond strength (MPa) for group II b

Pair wise groups comparison		Difference	P value
Group II b	Group II c	1.32	0.631
	Group II d	1.94	0.182
	Group II e	2.75	0.011*

* Moderately significant (P value: 0.01 < P ≤ 0.05)

Table VI: Pair-wise comparison of shear bond strength (MPa) for group II c and II d

Pair wise groups comparison		Difference	P value
Group II c	Group II d	0.61	0.986
	Group II e	1.43	0.538
Group II d	Group II e	0.81	0.945

Testing Of Shear Bond Strength:

The shear bond strength test was conducted in the laboratory at Composite Technology Park Kengari using an universal testing machine (Instron 4301, Canton, Mass). A load side density of 0-50 Kgs was set in the Instron Machine and the cross head speed was adjusted for 5mm per minute. The load at which the bracket debonded was recorded in Newtons and subsequently calculated in Mega Pascals.

Following the debonding, the residual adhesive remaining on the teeth was assessed by magnifying lens of magnification power 5X using the modified Adhesive Remnant Index (ARI).

Statistical Analysis:

For statistical evaluation of experimental data the mean and standard deviation were calculated for each group. Post-Hoc Tukey test was employed to find the pair wise significance between the groups. Weibull analysis was done to evaluate probability of failure of premolar metal brackets. The chi-square test was used to determine significant differences in the adhesive remnant index (ARI) scores between the different groups.

Results

Comparison of mean shear bond strength among all groups showed highest shear bond strength for group II b. Group II e recorded lowest mean shear bond strength among all groups. (Table I)

In order to find out significant difference among pair of groups, Mann-Whitney test was carried out in which shear bond strength recorded in all groups was found to be statistically insignificant (Table II, III, IV, VI) except among group II b and group II e (Table V).

Table VI: Pair-wise comparison of shear bond strength (MPa) for group II c and II d

ARI	Group I a	Group I b	Group II a	Group II b	Group II c	Group II d	Group II e
	No	No	No	No	No	No	No
1	4	5	4	4	5	4	5
2	1	2	2	2	2	3	2
3	15	13	14	14	13	13	13
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
Total	20	20	20	20	20	20	20
Mean	2.75	2.75	2.85	2.80	2.80	2.75	2.60
Median	3.00	3.00	3.00	3.00	3.00	3.00	3.00
SD	0.44	0.44	0.36	0.41	0.41	0.44	0.68

Analysis Of Ari Scores:

Chi-square test was used to find out if there was any significant association between the ARI scores in different groups. (Table VII)

$\chi^2=1.966$; $P=0.923$

No statistically significant association was found between the ARI scores in all the groups ($P>0.05$).

Weibull analysis done to evaluate probability of failure of premolar metal brackets showed maximum probability failure of 40% with group II e. Group II b and group I showed minimum failure probability of 5% calculated at clinically acceptable shear bond strength of 8MPa. (Table VIII)

Discussion

Bonding of orthodontic brackets has become a routine orthodontic procedure in fixed appliance therapy. Maximum conversion of monomer to polymer is necessary to achieve optimal physical properties of adhesive cements and depends on the composite composition, the light source, and the exposure time. It has been suggested that bond strength values between 5.9 MPa and 7.8 MPa are sufficient for a clinically effective orthodontic bonding.^[18]

In the present study comparing shear

Table VIII: Probability of failure premolar metal brackets tested at clinically accepted shear bond strength of 8 Mpa

Group	Type of brackets	Curing Light	Curing time	No of sample	Probability of failure
Group I a	Conventional uncoated	Halogen	40 seconds, 20 seconds on each interproximal side	20	10%
Group I b	Conventional uncoated	LED	20 seconds, 10 seconds on each interproximal side	20	5%
Group II a	Adhesive precoated	Halogen	40 seconds, 20 seconds on each interproximal side	20	10%
Group II b	Adhesive precoated	LED	20 seconds, 10 seconds on each interproximal side	20	5%
Group II c	Adhesive precoated	LED	20 secondswith single exposure	20	25%
Group II d	Adhesive precoated	LED	15 secondswith single exposure	20	30%
Group II e	Adhesive precoated	LED	10 secondswith single exposure	20	40%

bond strength of conventional uncoated and adhesive precoated brackets showed statistically insignificant difference irrespective of type of curing light used for polymerization. These findings are in agreement with most other previous studies which showed no significant difference in bond strength between the brackets.^{[13][14][15]} However these findings are not in concordance with previous studies which concluded that precoated brackets had significantly lower shear bond strength than the uncoated brackets bonded with Transbond XT.^{[16],[17]} It was suggested that increased viscosity of adhesive used on APC brackets combined with mesh retention mechanisms incorporated in metal bracket bases seemed to lower shear bond strength. Another study showed higher shear bond strength and less bond failure rate for adhesive precoated brackets.^[21]

Results from this study concluded that shear bond strength was not dependent on type of brackets used. There are many light cured adhesives available in the market, differing in the amount of filler particles and viscosity including dual cured composites and glass ionomer cements. All, however, are subject to bond failure because of bracket base contamination and inconsistent amounts of adhesive applied to the bracket. Adhesive precoated brackets have indisputable clinical advantages owing to the consistent quality and quantity of adhesive used, better asepsis, less wastage, easy flash removal and a better control of inventory.^{[9],[11],[12]}

Taking in view some advantages and differences among halogen light and light emitting diode curing unit, the present in vitro study compared the shear bond strength of brackets polymerized with two different light sources, halogen (3M ESPE, ELIPAR, 2500) and LED (3M ESPE, ELIPAR, S10). Results showed statistically insignificant difference in shear bond strength values between the groups regardless of type of curing light used for polymerization which is in agreement with the results of a previous investigation in which shear bond strength of brackets cured using new intensive LED curing units (Ortholux TM LED, 3M Unitek; UltraLume LED 5, Ultradent Products, Utah) were compared with halogen curing lamp (Optilux TM 501).^{[22],[23]} Another study also showed no significant differences in

total bond failure rate between brackets cured with a LED lamp (Ortholux LED, 3M Unitek) and those cured with a halogen lamp (Ortholux XT, 3M Unitek).^[24]

In the present study LED curing units reduced the time necessary to bond orthodontic brackets which was half of that used for halogen. The difference in shear bond strength values was not significant among groups whether halogen or LED curing light was used for polymerization. So LED curing light can be used for polymerization of orthodontic adhesive because it has advantages such as a short time to reach material polymerization, longer lifetime of over 10,000 hours, no filters to produce blue light, resistant to shock and vibration, and use minimal power to operate, stable, efficient, long-lasting output of blue light with little amount of wasted energy and minimum heat generation.^{[25],[26]} It may be speculated that this difference is due to the fact that LED emission spectrum is close to the maximum absorption peak of camphoroquinone which is a photoinitiator used in light cured adhesives and are more efficient in delivering usable light to activate the camphoroquinone.^[25]

In the present study, curing using LED unit was done at different exposure times and using different exposure methods. Results showed statistically insignificant difference in shear bond strength values for groups II b, II c and II d so polymerization using LED curing unit for 20 and 15 seconds with single exposure may also be used instead of the traditional 20 seconds, 10 seconds on each interproximal side. Group II e showed significantly low values so single exposure for 10 seconds can be considered insufficient for adequate polymerization of adhesive and for a stronger bond which is in accordance with a study which concluded 10 seconds of LED (Elipar FreeLight, 3M ESPE, Seefeld, Germany) curing resulted in significantly decreased shear bond strength values.^[27] These findings are not in concordance with previous studies which showed that the high intensity LED curing devices (Elipar FreeLight 2, 3M ESPE; Ortholux TM LED, 3M Unitek; UltraLume LED 5; Ultradent Products, South Jordan, Utah; Bluephase G2,) reduced the exposure time required to efficiently bond orthodontic

attachments to only 10 seconds.^{[28],[29]}

The mean shear bond strength values in all groups were all beyond the range of 5.9 – 7.8 MPa which is clinically acceptable for effective orthodontic bonding. Weibull survival analysis was done to predict the number of bonds likely to fail at a clinically acceptable strength of 8MPa.

Although groups II c, II d and II e showed shear bond strength values beyond the range clinically acceptable for effective orthodontic bonding, Weibull analysis showed high probability of failure of 25%, 30% and 40 % respectively in these groups. This suggests that LED with single exposure for 20, 15 and 10 seconds may be inadequate for orthodontic bonding as there are increased chances of failure of bonds.

The analysis of ARI indicated that most of the adhesive remained adhered to the tooth surface after debonding and was independent of type of brackets and light-curing unit used. This was in accordance with previous studies which also showed cohesive type of bond failure with most adhesive remaining on enamel surface.^{[17],[30],[31]}

Analyzing bracket debonding, it is desirable that the failure occurs between the bracket and the adhesive or at the adhesive interface. Failure between adhesive and enamel can create enamel fractures or cause irregularities. On the other hand, there was greater difficulty in removing excessive adhesive, which is consistent with the findings of a previous study.^[25]

Thus LED can be used for bonding orthodontic brackets. An exposure time of 20 seconds, 10 seconds on each interproximal surface would seem to be optimal. However it should be kept in mind that laboratory studies are a valuable screening tool, but clinical studies are needed to validate the preliminary in vitro performance of brackets bonded with the LEDs in vivo.

Conclusions

This study concluded that:

- LED with a shorter curing time which is half of that used for halogen provides clinically acceptable bond strength with minimal chances of bond failures.

- LED with single exposure for 20, 15, and 10 seconds may be inadequate for orthodontic bonding as there is increased chances of failure of bonds.
- Shear bond strength is not dependent on type of brackets used whether adhesive pre-coated or conventional uncoated brackets.
- In all groups most of the adhesive remained on the tooth surface after the debonding of the brackets which is desirable as failure between adhesive and enamel can create enamel fractures or cause irregularities.

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Biometric Relationship Between Inner Canthal Distance And Geometric Progression For The Prediction Of Maxillary Central Incisor Width.

Abstract

Statement of problem One of the primary concerns in denture esthetics is the selection of appropriate mesiodistal width of maxillary central incisors. Aim To examine the relationship between inner canthal distance and maxillary central incisor mesiodistal width in terms of geometric progression popularly known a golden proportion.

Materials and Method : Two hundred and fifty dentate Indian subjects (121 males 129 females; mean age 21.49 years) free from facial and dental deformities were examined. The mesiodistal width of each maxillary central incisor was measured between its interproximal contact points. The inner canthal distance was measured from medial angle to medial angle of the palpebral fissures of the eyes. The common ratios of geometric progression are 0.618 and 1.618 .The inner canthal distance of each subject was multiplied by a decreasing function value of the geometric progression term (0.618) to provide the combined width of two central incisors. The product was then divided by 2 to obtain the width of a single maxillary central incisor. A “t” test was used to identify any significant differences in the mesiodistal tooth width and inner canthal distance by gender. Agreement between the measured and calculated central incisor widths was evaluated with Pearson’s correlation coefficients as was intraexaminer reliability.

Results : The mean inner canthal distance of male and female subjects was 29.85±1.47mm and 27.46±2.1mm, respectively. The mean maxillary central incisor width of male and female subjects was 9.18±0.51mm and 8.42±0.40mm, respectively. Difference between the mean values for both measurements was significant. The actual and calculated width of maxillary central incisors was found to be highly correlated (r=0.96).

Conclusion : The results of the present study suggest that inner canthal distance and geometric progression may be a reliable predictor of the width of the maxillary central incisor. Interpretation and extrapolation of the results may be tempered, by an acknowledgement of the study limitation. Only one ethnic group (Indian) was evaluated, and subjects were chosen with a specific age range. It is possible that ethnic related difference in inner canthal distance may exist. Further research is necessary to validate the outcomes of this investigation.

Key Words

Inner Canthal Distance (ICD), Central Incisor Width (CIW), Geometric progression (GP).

Introduction:

One of the difficult aspects of complete denture prosthodontics is the selection of appropriately sized maxillary anterior teeth, especially the central incisors. When no pre extraction records are available, selecting the proper anterior teeth size for edentulous patients can be difficult^[1].

The mesiodistal width of central incisor can be determined by certain anthropometric measurements of face. Scandrett et al^[2] have also studied the relationship between width of maxillary anterior teeth and the central incisor to that of intercommisural width, bizygomatic width, sagittal cranial diameter and philtrum width. These investigators hypothesized that two or

more of these predictor variables would provide a better prediction of maxillary tooth width than any of them individually.

Another anthropometric measurement of face is the distance between inner canthus of the eyes. The inner canthal distance (ICD) is defined as the distance between the medial angles of the palpebral fissure^[3]. Laestadius et al^[4] reported that in 78% of the population evaluated, the ICD was attained by the time the subject was 1 year old. Subsequently, the growth rate in that area was slow in contrast to the outer orbital dimensions. The previous anthropometric parametric measurements have not been evaluated with geometric progression^[5] to determine proportionality between them

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and maxillary central incisor width.

Proportion is the study of the harmony of structures in space.^{[6],[7]} When the proportion or ratio of a smaller to greater part is the same as the ratio of the greater part to the whole, it is said to be in geometric progression.^{[5],[7],[8]} Because of their immense importance in geometry and architecture and their manifestations in nature, these ratios are called “Golden proportions”.

A proportion between two adjacent parts which is repeated across, enhances the unity within the diverse parts of a composition, and Lombardi^[9] states that when this repeated ratio is equal to the Golden Mean, the composition is said to be esthetic.

Levin^[10] has described the use of this proportion in dental esthetics. Any finite line can be arbitrarily divided into two

segments by a point and a ratio of the smaller segment to the larger, and the ratio of the larger to the entire segment can be calculated. Only when the line is divided mathematically into segments that exhibit the proportion 0.618:1 does the golden proportion exist. The Golden Proportion is described as follows: The "proportion of the smaller to the greater is the same as the proportion of the greater to the whole."

If, in a sequence of terms, the ratio between 2 consecutive terms is consistent, it is said to be in geometric progression (GP).

The ratio is called a common ratio. For example:

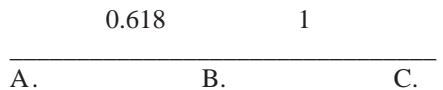
- 3,6,12,24, ;common ratio 2
- 8,4,2,1,1/2, ;common ratio 1/2
- 2,-10,+50, ;common ratio -5

In general, if a is the first term and r is the common ratio, then the GP may be written as follows:

$a + ar + ar^2 + ar^3 + ar^4 + ar^5 + \dots + ar^{n-1}$ to 'n' terms
 if x, y and z are 3 terms in a GP, then the common ratio is equal to the following:
 $y/x = z/y$ or $y^2 = xz$

Y, the square root of the product of 2 numbers x and y, is called the geometric mean. For example, the geometric mean of 4 and 9 is $\sqrt{4 \times 9} = 6$.

A straight line may be divided into two unequal parts (AB & BC) in any ratio. In a specific case when AB = 0.618 and BC=1, BC is the geometric mean of AB and AC.



$AB/BC = \text{smaller} / \text{larger} = 0.618 / 1 = 0.618$ and $BC/AC = \text{larger} / \text{whole} = 1 / 1.618 = 0.618$

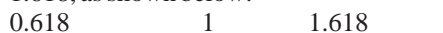
OR

$AB/BC = BC/AC$

OR

$BC^2 = AB \times AC$

Hence, AB, BC and AC are three consecutive terms of a geometric series in which the first term AB = a = 0.618, the second term = BC = ar = 1, so that the common ratio $r = 1/0.618$. Hence the third term AC = $ar^2 = ar \times r = 1 \times 1.618 = 1.618$, as shown below:



The fourth term will be $ar^3 = 2.618$. Thus we can construct the whole series as $a + ar + ar^2 + ar^3 + ar^4 + ar^5 + \dots$ to n terms.

Or
 $0.618 + 1 + 1.618 + 2.618 + 4.236 + 6.854 + \dots$ to n terms.

Similarly, if we take 1 as the first term and the common ratio as 1.618 or its reciprocal $1/0.618$, then we get the following geometric series:

$a + ar + ar^2 + ar^3 + ar^4 + ar^5 + \dots$ to n terms.
 Or
 $1 + 1 \times 1.618 + 1 \times 1.618^2 + 1 \times 1.618^3 + 1 \times 1.618^4 + 1 \times 1.618^5 + \dots$ to n terms.

Or
 $1 + 1.618 + 2.618 + 4.236 + 6.854 + 11.090 + \dots$ to n terms.

Hence, if the common ratios are 0.618 or 1.618, geometric progression results. For any decreasing function, we multiply by 0.618, and for any increasing function, we multiply by 1.618 to get the next result. As mentioned above, these ratios are called the golden proportion.

Some parts of the face have been reported to manifest golden proportions. The width of maxillary central incisor is in golden proportion to the width of lateral incisor, and the width of the lateral incisor is in golden proportion to the width of canine^[8]. The purpose of this study was to determine the relationship between inner canthal distance and the mesiodistal width of the maxillary central incisors in terms of geometric progression.

Material And Methods:

The study was conducted on 250 subjects of Sri Guru Das Institute of dental/medical college, Amritsar (Punjab). The subjects comprised 121 males and 129 females in the age group of 18-25 years. Young adults were selected because the ICD is established by 1 year of age, after which the rate of growth in the area is slow in contrast to the outer orbital dimensions^[4]. Subjects with caries, restorations, severe attrition, congenital facial defects, orthodontic or crown restorations were excluded.

Natural Tooth Measurements:

1. The mesiodistal width of each of the maxillary central incisor (CIW) was measured at the contact points intraorally with the spring loaded divider, pointed members held



Fig 1. : Armamentarium used



Fig 2. : Measurement of mesiodistal width of central incisor at the contact points

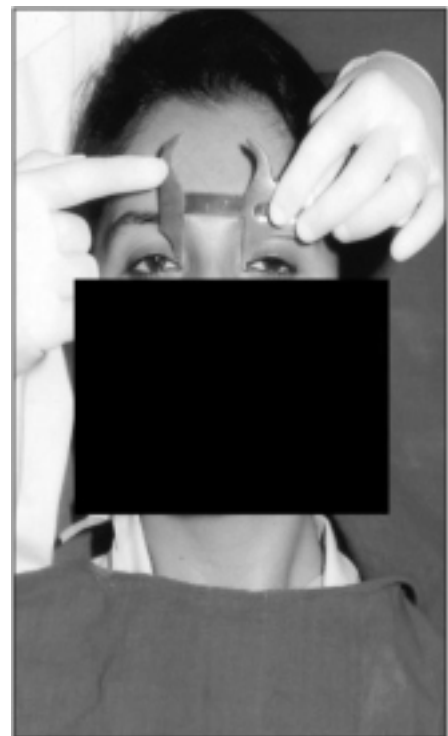
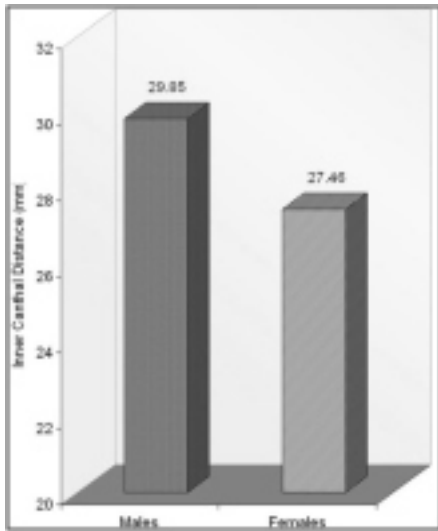
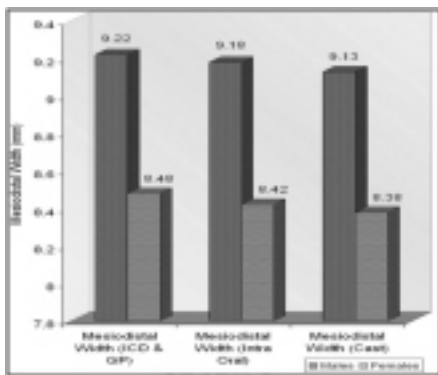


Fig 3. : Measurement of innercanthal distance with Boley's Gauge

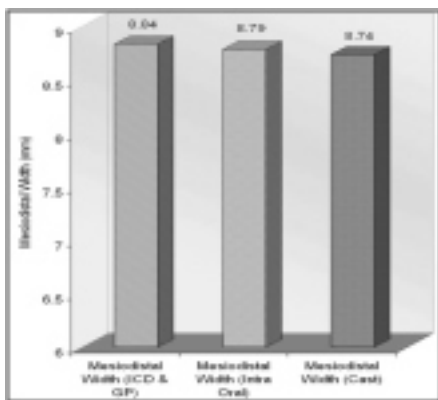
parallel to the incisal edges and vertical to the facial surface of tooth interdently. [Fig.1 & 2] The combined mesiodistal width of maxillary central incisors, thus obtained was divided by 2 to obtain the mesiodistal width of a single tooth. This procedure was similar to that reported by Garn et al,^[11] who



Graphs 1. : Mean Inner Canthal distance in males and females



Graphs 2. : Mean mesiodistal width of central incisor calculated by inner canthal distance and geometric progression, intraoral and cast (in males and females)



Graphs 3. : Mean mesiodistal width of central incisor (combined) calculated by inner canthal distance and geometric progression, (intraoral and cast)

found no significant difference in the mesiodistal diameter of the right and left maxillary central incisors and thus justified the common practice of combining these tooth measurements

- After the measurement procedure, the pointed members of the divider were placed on a piece of white paper, which was placed over a cork board, so that the pointed members perforated the paper when gentle

pressure was applied. The perforations were joined by a straight line, which was measured to an accuracy of 0.1mm by a digital caliper. Each tooth was measured five times and the average of these five values were recorded. Impressions of the maxillary and mandibular arches were made in alginate. [Zelgan, Dentsply India Pvt. Ltd.] Instructions by the manufacturer regarding powder water ratio [22gms of powder and 57ml of water approximately] and mixing of alginate material and dental stone were precisely followed. The impression was poured within 5 minutes and cast was made. The mesiodistal width of maxillary central incisor was measured on the cast as done intraorally.

Measurement Of Innercanthal Distance

- Subjects were seated in a dental chair with their heads supported in an upright position so that they looked forward at the horizon.
- The Boley gauge was placed against the forehead and lowered towards eyes. The arms of the caliper were adjusted so that they were in a gentle contact with the median angle of the palpable fissures of the eyes. [Fig.3]
- The distance between the two anatomical landmarks was recorded as the inner canthal distance to an accuracy of 0.1 mm.
- The inner canthal distance was measured five times for each subject and the values were averaged. The common ratio of geometric progression are 0.618 and 1.618. Any decreasing function is multiplied by 0.618 and increasing function by 1.618 to get the next result. As the inner canthal distance was greater than the combined widths of the maxillary central incisors, it was multiplied by 0.618. The resultant product was divided by 2 to obtain the width of a single central incisor. The formula can be expressed as follows:

$FCIW = ICD / 2 \times 0.618$, where FCIW is the calculated width of a maxillary central incisor. The calculated width was compared with the natural tooth measurement for each subject. The data thus obtained was put to a statistical analysis.

Results

Descriptive statistics for mean innercanthal distance and mean mesiodistal width of maxillary central incisor values using ICD and G.P for male and female subjects are presented in **Table 1 & Graph 1,2,3.**

Means for both measurements were significantly higher for males than females. The correlation between the measured and calculated central incisor width values for all subjects was 0.96(0.964 for males and 0.963 for females). A paired t test revealed no significant difference between the mean width of natural tooth and its calculated

Table- 1 : Mean Inner Canthal Distance And Mean Mesiodistal Width Of Maxillary Central Incisor Using Innercanthal Distance (ICD) And Geometric Progression (GP). (In Mm)

Measurement	Sex	No Of Cases	Mean	SD	Significance
ICD	Male	121	29.85	1.47	$t = 13.75$ $p < 0.001$
	Female	129	27.46	1.28	not significant
CIW	Male	121	9.22	0.46	$t = 13.62$
	Female	129	8.48	0.40	$p < 0.01$ not significant

ICD, Inner canthal distance; CIW, maxillary central incisor width (mesiodistal)

Table- 2 : Mean Mesiodistal Width Of Central Incisor In Males And Females (Intraoral). (In Mm)

Sex	Tooth No	Mean	SD	Significance
Male	11	9.20	0.50	$r = 0.61$
	21	9.16	0.52	$p > 0.05$
	Average value	9.18	0.51	Not significant
Female	11	8.43	0.41	$r = 0.20$
	21	8.42	0.40	$p > 0.05$
	Average value	8.42	0.43	Not significant

Table- 3 : Mean Mesiodistal Width Of Central Incisor In Males And Females (Cast). (In Mm)

Sex	Tooth No	Mean	SD	Significance
Male	11	9.12	0.51	$r = 0.15$
	21	9.12	0.51	$p > 0.05$
	Average value	9.13	0.50	Not significant
Female	11	8.38	0.42	$r = 0.20$
	21	8.37	0.42	$p > 0.05$
	Average value	8.38	0.41	Not significant

Table-4 Combined Mesiodistal Width Of Tooth No.11 And 21 (Intraoral)

Tooth No	Mean	SD	Significance
11	8.80	0.60	$r = 0.77$
21	8.78	0.59	$p > 0.05$
Average Value (In Mm)	8.79	0.59	Not significant

Table- 5 : Combined Mesiodistal Width Of Tooth No 11 & 21(Cast). (In mm)

Tooth No	Mean	SD	Significance
11	8.74	0.59	$r = 0.79$
21	8.74	0.59	$p > 0.05$
Average Value (In Mm)	8.74	0.59	Not Significant

size.

There was no satisfactory significant difference in the mesiodistal width of right and left central incisor measured intraorally and on the cast for both males and females ($p > 0.05$) (Table 2 and 3). Similarly, in all subjects, there was no satisfactory significant difference in the combined mesiodistal width of right and left central incisor measured intraorally and on the cast. [Table 4 and 5]

Discussion

As the subjects were from the same population, the results of this study are more applicable to the Indian population. In the present study, all the tooth dimension were significantly higher in males than in females. Variation based on gender has also been reported by Garn et al^[11] (males 8.78mm, females 8.50 mm); Sanin and Savara^[12] (males 8.70, females 8.54 mm). The mesiodistal width of each of maxillary central incisor was measured at the contact points. The contact areas of central incisor was chosen, as the width is maximum at these contact areas; which was in accordance with the statement made by Wheeler^[13]. The combined mesiodistal width of maxillary central incisors, thus obtained was divided by 2 to obtain the mesiodistal width of a single tooth. A similar study reported an insignificant difference in the mean value of mesiodistal central incisor crown diameter for 297 left and 297 right incisors (8.86 to 8.83 mm for men and 8.59 to 8.58 for women), justifying the common practice of combining left and right tooth measurements in comparative population studies^[14].

The results of the present study showed that the measured mean value of central incisor width to be 8.79 ± 0.59 mm, whereas the calculated width by means of ICD and GP was 8.84 ± 0.56 mm. The difference in the measured and calculated central incisor width was not statistically significant ($p > 0.05$), which does concur with the findings of previous study,^[11] in which the actual and calculated width of the maxillary central incisor were found to be highly correlated.

The mean ICD recorded in the present

study (28.62mm) was less than the value reported by Laestadius et al (30.00 mm), who- in contrast to the present study found no significant difference between mean value for male and females.

The results of the present study suggest that ICD and Geometric progression may be a reliable predictor of the width of the maxillary central incisors. Interpretation and extrapolation of the results may be tempered, however, by an acknowledgment of the study's limitations. Only one ethnic group (Indian) was evaluated, and the subjects were selected within a narrow age range. It is possible that ethnic- related difference in ICD may exist. Further research is necessary to validate the outcome of this investigation.

Conclusion

With in the limitations of this study, the following conclusions were drawn:

1. The mesiodistal width of maxillary central incisor measured intra orally and on the cast were highly correlated with the calculated width of central incisor by means of inner canthal distance and geometric progression in both males and females.
1. Sex related difference in the mesiodistal width of the central incisor was reported. The mean central incisor width was significantly higher in males and females
2. Inner canthal distance when multiplied by a decreasing function value of this geometric progression term 0.618 and divided by 2, was a reliable predictor of maxillary central incisor width.

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Evaluation And Diagnostic Usefulness Of Saliva For Detection Of HIV Antibody

Abstract

Background and Objectives: use of saliva as specimen for detection of antibodies to infectious agents has generated particular interest in AIDS research community since 1980's. HIV specific antibodies of immunoglobulin isotypes IgA, IgG and IgM are readily found in salivary secretions, in the present study HIV specific antibodies were detected in saliva and serum samples by ELISA in confirmed HIV seropositive and healthy individuals.

Methods: The 100 saliva and serum samples were collected from age and sex matched confirmed HIV seropositive subjects and 100 Healthy Controls. HIV antibodies were determined by Enzyme Linked Immunosorbant Assay (ELISA).

Results: The results were found to be 99% sensitive and 100% specific for saliva samples while it was 100% sensitive and specific for serum samples.

Interpretation and Conclusion: Saliva can be used as alternative to blood for detection of HIV antibodies as saliva collection is painless, non-invasive, inexpensive, simple and rapid. Salivary antibody testing may provide better access to epidemic outbreaks, children, large populations, hard-to-reach risk groups and may thus play a major role in the surveillance and control of infectious diseases.

Key Words

HIV, Saliva, Serum, Antibodies

Introduction

HIV infection is a major global health problem. As per recent reports by United Nation AIDS Control Society (UNAIDS) number of people living with HIV till 2010 were 33.2 Million (30.6–36.1 Million) and people who died of AIDS were 2.1 Million (1.9–2.4 Million). It is estimated by National AIDS Control Organization (NACO) that the number of people living with HIV infection in India till 2010 were 2.5 million (2-3.1 million).^[1] Prevalence is high in the 15-49 age group (88.7 percent of all infections), indicating that AIDS still threatens those in the prime of their working life. World Health Organization (WHO) and National AIDS control organization (NACO) in 1997, enumerated the different modes of transmission of HIV. These are Sexual intercourse (anal / vaginal / oral) with an infected partner (man to woman, woman to man and man to man), transmission with infected blood, blood products, organs, tissue transplantation and artificial insemination, contaminated syringes and needles, and from an infected mother to child, i.e. perinatal or vertical transmission. Worldwide, HIV is most commonly transmitted by sexual activity.

HIV is found in blood and other body fluids including semen, vaginal fluid and saliva. The immense majority of HIV infections are produced during unprotected sexual intercourse via the vaginal mucosa and especially the anal mucosa.^{[2],[3]} The risk of HIV transmission via oral secretion is an issue of growing interest to dental health professionals, above all with the upsurge in the number of infected individuals.

Although HIV RNA, proviral DNA and infected cells are readily detectable in salivary secretions and Gingival Crevicular Fluid (GCF) of infected individuals, the transmission of HIV by oral route is very low or virtually non-existent. The mechanism of this oral immunity is poorly understood. Reports of antiviral activity in the saliva of both healthy individuals and HIV infected individuals suggest the presence of a factor or factors in saliva that can inhibit HIV infection. Furthermore, it is well established that human saliva inhibits HIV infectivity in vitro.^{[4],[5],[6],[7]} The anti-HIV inhibitory factors in saliva may make a major contribution to the extremely low or negligible rates of oral transmission of the virus reported by

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epidemiological studies.^{[1],[4],[5]}

Evaluation and diagnostic usefulness of saliva for detection of HIV antibody has been studied since 1986 as saliva is a body fluid containing antibodies of diagnostic significance. Unlike venipuncture, saliva collection is painless, non-invasive, inexpensive, simple and rapid. By using sensitive immunoassays in salivary specimens it is possible to diagnose immunoglobulin's against a wide range of infectious diseases e.g. hepatitis A, B and C, measles, mumps, rubella, human immunodeficiency virus, Epstein Barr virus, parvovirus B 19, human herpes virus 6 and Helicobacter pylori infections. Salivary antibody testing may provide better access to epidemic outbreaks, children, large populations, hard-to-reach risk groups and may thus play a major role in the surveillance and control of infectious diseases. Evaluation and diagnostic usefulness of saliva for detection of HIV antibody has been done by Enzyme linked immune assay (ELISA) which has been modified by increasing the specimen volume, altering

the incubation periods, reagent concentrations, and reducing the assay cutoff values^{[6],[8],[9]} These modifications have resulted in improved ELISA sensitivity and specificity compared with those of matched serum test.

Material And Method

The present study was carried out in Dept.of Oral Medicine and Radiology, K.M Shah Dental College, Piparia, Vadodara, Gujrat. The study was approved by Ethical Committee of Sumandeep Vidyapeeth, Vadodara. The total of 200 subjects – 100 HIV confirmed seropositive as study group and 100 age and sex matched healthy individuals who had undergone a checkup by qualified medical physician as control group were randomly selected for the study from the OPD of Dhiraj General Hospital & K M Shah Dental College and Hospital Piperia, Vadodara and Non Governmental organizations working for HIV positive persons in Vadodara. Written consent was obtained from each participant. The aims and objectives of the study were to detect HIV antibodies in saliva and serum of newly diagnosed confirmed HIV seropositive patients by ELISA and to evaluate the sensitivity and specificity of ELISA test in serum and saliva samples of HIV positive and healthy individuals. Newly diagnosed confirmed seropositive patients before starting anti-retro viral therapy (ART) were selected. Three separate positive ELISA tests were considered confirmatory. Participants were excluded if they were on anti-retro viral therapy (ART). Patients with history of autoimmune disorder eg: Systemic Lupus Erythmatosis(SLE) or Discoid Lupus Erythmatosis(DLE), Rheumatoid arthritis who are likely to give false positive ELISA test were excluded from the study. Saliva collection and blood collection apparatus was used which included whole saliva Collector (50ml), 10 ml vial (transparent), lemon juice, dropper, tourniquet, spirit, cotton, bi ended needles, connector, vaccutainer tubes – 4 ml, 10 ml vial were used .

Results And Observations

The age range for study group was from 6years to 65 years with mean age of 34.14 ± 11.51 years whereas age range for control group was from 11 years to 62 years with mean age of 31.02 ± 7.15 years. The general socio-demographic data of the population revealed that most

of HIV positive males were laborers (33.3%) and truck drivers(21%) by occupation whereas most of HIV positive females were housewives(46.5%). Most common mode of HIV transmission in the study group was unprotected sexual practices (70%) followed by blood transfusion (18%), vertical transmission (9%) and intra-venous drug users(3%). Out of total 25 married females of study group 21(84%) had given history of single partner and 4(16%) had multiple partners whereas 3(27.2%) out of 11 widows also gave history of multiple partners. Out of total 28 cases of sexual transmission of HIV infection only 7(25%) females gave history of multiple partners.

Thus the results indicated that total 95% married males and 16% married females of study group had unprotected sexual activities with multiple partners which indicates 84% females acquired HIV infection from there HIV positive spouses.

Out of total 100 subjects in study group, 99(99%) were tested positive for HIV antibodies in saliva samples with one false negative result and all the subjects were detected positive for HIV antibodies in serum samples whereas all the subjects of control group were tested negative for HIV antibodies in serum and saliva samples.

Thus, the ELISA test was found to be 99% sensitive and 100% specific for detection of HIV antibodies in saliva samples of study group whereas it was found 100% sensitive and specific for detection of HIV antibodies in serum samples of study group.

Discussion

Generation of specific antibody response is a critical component of the host defense against pathogenic microorganisms and HIV is no exception. The presence of virus-specific antibodies in mucosal secretions including saliva has been well documented. HIV specific antibodies of immunoglobulin isotopes IgA, IgG and IgM are readily found in salivary secretions of infected people but at levels considerably lower than those in blood^[10]. Detection of HIV-specific antibodies in oral fluid transudate has been exploited recently as a highly sensitive and specific alternative to blood for diagnosis and population surveillance.

Spencer Hedge et al in 1998 explained the diagnostic significance of antibodies in oral secretions. Immunoglobulin's (IgG) were identified in human saliva nearly 50 years ago and shortly thereafter in 1963, the prevalence of IgA in saliva was demonstrated.^[11]

Parry J. V. et al 1987, performed a sensitive assays for viral antibodies in saliva. They described methods for detecting antibodies to HIV as well as antibodies to other viruses and proposed saliva as an alternative specimen for epidemiological investigations.^[12]

ELISA has been modified by increasing the specimen volume, altering the incubation periods, reagent concentrations, and reducing the assay cutoff values for detection of HIV antibody in saliva.^{[6],[7],[13],[14]} These modifications have resulted in improved ELISA sensitivity and specificity in saliva compared with those of matched serum test as reported by Timothy C Granade et al in year 1995 and 1998.^{12,13 [13],[14]}

In the present study we have evaluated diagnostic usefulness of saliva for detection of HIV antibodies. Unlike venipuncture, saliva collection is painless, non-invasive, inexpensive, simple and rapid.

In our study saliva and serum samples of 100 confirmed seropositive patients and 100 healthy individuals were tested by ELISA kit. The result was found to be 99% sensitive and 100% specific for saliva samples while it was 100% sensitive and specific for serum samples. The results were congruent with studies done by Soto-Ramirez et al^[15] in 1992, Chamanput et al^[16] in 1993, Ishiwaket al in 1995^[17], Schramm et al in 1999 and recently by Nitika et al in 2007^[18]. Diagnostic sensitivity and specificity of saliva for detection of HIV antibodies is reported by various authors is given in the following **Table 1**.

Thus, in the various studies, diagnostic sensitivity of saliva, analyzed by ELISA, is ranged from 95% to 100% and diagnostic specificity of under 90% has been reported. 3,5,7,8,14,15,16,17,18,^{[4],[5],[6],[7],[8],[9],[10],[11],[12],[13],[14],[15],[16],[17],[18],[19]}

In conclusion, Saliva can be used as alternative to serum and plasma for

Table 1: Sensitivity And Specificity Of Saliva For Detection Of HIV Antibodies By Various Authors

Authors	Year	HIV Positive Subjects	HIV Negative Subjects	Sensitivity	Specificity
Parry Et Al	1987	43	10	100	100
Archibald Etal	1991	21	---	95.2	---
Chamnanput Etal	1993	100	100	99	100
Luo N Etal	1995	50	57	96	100
Ishiwak Etal	1995	63	76	100	100
Pasquier Etal	1997	530	---	100	99.8
Prudencio Etal	1998	187	115	95.2	97.4
Schramm Etal	1999	684	652	100	99.1
Wesolowski Etal	2006	26066	---	90	99.8
Nitika Etal	2007	146	304	100	100

detection of HIV antibodies as a highly sensitive and specific alternative to blood for diagnosis and population surveillance.

Still much more work is required in this field so that saliva can be used as alternative to blood for detection of HIV antibodies.

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A Study To Evaluate The Effect On Transverse Strength And Modulus Of Elasticity Of Repaired Denture Base Resin After Chemical Surface Treatment – An In Vitro Study.

Abstract

Aim & Objectives: The objective of this study was to evaluate the effect on Transverse strength and Modulus of elasticity of repaired denture base resin after chemical surface treatment.

Materials and Methods: 50 rectangular specimens (65 × 10 × 3mm) of DPI heat cure acrylic were fabricated according to ADA Specification No. 12. and were divided into 5 groups, each consisting of 10 specimens. Group 1- specimens treated with methylene chloride for 30 seconds, Group 2 - specimens treated with acetone for 30 seconds, Group 3-with out any fracture (Intact specimens) ,Group 4- specimens treated without any surface treatment, Group 5 specimens treated with MMA for 180 seconds. All specimens were subjected to the 3-point bending test with an Instron universal testing machine to evaluate the flex modulus and transverse strength. The obtained data was statistically analyzed by One-way ANOVA & Newman-Keuls multiple post hoc test.

Results : Significant differences were found between the control and experimental groups. The results showed that the modulus of elasticity of the specimens treated with methylene chloride showed significant values than all the other groups, however the remaining groups did not show significant difference among themselves. The transverse strength of methylene chloride treated specimens showed highest values among all the tested groups ,followed by monomer group. Not much difference was shown by the acetone group when compared to the control group.

Conclusion : Methylene chloride group showed highest transverse strength and modulus of elasticity among all the tested specimens.

Key Words

Inner Canthal Distance (ICD), Central Incisor Width (CIW), Geometric progression (GP).

Introduction:

The fracture of heat cure denture bases is a common clinical occurrence. Autopolymerizing acrylic resin is commonly used for repair, as it facilitates a simple and quick repair. Chemical modifications of the fractured surfaces are done by applying chemical agents to ensure better bonding. Methacrylates (MMA), Organic solvents such as Chloroform, Acetone, and Methylene chloride are few of the chemical agents used for this process^[1]. The purpose of this study is to evaluate the effect on transverse strength and modulus of elasticity of repaired denture base resin after chemical surface treatment.

Materials and Methods:

A standardized aluminum die measuring 65 × 10 × 3mm was prepared according to ADA specification no.12 (Fig-1), for measurement of transverse strength and Flex modulus of a denture base resin.^[2]

The die was flaked in dental stone to

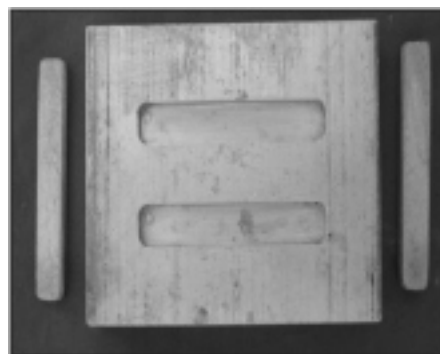


Figure 1 - Aluminium Die according ADA Sp.no.12

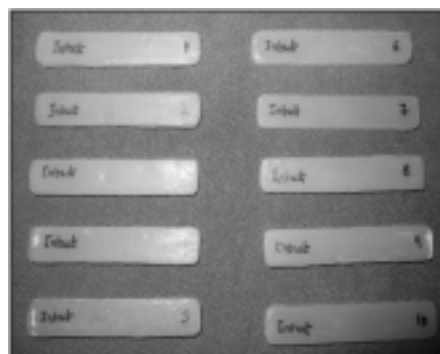


Figure 2 - Acrylic Specimens

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obtain mould spaces which were used as matrices for the fabrication of heat polymerized acrylic resin specimens. Heat cure acrylic resin was packed into the mould spaces and acrylization was done. The resin specimens were finished to a size of 2.5 × 10 × 64 mm with 600-grit silicon carbide paper under water irrigation (Fig -2). All the specimens were stored in water at 37°C for 7 days before the surface treatments.

The acrylic resin specimens were divided into 5 subgroups, each with 10 specimens. Group 1 -includes in methylene chloride (mc) for 30 seconds, Group 2 - in acetone (ac) for 30 seconds, Group 3-without any fracture (intact specimens) Group 4- had no surface treatment, Group 5 in MMA (mo) for 180 seconds. The prepared intact specimen was cut into half with a high speed diamond disk cutter under copious irrigation. Each surface was given a 45-degree bevel and polished with 600-grit



Figure 3 - Chemical Surface Treatment of the specimens

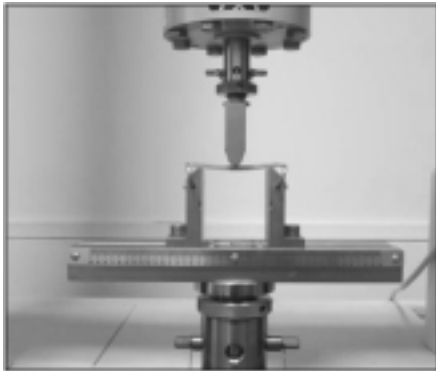


Figure 4 - Testing the Specimen using Instron testing machine

silicon carbide with water irrigation. Specimens surfaces were treated with chemical etchants, by immersion in acetone, in methylene chloride or in MMA (Fig-3).

After treatment of the cut surface, the heat-polymerizing strips were fixed in a stone mold to obtain a space for placing the repairing resin. Widths between half strips were 2 mm at the top and 6 mm at the bottom. The autopolymerizing acrylic slurry, which consisted of 10 g powder with 7.5 ml liquid, was infused into the space with the use of a vibrator to obtain specimens. The flasks were closed and placed under hydraulic pressure.

After the specimens were retrieved from the mold it is trimmed of the excess material.

All specimens were stored in 37°C distilled water for 7 days before the test. Each specimen was subjected to the 3-point bending test at a crosshead speed of 5 mm/min at a 50-mm distance with an Instron test apparatus. The load was applied to the center of the 2-mm repaired area for the experimental groups and to the center of the control specimens at a 5.0 mm/min crosshead speed (Fig-4). Transverse strength, fracture load, modulus of elasticity and deflection values were automatically calculated by the software and the results were recorded.

The breaking load was converted to

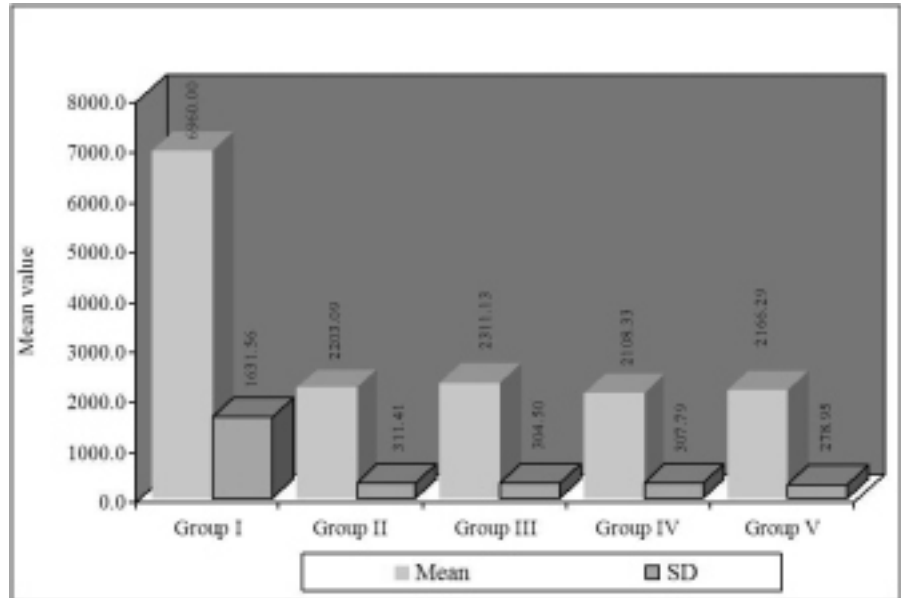


Figure 5 - Graphical representation of Newman-Keuls multiple post hoc for Flex modulus

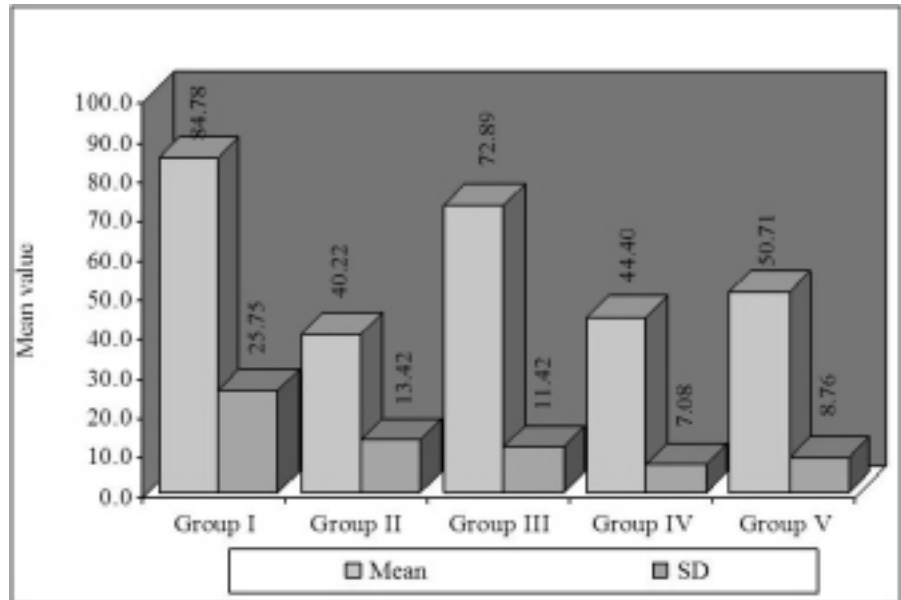


Figure 6 - Graphical representation of Newman-Keuls multiple post hoc for Transverse Strength

transverse repair strength (S) by the formula $S = 3 PL/2 bd^2$, where P is the load at fracture, L is the length between the jig tips (50 mm), b is the width, and d is the thickness of the specimen.

Results:

One-way ANOVA statistical analysis was used to determine whether significant differences existed between the means of the experimental groups (I, II, III, IV, V) with respect to Flex Modulus (Table-1) and Transverse strength (Table-2). Newman-Keuls multiple post hoc test was done for pair wise comparison of five groups (I, II, III, IV, V) with respect to Flex Modulus (Table-3) and Transverse strength (Table-4).

Among the 5 groups tested Group 1 (Specimens treated with Methylene chloride) showed highest flex modulus followed by Group 3 (Intact specimens), Group 2 (Specimens treated with Acetone), Group 5 (Specimens treated with Methyl methacrylate) and finally Group 4 (Specimens without surface treatment) when statistically analyzed by one way ANOVA test and Newman-Keuls multiple post hoc procedure (Fig-5)

Among the 5 groups tested Group 1 (Specimens treated with methylene chloride) showed highest transverse strength followed by Group 3 (Intact specimens), Group 5 (Specimens treated with Methyl methacrylate), Group 4

Table - 1

SV	DF	Sum of squares	Mean sum of squares	F-value	p-value
Between groups	4	166877725.20	41719431.30	74.7535	0.0000*
Within groups	44	24556102.38	558093.24		
Total	48	191433827.58			

*p<0.05

The above table shows the comparison of five groups (I, II, III, IV, and V) with respect to Flex Modulus (Mpa). Statistical analysis by one way ANOVA shows significant difference among the groups and within the groups tested.

Table - 2

SV	DF	Sum of squares	Mean sum of squares	F-value	p-value
Between groups	4	14213.8747	3553.4687	16.9181	0.0000*
Within groups	44	9241.7216	210.0391		
Total	48	23455.5962			

*p<0.05

The above table shows comparison of five groups (I, II, III, IV, V) with respect to Transverse strength (MPa) scores by one way ANOVA test and it is inferred that all the tested groups showed significant difference among themselves and also within the groups.

Table - 3

Group	Group I	Group II	Group III	Group IV	Group V
Mean	6959.9967	2203.0910	2311.1250	2108.3270	2166.2920
SD	1631.5600	311.4098	304.5014	307.7923	278.9459
Group I	P=1.0000				
Group II	P=0.0001*	P=1.0000			
Group III	P=0.0001*	P=0.7507	P=1.0000		
Group IV	P=0.0001*	P=0.9577	P=0.9315	P=1.0000	
Group V	P=0.0002*	P=0.9138	P=0.9039	P=0.8646	P=1.0000

*p<0.05

The above table shows Pair wise comparison of five groups (I, II, III, IV, V) with respect to Flex Modulus (Mpa). Analysis by Newman-Keuls multiple post hoc procedures shows significant differences among the tested groups.

Table - 4

Group	Group I	Group II	Group III	Group IV	Group V
Mean	84.7813	40.2199	72.8874	44.3971	50.7140
SD	25.7511	13.4192	11.4185	7.0824	8.7637
Group I	P=1.0000				
Group II	P=0.0001*	P=1.0000			
Group III	P=0.0764	P=0.0002*	P=1.0000		
Group IV	P=0.0002*	P=0.5273	P=0.0003*	P=1.0000	
Group V	P=0.0001*	P=0.2558	P=0.0016	P=0.3405	P=1.0000

*p<0.05

The above table shows Pair wise comparison of five groups (I, II, III, IV, V) with respect to Transverse strength (MPa) scores by Newman-Keuls multiple post hoc procedures which shows significant difference among all the tested groups.

(With out surface treatment) and finally Group 2 (Specimens treated with Acetone) when statistically analyzed by one way ANOVA test and Newman-Keuls multiple post hoc procedure (**Fig-6**)

Discussion

Acrylic resin polymers were introduced as denture base material in 1937 and by 1946, 98 of all denture bases were fabricated with polymethyl methacrylate (PMMA)^[31]. Today, inspite of advent of newer denture base materials in the market majority of denture bases are made with heat-cured PMMA polymers.

Despite of its popularity, the material is not without limitations. This is reflected in the unresolved problem of denture fractures and the accompanying costs of their repairs^[4].

The fracture of poly (methyl) methacrylate denture bases is a common clinical occurrence. Denture fracture can occur outside or inside the mouth. The reasons for the fractures occurring outside the mouth could be due to accidents or falls as a result of expelling the denture from the mouth while coughing, or dropping the denture while handling and cleaning them. Causes of denture fractures occurring inside the mouth are related to inadequate fit of the denture base, poorly balanced occlusion, faulty design and fabrication, insufficient strength of the material, excessive bite force, improper occlusal plane, high frenal attachments, stress induced in the denture base following years in clinical use, and primarily in the midline of maxillary complete dentures when opposed by mandibular natural dentition^{[5], [6]}.

The clinician must often decide whether to repair or replace the broken denture. To minimize inconvenience to the patient and save cost in the reconstruction of the dentures, quick and reliable denture repairs are often opted.

However the repaired denture strength relies on the type of repair material used. Numerous materials like autopolymerizing resin, heat cure resin, visible light cure, microwave cure have been used to repair dentures. Among which Heatcure & Autopolymerizing resins are commonly used. Clinically autopolymerizing acrylic resin is the most commonly used material for repair because it is easy, quick, and inexpensive method having adequate strength, good color match.

Adhesion between denture base and repair material can be improved by applying appropriate chemicals to the acrylic resin surfaces.

Methyl methacrylate, Chloroform, Acetone, and Methylene chloride have been used as softening agents in several situations, including repair of denture bases because of its ability to dissolve the denture material, allowing improved bonding by forming an interpenetrating

polymer network at the interface.

The purpose of this study is to evaluate the effect on Transverse strength and Modulus of elasticity of DPI Heatcure denture base resins repaired with commonly used DPI autopolymerizing resin after different chemical surface treatments.

The various chemical surface treatments used in this study were Acetone, Methylene chloride, and Heat cure monomer before the repairing procedure. Shenin 1984 stated that wetting the denture base resin surface with chloroform for 5 seconds creates a cleaner and more efficient site for bonding, increasing the strength of denture repairs; however, chloroform was identified as a noxious compound with a carcinogenic potential, and precautions are necessary to avoid inhaling chloroform vapor during surface treatment. As a result, chloroform has been replaced by methylene chloride. It has been suggested that the wetting of methylene chloride on the surface causes crazing as well as the formation of numerous pits up to 2 mm in diameter.^[7] In the present study also chloroform was not used to treat the specimens because of its carcinogenic property instead Methylene chloride was used.

Vallittu P K in 1994 investigated the transverse strength of the repaired test specimens of heat-cured acrylic resin after treating the specimens with methyl methacrylate for various amounts of time before the autopolymerizing acrylic resin was applied to the joint space. A three point loading test was used to determine the transverse strength of the test specimens. The results revealed that repaired test specimens were weaker than those unrepaired. The strength of the test specimens increased as the duration of methylmethacrylate wetting of the repair surface increased.^[8] Nagai E in 2001 have studied Transverse strength and modulus of elasticity of repaired acrylic denture base specimens and evaluated with a 3-point bending test in comparison to a heat-polymerized control group. Autopolymerizing acrylic resin was used with and without methylene chloride surface treatment. Specimens without methylene chloride surface treatment showed lowest strength value 53.2 MPa & lowest elastic modulus 2567.3 MPa.^[9]

Bural C in 2010 investigated flexural properties of heat-polymerised acrylic resin specimens repaired with two types of resins after the repair surfaces were wetted with heat, autopolymerizing monomers and acetone for 180 s. After repairs, specimens were subjected to three-point bending test and flexural strength, strain, fracture load, modulus of elasticity and deflection values were recorded. Within the wetting agents, heat cure monomer and auto polymerising monomer produced the best mechanical properties, while wetting with acetone did not provide superior effect over both monomers, they have concluded that in clinical use, wetting the repair surfaces may result in stronger repairs.^[10] Thus chemical surface treatment of the repairing surfaces of denture base material have been proved to increase the bond strength thereby improving modulus of elasticity and transverse strength.

Conclusion:

Within the limitations of the study the following conclusions can be drawn.

Modulus of Elasticity:

1. Modulus of elasticity of the specimens treated with methylene chloride showed significant values when compared to all others groups,
2. The remaining groups, acetone and monomer did not show much significant difference among themselves.

Transverse Strength:

1. The transverse strength of methylene chloride treated specimens showed highest values among all the tested groups.
 2. The transverse strength of monomer group when compared to the control group showed significant improvement. No much difference was shown by the acetone group when compared to the control group.
- Methylene chloride pretreatment of the specimens can be effectively used during repair process of the denture bases to improve the transverse strength as well as modulus of elasticity of the repaired denture bases.

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Effect Of Self-etch And Total- Etch Adhesive Systems On Streptococcus Mutans –an In Vitro Study

Abstract

Aims : To evaluate the antibacterial activity of three adhesive systems Xeno V, G Bond and Prime and Bond NT on Streptococcus Mutans An in vitro study

Materials and Methods : Adherence and Agar disk diffusion tests were performed. For adherence testing 60 human enamel specimens [6x5mm] were sterilized and adhesive systems were applied [N=15].The control group did not receive the application of any adhesive system. Specimens were immersed in brain heart infusion broth [BHI] inoculated with S Mutans. Standardized suspensions for 48hrs at 37o C and 5%CO2.The number of S Mutans cells adhered to each specimens were evaluated by the plating method on BHI agar. For agar disk diffusion testing adhesive disks and disk soaked in distilled water [negative control] or 0.2% chlorhexidine [positive control] were incubated with S Mutans for 48 hrs. The diameter of zones were measured. Data were submitted to ANOVA and Scheffe's post hoc test at the level of 0.05 level of significance.

Results : Adherence test showed that Xeno V, G Bond and Prime and Bond NT didn't show significant difference when compared to the control group. In disk diffusion Prime and Bond NT followed by Xeno V showed good inhibition zone when compared to G Bond.

Conclusion : when compared between them total etch adhesive agent Prime and Bond NT showed highest antibacterial efficacy followed by self etch adhesive agent Xeno V and G Bond.

Key Words

Antibacterial activity , total etch adhesive, self etch adhesives, streptococcus mutans.

Introduction

Recurrent dental caries has been associated with the deterioration of dental restorative materials. Breakdown in marginal areas between cavity preparation and restorative materials can provide potential for reinfection. Cariogenic micro-organisms can easily penetrate into the underlying dentine through these defects. Reducing or preferably preventing such marginal breakdowns is an important element in reducing the incidence of recurrent caries.^[1]

Dentin bonding agents were developed for the purpose of direct bonding of the hydrophobic composite resin materials to the hydrophilic dentin. It can be accomplished by means of etch and rinse or self etch adhesive system.^[2]

Settembrini et al reported that the strong acids of the total etch technique removed bacteria on the cavity walls. However with self etching primers, the demineralised smear layer which may contain bacteria is not removed and is incorporated into the hybrid layer. This

implies that residual bacteria are not washed away and thus cannot be eliminated. The dentin primer of these systems is the component that comes into contact and reacts with the dentin substrate at first stage of restoration in adhesive systems. Consequently when these systems are used antibacterial activity is considered to be an important factor.^[3]

To enhance antibacterial activity, first the incorporation of fluorides into the dentin bonding agents may be one way to inhibit bacterial growth. Furthermore monomer by themselves by a low pH or through the addition of special antibacterial groups, may produce antibacterial effect. The latter approach was followed by Imazao et al who developed a monomer 12-Methacryloxydodecylpyridiniumbromide [MDPB] that consistently demonstrated antibacterial effects.^[4]

Single step self-etch adhesives can be classified as mild [pH > 2], intermediate [pH=1.5] and strong [pH < 1] depending on their pH.5 Not only the antimicrobial agents but also other substances

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commonly found in the adhesive systems formulas such as adhesion promoting monomers that are acidic in different degrees might be able to exert some activity against bacterial growth.^[6]

Streptococcus mutans has been chosen as a representative oral bacterium as it has been counted among the early colonizing oral bacteria and has been identified as one of the major causative agents for the development of dental caries.^[7]

Limited study has been done to evaluate whether acetone/ethanol based single bottle self-etch adhesive agents inhibit Streptococcus mutans, when compare to fluoride containing Prime and Bond NT a total etch adhesive agent.

So the purpose of this study is to know the efficiency of single bottle self-etch adhesive agents namely Xeno V and G-Bond respectively depending on their pH in inhibiting Streptococcus mutans compared to Prime and Bond NT a total

etch adhesive agent incorporating fluoride as an antibacterial agent.

Materials and methods

The methodology of this study was divided into two parts adherence testing and agar disk diffusion tests.

Adherence test

Freshly extracted human molars were hand scaled ,cleaned with an aqueous slurry of pumice and stored in 0.85% NaCl at room temperature.60 enamel specimens were obtained from the proximal surface of crown portion measuring 6x 5mm using a diamond disc. Enamel specimens were coated with nail polish leaving a window of 4mm. Enamel specimens put into test tube containing 0.85% NaCl to prevent dehydration and sterilized in an autoclave at 1210C for 15 mins. Enamel specimens carried into laminated air flow chamber and divided into 4 groups. One control and three experimental groups.

In the prime and bond NT [PB NT] group specimens were etched with 37% phosphoric acid for 15 sec washed with sterile distilled water for 15 sec and dried with sterile absorbent paper. One coat of prime and bond NT was applied using microbrush tips and light cured for 10 sec using light curing unit.

For Xeno V and G bond[GB] one coat of adhesive agent applied with microbrush tip and light cured for 10 sec using light curing unit.

Each enamel specimens were placed in individual test tube containing 1.5ml of brain heart infusion broth and 0.1ml of Streptococcus mutans strain. Incubated at 370 C for 24 hrs at 5% CO2. After incubation enamel specimens were transferred into test tube containing 3ml of sterile saline solution and adhered bacterial cells dispersed. Intial suspension is diluted 1:10,1:100 & 1:1000 times in saline solution. 0.1ml of solution from each concentration is duplicated on brain heart infusion agar and incubated for 48hrs and number of colony forming units determined.

Agar disk diffusion method

Sterile filter paper disks of 8mm in diameter and 1mm in thickness [N=15] were impregnated with 10µl of each adhesive systems and placed on an agar plate inoculated with 0.1ml of S

Composition Of Materials Used

Prime and Bond NT Dentsply pH 1.2	UDMA, PENTA, Resin R5-62-1, T-Resin, Cetylamine hydrofluoride
Xeno V Dentsply pH 1.38	bifunctional acrylates, acrylic acid, acid phosphoric functionalised esters, acid acrylate water, tertiary butanol, phosphine oxide initiator, stabilisator.
G Bond GC pH 2	4-MET, phosphate ester monomer, UDMA, water, acetone, silica filler, Photoinitiator.

Table 1 - Agar Disc Diffusion Method Descriptive Method

	N	Mean	Std.Deviation	Minimum	Maximum
PBNT	15	5.3333	1.11270	4.00	7.00
XENO V	15	4.1333	1.35576	2.00	7.00
GB	15	2.3333	0.97590	0.00	4.00
CTR	15	7.0333	1.10948	5.00	8.50
Total	15	4.7083	2.05907	0.00	8.50

Table 2 - Anova

	Sum Of Squares	Df	Mean Square	F	Sig.
Between Groups	176.512	3	58.837	44.747	.000
Within Groups	73.633	56	1.315		
Total	250.146	59			

Table 3 - SCHEFFEaPOST HOC TEST

GROUPS	N	Subset for alpha = .05		
		1	2	3
PBNT	15		5.3333	
XENO V	15		4.1333	
GB	15	2.333		
CTR	15			7.0333
Sig.		1.000	.052	1.000

Table 4 - Adherence Test Descriptive Method

R	N	Mean	Std. Deviation	Minimum	Maximum
110					
PBNT	15	323124.6667	4898.18898	315000.0	330000.0
XENO V	15	351828.6000	6546.84783	337000.0	360000.0
GB	15	419518.6667	5295.42912	405000.0	426840.0
CTR	15	590794.6667	5713.56640	580000.0	600000.0
Total	60	421316.6500	104939.840	315000.0	600000.0
R					
1100					
PBNT	15	213272.0000	3441.15056	207000.0	217680.0
XENOV	15	235451.3333	5595.32313	226330.0	242330.0
GB	15	275598.7333	99247.7362	31110.00	316700.0
CTR	15	442735.3333	7985.67903	418640.0	450000.0
Total	60	291764.3500	102938.603	31110.00	450000.0
R					
11000					
PBNT	15	99417.3333	3748.58157	92640.00	107500.0
XENOV	15	106526.6667	6417.88424	100000.0	121000.0
GB	15	140466.6667	13032.1945	125000.0	168000.0
CTR	15	192600.0000	5590.80878	182000.0	200000.0
Total	60	134752.6667	37945.6699	92640.00	200000.0

Table 5 - Anova

	Sum of squares	df	Mean square	F	Sig.
R110	647944283416.050	3	215981427805.350	6773.769	.000
Between Groups	1785558351.600	56	31884970.564		
Within Groups	649729841767.650	59			
Total					
R1100	485786547382.050	3	161928849127.350	65.051	.000
Between Groups	139398467203.600	56	2489258342.921		
Within Groups	625185014585.650	59			
Total					
R11000	81363849413.333	3	27121283137.778	423.214	.000
Between Groups	3588708760.000	56	64084085.000		
Within Groups	84952558173.333	59			
Total					

Table 6 - R110 Scheffe

GROUPS	N	Subset for alpha = .05			
		1	2	3	4
PBNT	15	323124.67			
XENOV	15		351828.60		
GB	15			419518.67	
CTR	15				590794.66
SIG.		1.000	1.000	1.000	1.000

mutans.15 disks were soaked in sterile distilled water as negative control and 15 disks were soaked in 0.2% chlorhexidine as a positive control. The size of inhibition zone produced around the disks was measured after 48hrs of incubation using the formula size of inhibition zone in mm = [(diameter of halo -diameter of specimen) x ½

Adherence test and agar disk diffusion method were statistically analyzed with ANOVA and scheff's post hoc test.

Results

Agar disc diffusion method

The mean differed statistically significant between the positive control and all the other study groups. The CTR group [Control] had the highest mean of about 7.033 followed by PBNT and Xeno V which had mean value of 5.33 and 4.1333 respectively. GB group had the lowest mean value 2.333 (Table 1)

When compared between the groups the observed F value was found to be highly significant.[P<0.000] (Table 2)

Further Schffe's post hoc test indicates that group GB had least value, followed by Xeno V and PBNT. CTR group had the highest value. However, no significant difference was observed between Xeno V and PBNT group. (Table 3)

Table 7 - R1100 Scheffe

GROUPS	N	Subset for alpha = .05		
		1	2	3
PBNT	15	213272.00		
XENOV	15	235451.33		
GB	15		275598.73	
CTR	15			442735.33
SIG.		.688	.195	1.000

Table 8 - R11000 Scheffe

GROUPS	N	Subset for alpha = .05		
		1	2	3
PBNT	15	99417.3333		
XENOV	15	106526.67		
GB	15		140466.67	
CTR	15			192600.00
SIG.		.129	1.000	1.000

Adherence test

The statistical analysis of the adherence data showed that CTR [Control] group had the highest mean value followed by GB and Xeno V. PBNT had lowest mean value in all the three ratios of 1;10, 1;100 and 1;1000. (Table 4)

ANOVA indicates significant difference between groups in all the ratio 1;10, 1;100 and 1;1000. [P<0.000] (Table 5)

Further scheffe's post hoc test indicates that group PBNT, Xeno V had least value followed by GB. CTR group had the highest value. However no significant difference was observed between the groups. (Table 6,7,8) [P>0.05]

Discussion

Concerns have been expressed about residual bacteria in cavity preparations. Not only do residual bacteria reside in the dentinal tubules and can therefore be a source of infection to the pulp but bacteria are also present at the area of the contraction gap between tooth and composite resin. Brannstrom [1987] characterizes cavity infection by bacteria as being due to multiple sources^[1]. invasion from the tooth surfaces via marginal gaps between tooth and restorative material^[2]. bacteria present in the smear layer^[3]. bacteria present in the dentinal tubules^[4]. bacteria at the gap at the dentin enamel junction^[5]. microbes recontaminating the surface after cleaning. After cavity preparation assessments of residual caries and bacteria has in most cases been a subjective assessment. A number of different investigators have described

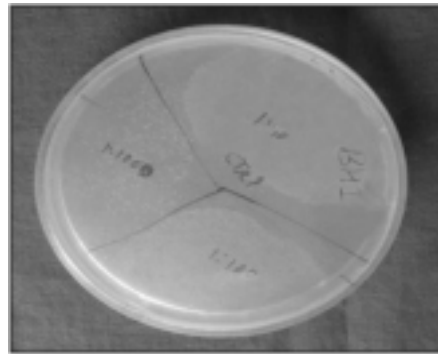


Fig 1 : Co1lony forming units formed [CFU/ml], 1. Control

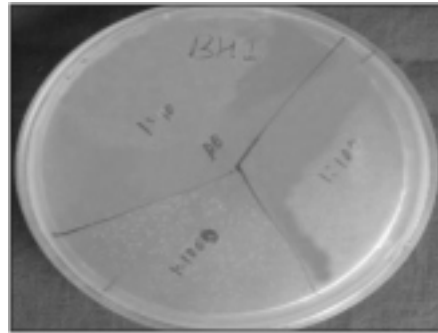


Fig 1 : Co1lony forming units formed [CFU/ml], 2. Prime And Bond Nt

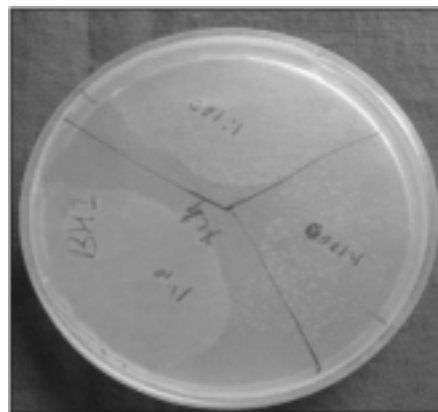


Fig 1 : Co1lony forming units formed [CFU/ml], 3. Xeno V

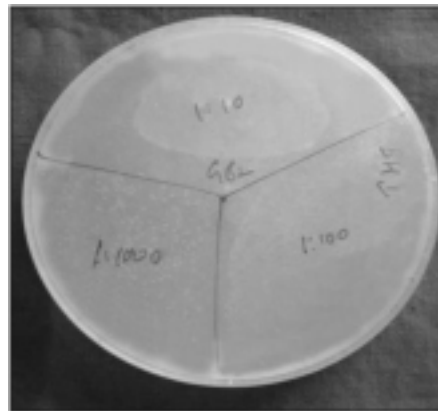


Fig 1 : Co1lony forming units formed [CFU/ml], 4. G Bond

procedure for the detection of carious dentin using dyes that assist visual detection^[8]. But it has been suggested that the use of disclosing dye doesn't completely eliminate the chances of bacteria remaining in a cavity and the

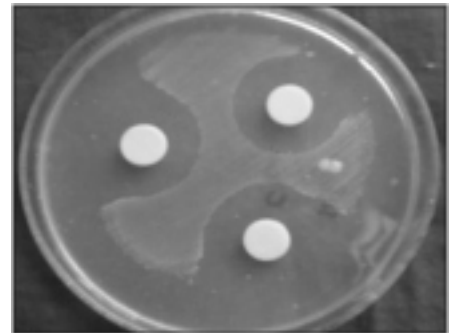


Fig 2 : Inhibition zone formed, 1 .0.2% chlorhexidine

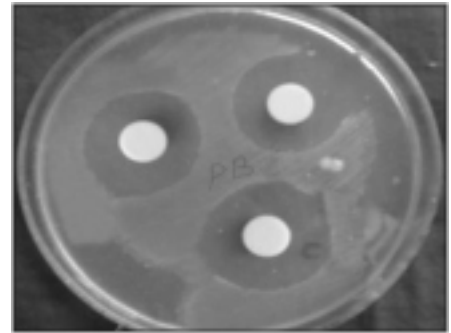


Fig 2 : Inhibition zone formed, 2. Prime and bond NT

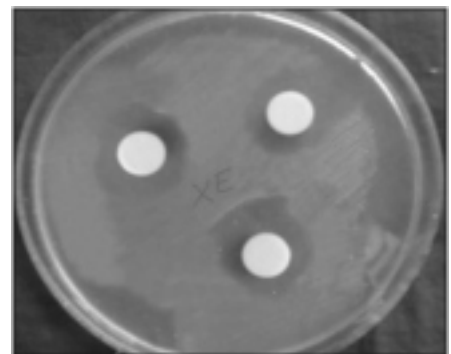


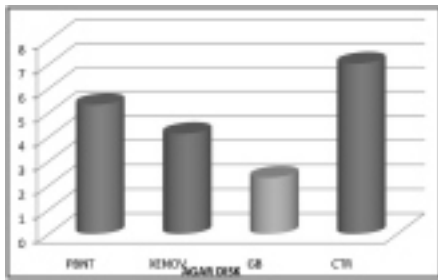
Fig 2 : Inhibition zone formed, 3. Xeno V



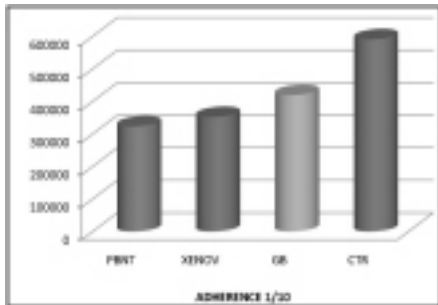
Fig 2 : Inhibition zone formed, 4. G Bond

accuracy of this material in reflecting the true bacterial condition has been questioned. Based on this evidence the need for a dentin adhesive with a potential antibacterial effect is of interest because it is in direct contact with the residual bacteria infected dentin in a prepared cavity.^[9]

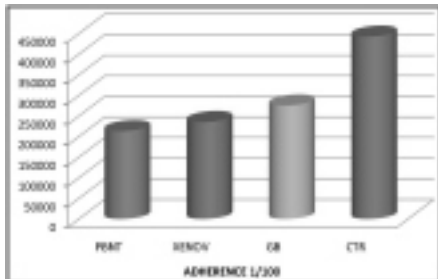
Settembrini et al found that many of the



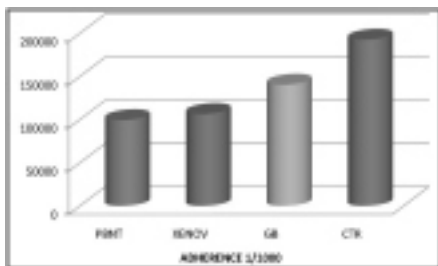
Graph Table 1 : Inhibition Zone (Mm)



Graph Table 2 : Number Of Bacterial Recovery (Cfu/MI)



Graph Table 3 : Number Of Bacterial Recovery (Cfu/MI)



Graph Table 4 : Number Of Bacterial Recovery (Cfu/MI)

commercially available acid etchants demonstrated antimicrobial activity against several bacteria commonly found in the oral cavity. So the lack of antibacterial activity of one bottle adhesives or the addition of antimicrobial agents to one bottle dentin adhesives might not be necessary in light of the antimicrobial activity of phosphoric acid etchants.

Self-etching adhesives have been introduced in an attempt to simplify the clinical application procedure and reduce the technique sensitivity and risk of the primed surface being contaminated. In self etching adhesive systems the pH of self etching primer solution is sufficiently low to demineralise the

smear layer and underlying dentin surfaces, so etching and priming of the cavity can be accomplished simultaneously. Therefore the separate acid etching step is omitted. Because of the non rinsing procedure residual bacteria may remain at the interface between the tooth and the restorative material.

The dentin primer is the compound that comes into contact and reacts with the dentin substrate at the first stage of restoration in an adhesive system. If tooth conditioners such as primer possess antibacterial activity these bacteria could be eliminated there by preventing the secondary caries. So the antibacterial activity of these adhesive systems primers which are directly applied to the dentin plays an important role in the restoration's longevity.^[10]

In the present study a comparison was made to check the antimicrobial efficacy of total etch adhesive agent Prime and Bond NT with self etch adhesive agents namely Xeno V and G Bond on streptococcus mutans.

Total etch with a 37% phosphoric acid etchant was used as that the etchant usually >30% phosphoric acid would exert a significant antibacterial effect on the microflora of the infected dentin.^[2] Even studies have shown that phosphoric acid etchant materials demonstrated antimicrobial activity against several bacteria commonly found in the oral cavity.^[8]

Previous studies have reported that the antibacterial effect of some adhesive system is due to their low pH.3. Based on this low pH of the primer namely Xeno V [pH 1.38] and G Bond [pH 2] was selected in the present study to check the antimicrobial efficacy.

Chlorhexidine is an antiseptic with a wide spectrum of action and its use has been generalized over the past two decades for the chemical control of bacterial plaque and disinfection of therapeutic cavities.^[9] Silva et al reported a significant decrease in the number of bacteria in the dentinal tubules after application 0.2% chlorhexidine for 5 mins. It is also effective in reducing the levels of streptococcus mutans found on exposed carious root surfaces. For this reason it is adapted as a positive control

for studies on bacterial growth or antibacterial activity.^[11]

In terms of adherence test the CTR [Control] group showed more adherence of micro-organisms followed by G Bond and Xeno V. The PBNT group showed less adherence, because it is a total etch adhesive agent and about 83% of microorganisms are eliminated by acid etching.^[2] Moreover its pH is about 1.2 and incorporation of antibacterial agent fluoride into the primer also inhibit the growth of microorganisms. But in Xeno V and G Bond their pH is about 1.38 and 2 respectively, the acidic nature of the primer [acrylic acid, 4-Methacryloxy ethyltrimellitic acid] itself acts as an antibacterial agent. But when compared with the adhesive agent incorporating fluoride as an antibacterial agent, the acidic nature of these bonding agents antibacterial property in inhibiting streptococcus mutans is less. But statistically the difference between the groups is insignificant. This is because even though total etch technique is capable of complete removal of microorganisms –contaminated smear layer with phosphoric acid, it is a multistep procedure and there is a chance of cross contamination. So self etching adhesives belong to the new generation of bonding agents that modify and incorporate the bacteria containing smear layer into their mechanism^[11] was used to compare with total etch adhesive agent. In addition to adherence testing agar disk diffusion testing was included. The agar diffusion method is generally used to investigate the antibacterial activity of materials from which an antibacterial component leaches out and the activity is determined based on the size of the inhibition zones.^[6]

In this method 0.2% Chlorhexidine showed highest inhibition zone which is used as positive control followed by PBNT and Xeno V. G BOND showed the least inhibition zone. The statistical result showed that PBNT and Xeno V is significant when compared to other groups. The reason for PBNT showing good inhibition zone is due to the fluoride content and its low pH [1.2] and Xeno V is due to its low pH 1.38. But the drawback of this method is, it did not differentiate between bactericidal and bacteriostatic activity and finally the method is at best semi quantitative.^[2]

Thus within the parameter of this invitro study adhesive agent incorporating fluoride or the low pH of the monomer itself ,even 37% of phosphoric acid etchant in etch and rinse technique can reduce the occurrence of secondary caries.

Conclusion

Within the limitations of this invitro study the following conclusions can be drawn

Total etch adhesive agent Prime and Bond NT and self etch adhesive agent Xeno V showed better antibacterial activity against streptococcus mutans.

When compared between them total etch adhesive agent Prime and Bond NT showed highest antibacterial efficacy followed by self etch adhesive agent Xeno V with pH 1.38 and G Bond with pH 2 which showed less antibacterial efficacy.

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The Evaluation Of Gutta-Percha And Guttaflow In The Filling Of Lateral Grooves And Depressions

Abstract

Aims : The purpose of this study was to compare the flow of GuttaFlow (Coltne/Whaledent Inc, Cuyahoga Falls, OH) and gutta-percha into lateral grooves and depressions in the apical 7 mm of the root canal system.

Materials and method: A maxillary canine was used to fabricate a split-tooth model with depressions and lateral grooves placed in the canal walls at 3 mm, 5 mm, and 7 mm from the working length. The model was obturated with GuttaFlow or gutta-percha and Rothi[®] s 801 sealer (Roth International, Chicago, IL). Obturations with gutta-percha were performed by using warm vertical compaction with the System B plugger (Analytic Endodontics, Orange, CA) advanced to 5 mm or 3 mm from the working length.

Statistical Analysis: was performed by using the Friedman test to evaluate for differences between the four treatment groups. Where appropriate, the Wilcoxon signed-rank test was used to make comparisons between two treatment groups and within each treatment group. The significance level was set at 5% ($p \leq 0.05$).

Results & Conclusion : GuttaFlow completely obturated the grooves and depressions at all levels from the working length. Guttaflow flows significantly better in the apical 3 mm of a split-tooth model than gutta-percha placed using a warm vertical technique.

Key Words

Accessory canals; continuous wave of vertical condensation; GuttaFlow;lateral canals; thermoplasticized gutta-percha

Introduction

The three phases of root canal treatment comprise of chemo-mechanical preparation, disinfection and obturation of root canal space^[1]. A primary objective of root canal therapy is complete obturation of the root canal space with the aim of sealing as much of the cleaned and shaped root canal system as possible^[2,3]. The difficulty in adequately obturating the root canal system is ascribed to its anatomical complexity and peculiar morphological configuration, which includes multiple foramina, apical deltas, accessory and lateral root canals. Since these components may constitute a pathway for passage of bacteria and products of tissue degradation between the root canal space and the surrounding periodontal system consists of an essential approach to yield the healing of periapical tissues^[4].

Gutta-percha has been used in dentistry for over 150 years^[4] and has become the most commonly used obturation material^[5]. Traditionally, gutta-percha has been placed and compacted with a cold lateral technique^[6]. In 1967,

Schilder^[3] described warm vertical compaction as an alternative to cold lateral condensation with the idea that compaction of thermoplasticized gutta-percha would permit full adaptation of the gutta-percha to the anatomic complexities of the root canal. Numerous modifications have been introduced for vertical compaction of gutta-percha^[7] and backfilling with thermoplasticized, injectable gutta-percha^[8]. More complete obturation of the main root canal and accessory canals and foramina may have a significant impact on the overall success rate of endodontic treatment^[3].

Guttaflow was developed by Coltène Whaledent using modern expertise in silicone polymer technology. It is a cold, fluid obturation system that combines sealer and gutta-percha in a single material. It consists of a polydimethyl siloxane matrix which is highly filled with very finely ground gutta-percha and nano silver. The sealer part of Guttaflow is highly thixotropic, and with its fine grain size ($<9 \mu\text{m}$), the material flows well under slight pressure into the finest

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lateral canals.

The purpose of our study is to evaluate the movement of gutta-percha and Guttaflow into lateral grooves and depressions in the apical 7 mm of a split tooth model using gutta-percha as an apical plug.

Materials And Method

This study was conducted in the Department of Conservative Dentistry and Endodontics in S.G.T. Dental College. An extracted human maxillary canine with single, straight canal was used to create a split tooth model. The crown was removed and working length was established 1 mm from the anatomic apex. Pre-flaring of the coronal third was done using #3 and #4 gates glidden drills. The apex was prepared to a .04 taper size #40 at the working length. The tooth was then embedded in acrylic resin and four holes were placed in the acrylic model in the buccal lingual direction, two on the

mesial and two on the distal surface. The tooth was then separated into buccal and lingual halves through the centre of the canal using a microtome. Lateral canals were placed on the buccal half of the model at 3, 5, 7mm from working length using a diamond disc. Depressions were made at the same levels using a half round bur. The two halves were re-approximated using four bolts that fit tightly into the predrilled holes. A 2mm apical plug with 0.04 % gutta-percha was created. The model was kept at 37S04;C at all times between obturations. Three experimental groups were included as follows:

Group I = GuttaFlow (GF)

Group II = System B plugger inserted to 5 mm from working length (Gp5)

Group III = System B plugger inserted to 3mm from working length (Gp3).

The model was irrigated with 15% EDTA and 5.25% NaOCl followed by final rinse with isopropyl alcohol. The canal was dried with paper points. Ten obturations were performed for each group.

Guttaflow plastic tip was inserted into the canal to a depth at which the tip no longer advanced. GuttaFlow capsule was activated for 30 seconds and the material was dispensed until it could be seen moving out of the canal around the tip. All obturations with gutta-percha were performed using system B continuous wave condensation with gutta-percha cones and sealer. Backfilling was performed with Obtura II set at 200S04;C. After each obturation the model was separated into its facial and lingual halves. The halves were viewed and photographed at X10 magnification. (Fig. 1)

Evaluation of obturation of lateral grooves and depressions at 3mm and 5mm was scored as follows:

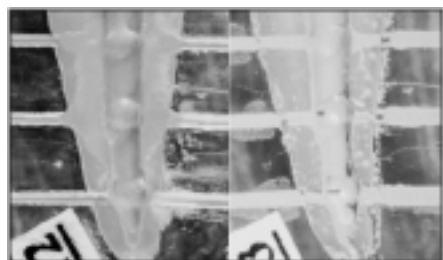


Fig 1.: Gutta Flow

0= no gutta-percha or Guttaflow in grooves and depressions.

1= presence of gutta-percha or Guttaflow in grooves and depressions.

Statistics

Statistical analysis was performed by using Friedman's test to evaluate for differences between 3 treatment groups. Where appropriate, Wilcoxon signed rank test was used to make comparisons between two treatment groups and within each group.

Results

Results of the study showed that Guttaflow flowed into all depressions and lateral grooves in the apical 5 mm of the split-tooth model. In the apical 3 mm of the model, the material was significantly better than gutta-percha in obturating lateral grooves and depressions regardless of the depth of insertion of the System B plugger. Better flow of material was seen at the 3-mm level for Guttaflow than gutta-percha when the System B plugger penetrated to 5 mm from the working length. (Table 1 and 2) Guttaflow resulted in no extrusion of material beyond the apex in 100% of obturations. However according to the study conducted by TM Zielinski et al^[11] Guttaflow resulted in extrusion of material as no apical barrier was used. Intergroup comparison at different groove levels showed that GuttaFlow had significantly better flow than guttapercha into grooves at 3mm level when the when the plugger was inserted to 5mm from the WL.

TABLE 1 : Number of Specimens with Flow of GuttaFlow or Gutta-Percha into Each Depression at the Various Levels from the WL

Depression Level from WL	Depression Level from WL	
	5mm	3mm
GF	15/15	15/15¥
GP5	15/15	10/15
Gp3	15/15	15/15¥

GF, GuttaFlow; GP5 and GP3, guttapercha with obtura heat plugger penetration to 5mm and 3mm from the WL, respectively. ¥GF and GP3 had significantly better flow than GP5 at 3 mm from WL.

TABLE 2 : Number of Specimens with Flow of GuttaFlow or Gutta-Percha into Each Depression at the Various Levels from the WL

Depression Level from WL	Depression Level from WL	
	5mm	3mm
GF	15/15	15/15¥
GP5	15/15	1/15
Gp3	15/15	15/15¥

GF, GuttaFlow; GP5 and GP3, guttapercha with obtura heat plugger penetration to 5mm and 3mm from the WL, respectively. ¥GF and GP3 had significantly better flow than GP5 at 3 mm from WL.

Discussion

The purpose of this ex vivo study was to compare the flow of GuttaFlow and gutta-percha into depressions and lateral grooves in the apical half of a split-tooth model. The use of the same split-tooth model for all obturations and monitoring of material placement and compaction forces ensured standardization of each obturation among the four experimental groups. Clinical conditions of temperature and humidity were maintained throughout the experiment.

GuttaFlow flowed into all depressions and lateral grooves in the apical 5 mm of the split-tooth mode, coronal to the apical plug. Better flow of material was seen at the 3-mm level for GuttaFlow than gutta-percha when the System B plugger penetrated to 5 mm from the WL.

The tendency for GuttaFlow to extrude beyond the apex raises concerns regarding cytotoxicity. All sealers are initially cytotoxic^{[9],[10],[11],[12]}, with little cytotoxicity noted after 24 hours^[13]. A study performed by Bouillaguet et al.^[14] found that set GuttaFlow was significantly less cytotoxic than set AH Plus (Dentsply/Maillefer, Konstanz, Germany), Epiphany sealer (Pentron Clinical Technologies, LLC, Wallingford, CT), and Resilon (Pentron Clinical Technologies) at 24 hours and 48 hours. Hence, an apical plug of 2mm was created with guttapercha.

Studies evaluating the sealability of GuttaFlow have shown conflicting results. Using a bacterial leakage model, Monticelli et al.^[15] showed that teeth obturated with GuttaFlow had an inferior seal against bacterial leakage compared with teeth obturated with gutta-percha and AH Plus by using a warm vertical technique. In contrast, Brackett et al.^[16] found no significant difference in sealing ability between GuttaFlow and vertically compacted, thermoplasticized gutta-percha and AH Plus sealer when using a fluid filtration technique. The variability in results may be attributed to differences in the methods of leakage assessment.

The manufacturer claims that GuttaFlow achieves a final set within 25 minutes to 30 minutes after trituration of the GuttaFlow capsule regardless of temperature or humidity^[17]. Based on data obtained during a pilot study, it was found

that the material did not set in either the split-tooth model or on the bench top after 30 minutes or 40 minutes and inconsistently set after 45 minutes. Because the material was only found to set consistently after 50 minutes, the split-tooth model was kept in the incubator for 50 minutes after each obturation to ensure complete set of the GuttaFlow.

The split-tooth model was irrigated with isopropyl alcohol before obturation with GuttaFlow as the manufacturer suggests because of the fact that residual chemicals within the canal system may impede setting of the material^[17]. In a pilot study, GuttaFlow failed to set after more than 1 hour in the incubator in cases in which the model was irrigated with NaOCl as the final rinse.

The insufficient softening of the gutta-percha by heat could be responsible for low gutta-percha adaptation and flow in the lateral grooves as compared to Gutta Flow. A low percentage of gutta-percha polymer could result in reduced plasticity and a decreased flow rate of the filling material.

It is important to highlight that this study utilized teeth with straight roots and single canals, whereas most posterior teeth have a more complex anatomic configuration with a number of isthmus, curvatures and foramina. Even so, we expect that the findings of this study may widen the scopes, on the filling of lateral canals and prompt the development of further researches.^[4] Subsequent studies could further develop the existing model to include depressions and grooves of varying sizes as well as different master apical file sizes and tapers and varying canal curvatures.^[5]

According to various studies conducted maximum number of lateral canals are in the apical third of the roots. In this study we made an apical plug of 2mm with gutta-percha. This may have resulted in non sealing of lateral canals in apical 2 mm of the root.

Conclusion

Within the limitations of this in-vitro study it can be concluded that Guttaflow

flows significantly better in the apical 3 mm of a split-tooth model than gutta-percha placed using a warm vertical technique.

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A Comparative Analysis Of Sagittal Condylar Guidance Determined By Two Articulator Systems And Orthopantomographs(OPG) In Completely Edentulous Patients.

Abstract

Purpose: The purpose of this study is to analyse the discrepancy between condylar guidance values obtained on these two articulators using protrusive Records and the condylar guidance values on Orthopantomographs(OPG).

Materials and Methods: 20 edentulous patients, free of signs and symptoms of Tmj disorder and 40-60years aged edentulous patients of with class-1 jaw relation were selected. The primary and final impression of the edentulous ridges were taken. The dental stone casts of the final impression were poured. The stone casts were mounted on Hanau H2 articulator and Hanau Wide Vue articulator after facebow transfer of maxillary occlusal rims on both articulators. Centric relation mounting was done. Extra-oral tracing was done to verify the centric relation and arrow point tracing was obtained. For all patients, the protrusive records were obtained, when the mandible forward by approximately 6mm. The condylar guidance values obtained were tabulated. The Orthopantomograph (OPG) was taken. The line was marked by joining orbitale and porion. The point present most superior and most inferior of the curvatures were identified. These two lines were connected representing the mean curvature line. The tabulated data were subjected to statistical analysis, ANOVA for group comparison, Tukey's HSD test for inter-comparison, student's unpaired 't' test for intragroup comparison, and level of significance(P) was calculated using the same.

Results: The mean sagittal condylar values of the three different groups were found to be highly significant on the right($P < 0.0001$) and left side($P < 0.0001$) respectively. There was a very highly significant difference between the Hanau Wide Vue($P < 0.0001$) and Hanau H2($P < 0.0001$) on the right and left side respectively. No significant difference found between the Hanau Wide Vue Articulator and Orthopantomograph(OPG)[$P = 0.207$ right, $P = 0.572$ left] and statistically high significant difference was found between Hanau H2 and orthopantomograph (OPG) group [$P < 0.0001$ right and left side]. On intragroup comparison there was no statistically significant difference in sagittal condylar values on the right and left sides.

Conclusion: The mean difference in the sagittal condylar guidance values obtained from Hanau Wide Vue and Hanau H2 articulators shows a low level of reproducibility, and no significant difference found in mean sagittal condylar values obtained from Hanau Wide Vue Articulator and orthopantomograph(OPG) tracings indicates replication of sagittal condylar guidance values from image of articular eminence.

Key Words

sagittal condylar inclination, completely edentulous, condylar guidance, Hanau H2 articulators, Hanau Wide Vue articulators, interocclusal records orthopantomograph(OPG).

Introduction

The main aim of Prosthodontic rehabilitation is to make a prosthesis, which is in harmony with the patient's stomatognathic system. The inclination of the condylar path is the most important consideration in the oral rehabilitation. Condylar path is the path traversed by the condyle in relation to the articular eminence when the mandible is moved either protrusively or laterally from centric relation.^[1] The condylar guidance is very important in edentulous patients. If not recorded accurately, it will lead to occlusal interference during mandibular movements.^[2] The condylar guidance is

basically defined as the mandibular guidance generated by the condyle and articular disk traversing the contour of the glenoid fossae.^[3]

The condylar guidance in semiadjustable articulators is set either by individual protrusive or lateral interocclusal registrations^{[4],[5],[6]}. The purpose of the protrusive jaw relation is to set the condylar elements of the articulator so they will reproduce inclinations, which are exact or nearer to the patients temporomandibular articulation^[7]. The various methods used to record condylar guidance clinically are either extra-oral

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or intra- oral methods. Centric and eccentric relations can be recorded through intraoral or positional wax method, graphic recordings, functional recordings^[8]. Gysi and McCollum generally gave the example of extra oral methods which mainly used in edentulous patients^[9].

Several studies have shown the unreliability of recording and reproducing condylar guidance using these methods^{[10],[11]}. Studies have shown that average interocclusal registration values of the condylar guidance inclination vary from 21-64degrees^[12]. Condylar guidance can also be recorded with radiographs, lateral cephalometrics, pantomograph, tomography, digital CT scans^{[13],[14],[15]} and electronic axiography^[16]. There are various articulator systems which vary in reproducing sagittal condylar guidance angulations. Studies for recording condylar inclination on various articulator systems in edentulous patients are very scarce. In this study two articulators have been used; one is Arcon(Hanau™ Wide-Vue 182-3 Articulator, Whip Mix Corporation, USA) and

another is Non-Arcon(Hanau™ H2 145 Articulator, Whip Mix Corporation, USA.) The purpose of this study to analyse the discrepancy between condylar guidance values obtained on these two articulators using protrusive records and the condylar guidance value on Orthopantomographs(OPG).

Materials And Methods

Patients

Before starting the study, ethical clearance was obtained from the institutional ethical board.

All subjects included in this study were screened through a detailed case history and were well informed regarding the study design. Written consent form from each of the subjects was obtained. A total of 20 completely edentulous subjects of either sex were selected for this study. Inclusion criteria for the subjects was patients in the age group of 40-55yrs, patients who had been completely edentulous only within the past 3 years, patients with good or fair condition of residual alveolar ridges and patients with class-1 jaw relation. Exclusion criteria was patients with Temporomandibular disorders, poor or resorbed ridges, poor general health and lack of adequate neuromuscular control of jaw movements

Clinical Methods

One set of upper and lower edentulous preliminary compound (Y-Dents® Impression Compound, MDM Corporation, Delhi, India) impressions were made for each subject and were poured in dental plaster (Kaldent, kalabhai Karson Pvt. Ltd, Mumbai India) following the manufacturer's instructions and guidelines, giving a set of mandibular and maxillary cast for each individual. On the preliminary cast thus obtained, Autopolymerizing acrylic resin(DPI, Dental products of India; The Bombay Burmah Trading Corporation Ltd,India) special trays were fabricated. Final zinc oxide eugenol(DPI,Dental products of India; Impression paste,The Bombay Burmah Trading Corporation Ltd,India) impressions were made for each subject and were poured in Type-III dental stone (Gold Stone, kalabhai Karson Pvt. Ltd, Mumbai India) following the manufacturer's instructions and guidelines. The master casts obtained were duplicated with agar material(Sindhu Ultramarine Chemicals

pvt. Ltd,India). Heat cured Permanent denture bases(DPI, Dental products of India; The Bombay Burmah Trading Corporation Ltd,India) and wax record rims (Y-Dents®no.2, Modelling wax,MDM Corporation,Delhi,India) were fabricated on the original master casts as well as the duplicated master casts. Thus two sets of record blocks were obtained for recording maxillomandibular relations on each of the two articulators.

In this study two semiadjustable articulators were used Hanau Wide Vue and Hanau H2 Articulator [Figure 1a & b]. Facebow registrations for both the Semiadjustable articulators(H2 And Wide Vue) were accomplished using the standard technique as per the manufacturer's instructions, with Axis Orbitale as a reference plane and orbitale as an anterior point of reference. Zeroing of both articulators was done(700 Sagittal and 0° Lateral condylar inclinations for H2; 30° Sagittal 30° Lateral condylar inclinations for Hanau Wide Vue). The facebow system used for H2 articulator was (The Hanau™ Earpiece Facebow ,Whip Mix Corporation, USA) and for Wide vue was(Hanau™ Springbow, Whip Mix Corporation, USA).

After the facebow transfer on both the articulators, maxillary casts were secured with plaster(Kaldent,kalabhai Karson Pvt. Ltd, Mumbai India)and mounted on the respective articulators. For each patient, for each articulator system, a centric jaw relation was recorded, and mandibular casts were mounted on the two articulators. A set of Hight extraoral tracers were attached to each set of record rims on both the articulators. The patient was trained to give a set of Gothic arch tracing on both sets of tracers. Intraoral centric and protrusive records (6mm from centric) were made with plaster(Kaldent,kalabhai Karson Pvt. Ltd, Mumbai, India) [Figure 2]for each patient for both the articulators.

The lower cast was remounted on each articulator for each patient according to the new centric relation record obtained from the tracing. The tracing plates were detached from the occlusal rims, keeping the central bearing plates with the intervening protrusive interocclusal record in place.

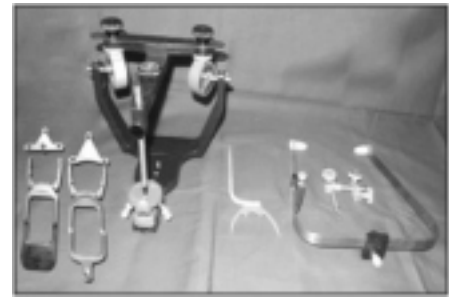


Figure 1(a) : Armamentarium for Hanau Wide Vue system

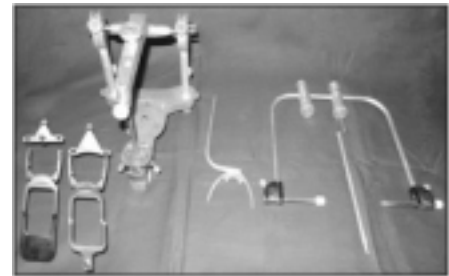


Figure 1(b) : Armamentarium for Hanau H2 system



Figure 2 :Centric and Protrusive Interocclusal records.

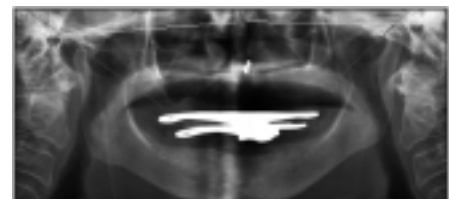


Figure:3 : OPG(Orthopantomograph) tracing showing angle of the sagittal condylar guidance.

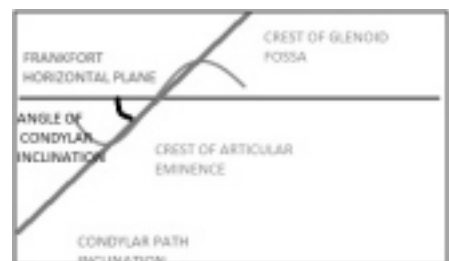


Figure:4 : Line diagram of the OPG (Orthopantomograph) tracing of the angle of sagittal condylar guidance

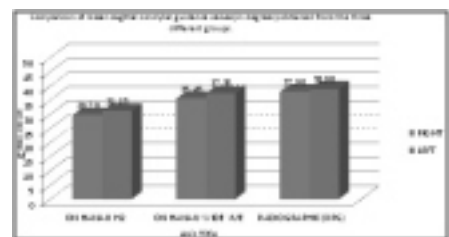


Figure:5 : Comparison of mean sagittal condylar guidance values(in degrees) obtained from the three different groups.

The two protrusive records were used to program each of the articulators respectively. Each of the protrusive interocclusal record was occluded between the respective recordings bases on each of the articulators, and then condylar locks of the articulators were rotated. For both articulators, the condylar balls on the articulator were raised or lowered, until the maxillary occlusal rim settled into stable position in protrusive relation. Condylar elements of the articulators were adjusted to get protrusive relation and with this we set horizontal condylar inclinations on both sides of both the articulators (Hanau Wide Vue and Hanau H2). The right and left sagittal condylar guidance values on both articulators were tabulated. The entire procedure was carried out by the same operator for all patients on both the articulators.

Radiographic Methods

An Orthopantomograph (OPG) of the jaws with the rims and protrusive interocclusal record insitu to hold the mandible in protruded position was made for each patient. The images of the OPG were printed. The sagittal outlines of the left and right articular eminence and glenoid fossae were traced on a transparent acetate tracing sheet by the examiner. The left and right "orbitale" (lowest point in the margin of the orbit) and "porion" (highest point in the margin of the auditory meatus) were identified and the Frankfort horizontal plane was constructed by joining the two landmarks on each side. The most superior point on the articular eminence and the most inferior point on the articular tubercle were identified and a second line to represent the mean condylar path inclination was constructed by joining the two points. The angle formed by the intersection of the two lines was determined to represent the angle of sagittal condylar inclination. [Figure 3][Figure 4] This was determined by the examiner and the average was taken as the true value.

The data recordings comprised of three values for each of the 20 patients: the sagittal condylar inclinations obtained by programming the Hanau H2 and Hanau Wide Vue articulator, and the sagittal condylar inclination obtained from the OPG. The data thus obtained was tabulated and subjected to ANOVA test for group comparison. For multiple

comparison Tukey HSD Test was done. The statistical analysis was done using SPSS (Statistical Package for the Social Sciences, IBM Software Group, USA) Version 17.0 software program. The results obtained were considered highly significant when $P < 0.01$, significant when $P < 0.05$, and were considered non-significant if the P value was more than 0.05.

Results

Table 1 and 2 show the mean and standard deviation of the sagittal condylar guidance values on right and left side respectively for 20 subjects (N), obtained by Hanau H2, Hanau Wide Vue, and Orthopantomograph (OPG) tracings. The mean sagittal condylar guidance values for Hanau H2, Hanau Wide Vue and Orthopantomograph (OPG) tracings were 29.70 ± 4.868 degrees, 35.45 ± 4.696 degrees, 37.90 ± 3.892 degrees on the right side and 31.15 ± 4.043 degrees, 37.35 ± 5.174 degrees, 38.90 ± 5.220 degrees on the left side. [Figure 5]

Table 3 and 4 show the mean difference in sagittal condylar guidance values on the right side and left side respectively. The mean difference in sagittal condylar guidance value between Hanau H2 and Hanau Wide Vue articulators was found to be highly significant ($P < 0.0001$) on the right side and left side ($P < 0.0001$). The mean difference in sagittal condylar guidance values between Hanau H2 and Orthopantomograph tracing was found to be statistically highly significant with on right ($P < 0.0001$) and left side ($P < 0.0001$) respectively. A non significant difference in mean sagittal condylar guidance values was found between Hanau Wide Vue and Orthopantomograph on right side ($P = 0.207$) and on left side respectively ($P = 0.572$)

Table 5 shows intra-group comparison of sagittal condylar guidance values obtained from three different groups. Mean sagittal condylar guidance values obtained from Hanau H2 and Hanau Wide Vue on the right and left sides were statistically non significant with ($P = 0.312$) and ($P = 0.231$) respectively.

Discussion

During any Prosthodontic rehabilitation, it is very important to restore the patients'

Table 1: Mean sagittal condylar guidance values of the three different groups on the right side (in degrees)

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Hanau H2	20	29.7	4.868	1.088	22	41
Hanau Wide Vue	20	35.45	4.696	1.05	25	42
Radiographic(OPG)	20	37.9	3.892	0.87	25	45
Total	60	34.35	5.623	0.726	26	45

F=17.458 P=< 0.0001 (highly significant)

Table 2: Mean sagittal condylar guidance values of the three different groups on the left side (in degrees)

Group	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Hanau H2	20	31.15	4.043	0.904	26	41
Hanau Wide Vue	20	37.35	5.174	1.157	27	45
Radiographic(OPG)	20	38.9	5.22	1.167	29	46
Total	60	35.8	5.836	0.73	26	46

F=14.341 P=<0.0001 (highly significant)

Table 3: Intercomparison of mean sagittal condylar guidance values of the three different groups on right side (in degrees)

Tukey HSD test (Right)	(I) Parameter	(J) Parameter	Mean Difference (I-J)	P Value
	Hanau H2	Hanau Wide Vue	-5.75	<0.0001hs
	Hanau H2	Radiographic(OPG)	-8.2	<0.0001hs
	Hanau Wide Vue	Radiographic(OPG)	-2.45	0.207ns

Table 4: Intercomparison of mean sagittal condylar guidance values of the three different groups on the left side (in degrees)

Tukey HSD test (Right)	(I) Parameter	(J) Parameter	Mean Difference (I-J)	P Value
	Hanau H2	Hanau Wide Vue	-6.2	<0.0001hs
	Hanau H2	Radiographic(OPG)	-7.75	<0.0001hs
	Hanau Wide Vue	Radiographic(OPG)	-1.55	0.572ns

hs (highly significant), ns (non-significant)

Table 5: Intragroup comparison of sagittal condylar guidance values of the three different groups on the right and left sides (in degrees)

Group	Side	N	Mean	Std. deviation	P
Student's					
Unpaired t-test					
Hanau H2	Right	20	29.7	4.868	0.312ns
	Left	20	31.15	4.043	
Hanau Wide Vue	Right	20	35.45	4.692	0.231ns
	Left	20	37.35	5.174	
Radiographic(OPG)	Right	20	37.9	3.892	0.496ns
	Left	20	38.9	5.22	

ns (non-significant)

occlusion so that it coincides with the centric relation. The condylar guidance is the angle at which the condyle moves away from a horizontal reference plane from centric relation along the articular eminence of mandibular fossa. The range of horizontal condylar guidance values were 30-35 for the Hanau H2 (nonarcon)

and 25-45 for the Hanau Wide Vue(arcon) articulator;these values are in accordance with Payne^[17].

The Semiadjustable articulators used were Hanau H2(Non Arcon) and Hanau Wide Vue(Arcon) with their facebows.Orbitale was used as Anterior point of reference in both the articulators for orientation of maxillary cast which gives three –plane position of maxillary cast on both the semiadjustable articulators.^[18] After the maxillary casts were mounted centric relation records were used to mount the mandibular cast. Hight extra-oral tracer were attached to the record rims. After gothic arch tracings, centric and protrusive records were made. Protrusive records were obtained at a 6mm distance from centric relation in the tracing. According to one author horizontal condylar guidance changes with amount of protrusion, so it was important to keep the distance of protrusion same.^[19] Posselt et al^[20] also reported that correlation exists between degree of protrusion that can influence the setting of condylar readings. In the present study the amount of protrusion was same as the same protrusive records used for both the articulators.^[21]

The panoramic radiographic image (orthopantomograph) was selected to obtain individual sagittal condylar guidance value which was considered as a standard for comparison with the two articulator groups. The panoramic radiographic image of the sagittal outline of the articular eminence and glenoid fossa was clearly identified in 20 subjects. When viewing the region of the temporal bone on OPG two radiopaque lines are apparent, the lighter and superior one depicting the the articular eminence and fossa; and the heavier, more inferior one representing the inferior border of zygomatic arch.

A difference in the sagittal condylar guidance values was noted between both the articulators. The mean sagittal condylar guidance values for the Hanau H2 (Non-Arcon) on the right side was 29.70±4.868 and on the left side was 31.15±4.043 degrees. The mean value for Hanau Wide Vue(Arcon) on the right side was 35.45±4.696 and on the left side was 37.35±5.174 degrees [Table 5]. These values are not statistically not significant but clinically condylar guidance values on the right side were slightly less than

the left side in both the articulators.

These results are similar to those obtained in studies done by Arthur^[22] and Gheriani and Winstanley^[23]. This may be due to the anatomy of the condyle and glenoid fossa which dictate the condylar guidance, as it is determined by the distal slope of the Articular eminence. Steeper the curvature of the condyle, greater will be the condylar guidance, and vice-versa. In spite of a normal anatomy, the guidance may not be accordingly steep, as the condylar guidance is also affected by the ligament, muscle and soft tissues of the temporomandibular joints. The masticatory habits of the individual chewing pattern may also be responsible,as most subjects favour their right side for chewing which consequently leads to greater wear of the right condyle as compare to the left.

While comparison was made between the Hanau H2 articulator and Hanau Wide Vue Articulator in the present study, the mean difference for sagittal condylar values was 5.750 and 6.200 on right and left sides respectively, and this difference was highly significant for both right and left sides respectively. According to Shillinberg et al^[24] and Rosenstiel et al^[25] with the non-arcon design condylar inclination of the mechanical fossae changes in relation to the maxillary occlusion plane as the articulator is open and can lead to errors when a protrusive record of certain thickness is being used in program the articulator. They reported that with a 3 to 5 mm thickness of interocclusal record there would be a difference of 8o between where the articulator settings are adjusted and closed position where the articulator is used. Thus the average thickness of centric and protrusive interocclusal record must be within the range of 3-5 mm depending on the type of interocclusal record material, While comparing sagittal condylar guidance values obtained from Hanau Wide Vue and OPG readings, a mean difference of 2.45o and 1.55owas found on the right and left side respectively, which was statistically non significant [Table 3 and Table 4]. According to one study of the condylar movements, it was confirmed that in protrusion,the condylar head follows closely the anatomical form of the articular eminence and represents a very high correlation coefficient and level of significance^[26]. According to

Isberg at al^[27], a high degree of correlation exists between the protrusive condylar path and the steepness of articular eminence, which may be attributed to the active role played by the soft tissues during condylar movements. Stallard and Stuart^[28] propose that the muscles operating the mandible hold the condyles against the eminence throughout all condylar movements and these movements are guided by ligaments.Gilboa et al, reported a high degree of correlation between articular morphology and panoramic images and suggested that the inclination of the articular eminence in a panoramic image may be of value in setting the condylar guidance in semiadjustable articulators, which supports the present study.The correlation between mean sagittal readings of the Hanau Wide Vue articulator and radiographic(OPG) readings could be possibly due to the antomic representation of the articulator design in close approximation with the human temporomandibular joints.

Conclusion

From the results obtained from the study it may be concluded that the mean difference in sagittal condylar guidance values obtained from Hanau H2 and Hanau Wide Vue articulators

were highly significant indicating a low level of reproducibility. On the other hand the mean difference in sagittal condylar guidance values obtained from H2 articulator and OPG tracings was statistically highly significant whereas the mean difference in sagittal condylar guidance values obtained from wide vue and OPG tracings were non- significant. In the articulator groups studied, there was no significant difference in the condylar guidance values on the right and left sides, however slightly less value on the right side were observed.

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Comparative Analysis Of The Flexural Strength Of Conventional Polymethyl Methacrylate Resin, High Impact Resin And Glass Fiber Reinforced Resin – An Invitro Study

Abstract

Polymethyl methacrylate has been used to fabricate dentures since 1937. Despite many improvements in its physical properties it is shown to fracture. One method to improve its fracture resistance is particulate and fiber reinforcement.

Aim and Objectives: This is a comparative study which was performed to compare the flexural strengths of a commercially available heat polymerized acrylic denture base material (Group-A) control group, High impact resin (Group-B), Conventional resin reinforced with 2% glass fibers by weight (Group-C), and Conventional resin reinforced with 5% glass fibers by weight (Group-D). Group – B, C, D are the test groups. The sample size is 120, each group comprising 40 specimens.

Statistical Analysis: One-way Analysis of Variance has been used to find the significance of flexural strength and Post-Hoc Tukey test has been used to find the significance between various comparisons. Results :- The reinforcement of the resin with the glass fibers definitely improved the flexural strength. An increase in the percentage of the glass fibers also had shown improvement in the flexural strength.

Key Words

Glass fiber reinforcement, flexural strength, denture base resin, high impact resin

Introduction

Dr Walter Wright in 1937 introduced plastic denture base materials called Vernonite. By 1946 it was estimated that 95% of all dentures are made of this resin^[1]. Despite its excellent properties there is need for improvement in its fracture resistance^[2]. Fractures in denture results from two different types of forces, namely flexural fatigue and impact. The midline fracture in a denture is often a result of flexural fatigue. Methods to improve the inherent material properties of Polymethylmethacrylate resin have included reinforcing agents such as particulates, and fibers. The first approach is to increase the strength of denture base polymer by adding a cross-linking agent of polyfunctional monomer such as polyethylene glycol dimethacrylate^[3]. Cross linking lowers strength and flexibility but increases solvent resistance, softening point, and hardness. Fatigue and impact strength are usually reduced^[4]. The second approach is to devise a reinforcement of denture base polymer with fibers or rods such as metal fibers, carbon fibers, Aramid fibers

and ultra high-molecular weight polyethylene fibers. The most commercially successful method of reinforcement is rubber toughening; in spite of this the material has compromised flexural properties. A rubber phase may be introduced into the acrylic matrix as either co-polymer, rubber particles or as core shell particles. Rodford described the dissolving of the butadiene-styrene co-polymer in methyl methacrylate monomer. Core shell particles are a development of the rubber toughening process, utilizing the arrangement of rubber and acrylic that imparts the greatest toughness upon the acrylic-namely a core of rubber phase material, surrounded by an acrylic shell. Smith (1957) reported on glass reinforcement of Polymethylmethacrylate by simply mixing discrete fibers with the dough or by lamination with the glass cloth. The incorporation of glass fibers was limited to 20% due to the deleterious effects on the doughing properties above this percentage. Ideally, to strengthen polymer resins by including the glass fibers, there should be good adhesion between polymer matrix and

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the fibers. Silanization of the glass fibers will improve the adhesion between the fibers and the resin. Research into the use of glass fibers for the reinforcement of PMMA continues till date. The objective of the study was: -to compare the flexural strength of the conventional polymethylmethacrylate resin and high impact resin and glass fiber reinforced acrylic resin.

Materials and Methods

This was an invitro study which was performed to compare the flexural strengths of a commercially available heat polymerized acrylic denture base material (Group-A) control group, High impact resin (Group-B), Conventional resin reinforced with 2% glass fibers by weight (Group-C), and Conventional resin reinforced with 5% glass fibers by weight (Group-D). Group – B, C, D are the test groups.

A stainless steel die of dimensions 65 mm X 10 mm X 3 mm was fabricated to make one hundred and twenty acrylic specimens according to standard compression moulding technique and

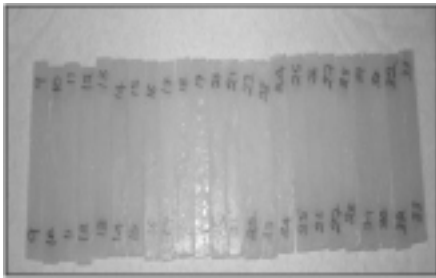


Fig 1 : Specimens Retrieved

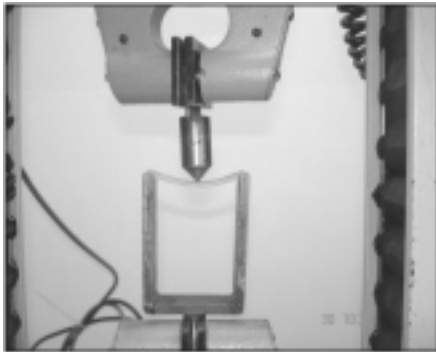
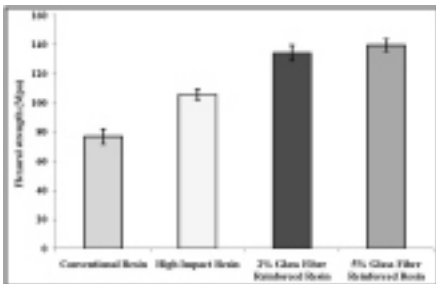


Fig 2 : Testing for the Flexural Strength (Final Fracture)



Fig 3 : Fractured Specimens



Graph 1 : Comparison of average Flexural strength in Mega Pascal units in four types of materials

following short curing cycle. The four experimental groups consists of 30 samples of (Group-A) as control group, 30 samples each of (Group-B), (Group-C), and (Group-D). (Fig 1)

Group-B specimens were prepared in the above mentioned manner. The Group-C and Group-D which consists of conventional acrylic resins specimens of same dimensions reinforced with 2% and 5% by weight glass fibers. The glass fibers were cut to 5mm length. The cut fibers were subjected to salinization,

Table 1 : Comparison of Mean pattern of Flexural strength in Mega Pascal units in four groups

Groups	Range	Mean±SD	95% CI
Conventional resin	68.07-91.87	76.89±5.28	74.91-78.56
High Impact Resin	99.52-115.56	105.75±3.53	104.43-107.07
2% Glass Fiber Reinforced Resin	119.17-143.22	134.25±5.29	132.27-136.22
5% Glass Fiber Reinforced Resin	129.28-148.99	139.49±4.27	137.90-141.09

CI = confidence interval SD = Standard deviation

Table 2 : Comparison of Effect sizes between the groups

Control Group	Comparison group	Effect Size	Description
Conventional resin	High Impact Resin	6.34	Very Large
Conventional resin	2% Glass Fiber Reinforced Resin	10.71	Very Large
Conventional resin	5% Glass Fiber Reinforced Resin	12.87	Very Large
High Impact Resin	2% Glass Fiber Reinforced Resin	6.26	Very Large
High Impact Resin	5% Glass Fiber Reinforced Resin	8.50	Very Large
2% Glass Fiber Reinforced Resin	5% Glass Fiber Reinforced Resin	1.08	Large

thesilane coupling compound was wipe applied on the surface of the glass fiber and were allowed to dry in the air for 20 minutes. Later on they were soaked in the monomer for about 10 minutes to allow better bonding. The fibers were removed from the monomer, and the excess liquid was allowed to dry. The fibers and the preweighed resin were mixed thoroughly to disperse the fibers. After reaching its dough stage, the material was kneaded and packed into the prepared molds. The specimens were polymerized and recovered in the same manner as Group-A and Group-B. All the specimens were stored at room temperature in water for one week before testing.

Results

All the samples were tested for flexural strength using a 3 – point bending test with a universal testing machine (INSTRON – Model No 1011) at a crosshead speed of

2mm/min as shown in (Fig 2). A load was applied using a centrally located rod until a fracture occurred (Fig-3). The results were analyzed with a one-way analysis of variance (ANOVA) (Table no 1)

The Flexural strength in Mpa for Group B was 105.75 3.53, and it was Group C in was 134.25 5.29 significantly ($p < 0.001^{**}$; Tukey) raised over and Group D 139.49 4.27 also significantly rose ($p < 0.001^{**}$; Tukey) when compared to the mean Flexural strength in Group B .The Flexural strength in Group C was 134.25 5.29 Mpa and in Group D was 139.49 4.27 Mpa.

Discussion

Methods to improve the inherent material properties of Polymethylmethacrylate resin have included reinforcing agents such as particulates, and fibers. The first approach is to increase the strength of denture base polymer by adding a cross-linking agent of polyfunctional monomer such as polyethylene glycol dimethacrylate (highimpactresin - Group - B). The second approach is to devise a reinforcement of denture base polymer with glass fiber (Group - C , Group - D). Silane coupling agents have been used successfully to improve adhesion between polymer and glass fibers. The function of the Silane coupling agent is based on two types of chemical bonds. One of those bonds is a Siloxane bridge formed by the condensation reaction of Silanol groups and the silica surface of glass fiber. Simultaneously with the condensation reaction, the Silanol molecule form hydrogen bonds.

Glassfiber reinforced denture base resin has many factors such as matrix resins, silane-coupling agents and glass fiber which affect water absorption. Glass fiber reinforcement increases dimensional change, which can compensate for polymerization shrinkage to certain degree.

The present study was to compare the flexural strength of conventional heat cure resin, high impact resin and Glass fiber reinforced resin using a three point bending testing machine.

For comparison of the flexural strength, 30 specimens from control group and 90 specimens i.e. 30 specimens from each test group has been tested. The peak load at which the Group-A specimens fractures ranged from 9.8kgf - 12.72kgf, and the flexural strength ranged from 70 Mpa - 90 Mpa. Group-B specimens' fracture ranged from 14.01kgf - 16 kgf, and the flexural strength ranged from 100Mpa - 120 Mpa. Group - C specimens fracture ranged from 16.5 kgf - 19.5 kgf and the flexural strength ranged from 120 Mpa. - 138 Mpa. Group - D specimens fracture ranged from 18 kgf - 21 kgf and the flexural strength ranged from 135 Mpa. - 145 Mpa. Thus, higher the force required to fracture the specimens, greater is the flexural strength.

Inter group comparison among the three groups shows 6.34% increase in flexural

strength in Group-B, 10.71% increase in flexural strength in Group-C and 12.87% increase in flexural strength in Group-D in comparison to Group-A. Analysis of variance showed that the difference in load at fracture and corresponding transverse strength was statistically significant ($p < 0.001^{**}$, Tukey).

Results of study showed substantial improvement of flexural strength in Group-C and Group-D i.e., the glass fiber reinforced specimens. This may be explained based on the fact that the modulus of elasticity of glass fiber is very high; most of the stresses are received by the fibers without any deformation.

From this study, it has been observed that the pretreated glass fiber by silane coupling agent improves a chemical bond with the acrylic polymer and the flexural strength. This modified method of reinforcing heat cure acrylic resin can be used in reinforcing the complete denture and distal extension partial denture bases, which are more prone to fracture by, fatigue failure in certain areas. Since the study has been restricted to laboratory investigations, further observations in clinical application are required.

Conclusion

From the results obtained in this study, the following conclusions were drawn:

1. It has been observed that the pretreated glass fiber by silane coupling agent improves a chemical bond with the acrylic polymer.
2. There has been considerable improvement in the flexural strength from conventional heat cure resin to the high impact resin because of the particulate reinforcement i.e. with the butadiene styrene.
3. A significant amount of increase in flexural strength has been noticed, and gives an inference that fiber

reinforcement enhances the flexural strength when compared to the particulate reinforcement.

4. Results of study showed substantial improvement of flexural strength in Group-C and Group-D i.e., the glass fiber reinforced specimens.
5. There is a considerable difference in flexural strength between 2% and 5% glass fiber reinforced specimens. So the flexural strength can be increased by increasing the percentage fibers added to it. This will facilitate the improvement in strength up to 20%, above which will not improve the strength but makes manipulation difficult.

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A Novel Combination Of Platelet Rich Fibrin And Pepgen P-15 Xenograft, In The Treatment Of Intrabony Defects: A Volumetric CT Scan Analysis.

Abstract

A novel combination of Pepgen P-15 xenograft and platelet rich fibrin (PRF) is used in the periodontal regeneration of intrabony defects, in three patients (two males, one female) on tooth site #20, #21, #30. Clinical parameters like pocket probing depth, relative attachment level, position of gingival margin were evaluated presurgically (baseline) and post surgically at 6 and 9 month intervals. Radiographic parameters including linear bone growth (LBG) and volumetric bone gain were assessed through the acquired Dentscan three dimensional reconstructed images. There was an improvement in all the clinical parameters and increase in radiographic LBG of 33 to 37% and volumetric bone gain of 55 to 81%, at defect sites. Clinical and CT scan assessment indicate the regenerative potentiality of PRF and Pepgen P-15, in treatment of periodontal intrabony defects.

Key Words

Polypeptide Hormones; Intra-Bony Defect; Regenerative Treatment; Volumetric CT

Introduction

In the past, various treatment modalities have been attempted to enhance the periodontal regeneration. Recently, a synthetic biomimetic hydroxyapatite xenograft, PEPGEN-P15®*, has been demonstrated to promote the bone formation. It is one among the many materials to mimic autogenous bone, as 15 amino acid sequence of Type I collagen (P-15 peptide) coats the surface of anorganic bone mineral (ABM).^[1] P-15 peptide has steric similarities to the cell binding site of type-I collagen present in the bone.

Another recent approach, for periodontal regeneration is the use of polypeptide growth factors, known to promote proliferation and migration of periodontal ligament cells, synthesis of extracellular matrix as well as differentiation of cementoblasts and osteoblasts. Platelet-rich fibrin (PRF), a second-generation platelet concentrate (PC), originally described by Choukroun et al,^[2] is a safe and convenient approach to deliver high concentrations of polypeptide growth factors. PRF can be obtained by gentle centrifugation of peripheral blood, not requiring the addition of any anticlotting agent, which

renders its preparation less chaotic. Dohan Ehrenfest et al^[3] showed that approximately 97% of platelets and 50% of leukocytes of the original blood volume were concentrated and three dimensionally distributed in the PRF clot, that is believed to release polypeptide growth factors, such as transforming growth factor- β 1, platelet-derived growth factor, vascular endothelial growth factor and matrix glycoproteins (such as thrombospondin-1), in a sustained fashion for at least 7

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days, as shown in vitro.³ PRF also shows positive effects like “Jump-starts” the cascade of osteogenesis in a bone graft, facilitates graft stabilization, promotes early consolidation of the graft, speeds up mineralization and finally improves trabecular bone density.^[2]

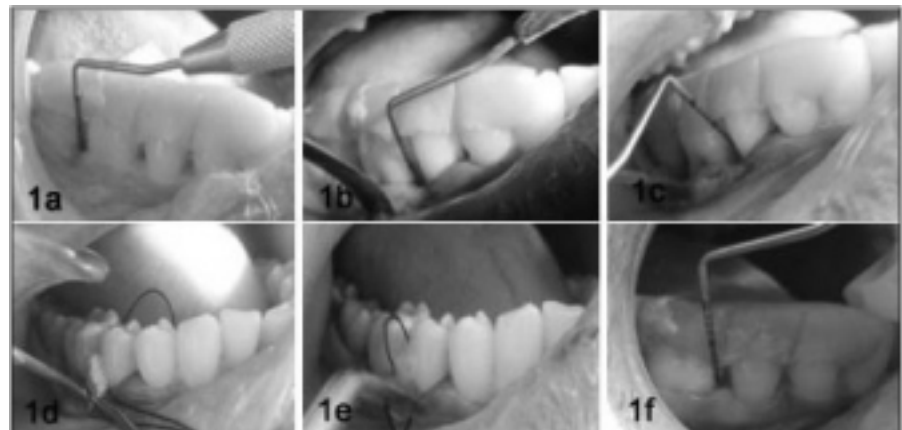


Figure 1. Surgical procedure A: Preoperative #30; B, C: Intraoperative measurements taken at intrabony defect site #30 after Open-flap debridement; D: Placement of PEPGEN P-15 graft; E: Placement of PRF; F: 9 month postoperative PD was reduced to 3 mm

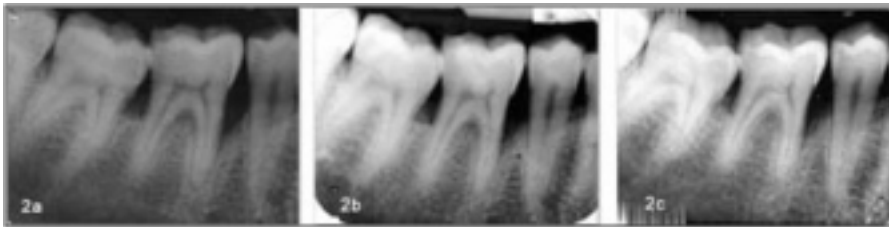


Figure 2. Intraoral periapical radiographs #30; A: Preoperative (baseline); B: 6 months postoperative; C: 9 months postoperative



Figure 3. Preoperative Dentascan Images. A: sagittal section; B: axial section; C: coronal section; D: defect volume obtained; E: linear bone defect measurements; F: 3D Reconstructed model

Hence, the present case series, reveals a clinical and radiographic evaluation of, PEPGEN-P 15, when used in combination with PRF in the treatment of periodontal intrabony defects with the primary outcome variables being the linear bone growth and defect volume gain, as evaluated using a high resolution spiral computed tomography (CT) scan.

Clinical Presentation

Three patients (two male and one female, aged 25 to 35 years) diagnosed with generalized chronic periodontitis, having intrabony defects at teeth sites #20 mesial, #21 distal and #30 mesial, with radiographic evidence of bone loss (Fig. 2), were treated in the Department of Periodontology & oral Implantology, Maharishi Markandeshwar College of Dental Sciences & Research, Mullana, Haryana, India from January 2012 to March 2012. The patients were systemically healthy, nonsmokers and reported no

known drug allergies and no current medications. Phase I therapy was performed. Volumetric analysis of the defect sites was done, by acquiring three-dimensional CT scan images, using a multidetector 64-slice CT scan machine†, aided by Dentascan software. Clinical parameters in all three patients, including: 1) pocket probing depth (PD) >5mm; 2) Relative clinical attachment levels (RAL) >10mm; and 3) Relative position of gingival margin (PGM) (mid-facial), were recorded immediately before surgery (as baseline), at 6 and 9 month intervals. A millimeter graded periodontal probe‡ with acrylic stent as reference point was used for measurements. (Fig. 1a)

Case Management

Prior to the procedures, written informed consent was obtained from all patients. The procedures followed were in accordance with the ethical standards of the University Ethical committee on

human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. A conventional open flap debridement surgery in the respective quadrant, along with placement of Peppen-P15 in combination with PRF within the intrabony defect sites was done (intrabony component of >3mm, Fig. 1b through 1e). Interrupted sutures were given and a periodontal pack was placed. The patients were given postsurgical instructions and advised to rinse with 0.12% Chlorhexidine mouth rinse twice daily for 1 week. A prescription of systemic antibiotics (500 mg amoxicillin, every 8 hours for 5 days), and analgesics (400 mg ibuprofen, every 8 hours for 5 days) was provided.

Results

At 6 and 9 month follow-up examination, it was observed that PD reduced in range of 3 to 5 mm with 1 to 2 mm coronal shift in PGM and again in CAL of 2 to 5 mm (Table 1).

A three-dimensional (3D) reconstructed Dentascan images acquired at 9 month interval, confirmed positive changes in the defect morphology, with a linear bone growth of 1.5-3mm (33 to 37 %). The volumetric analysis showed a bone fill of 55 to 81% at the defect sites (Table 2, Figs. 3 through 4).

Discussion

The in vitro studies by Bhatnagar et al^[1], Yuan et al^[4] and in vivo studies by Yukna et al^[5] have shown the efficacy of ABM/P-15 (Peppen-P15) to promote attachment of periodontal ligament fibroblasts and provide better bone healing than ABM alone.

The present case series demonstrates that platelet rich fibrin, and xenograft Peppen-P15 enhances the clinical and the radiographic outcome in regeneration of intrabony osseous defects, as observed in the clinical studies by Pradeep AR et al and Lekovic V et al, indicating that PRF in combination with bone grafts like hydroxyapatite or bovine porous bone mineral, can significantly improve the regenerative effects within intrabony periodontal defects.^{[6],[7]} The use of combination of Platelet rich fibrin with bone graft was more beneficial, as two distinct wound healing processes results in their synergistic effect.^[8] Also, in present case series, a 3-dimensional volumetric analysis using Computed

TABLE 1 Clinical Parameters at Baseline and 6 and 9 months postoperative (mm)

	Case I (#30 MESIAL)			Case II (#20 MESIAL)			Case III (#21 DISTAL)		
	Baseline	6 months	9 months	Baseline	6 months	9 months	Baseline	6 months	9 months
PD	8	4	3	6	4	3	6	4	2
RAL	12	8	6	10	8	6	10	8	6
PGM (midbuccally)	7	6	6	4	3	3	8	7	7
BOP	0	1	0	0	0	1	0	0	1

TABLE 2 Radiographic Parameters at Baseline and 9 months postoperative

	Case I (#30 MESIAL)			Case II (#20 MESIAL)			Case III (#21 DISTAL)		
	Baseline	9 months	% gain	Baseline	9 months	% gain	Baseline	9 months	% gain
Linear Defect Depth (mm)	8.1	5.1	37	4.6	3.0	35	4.6	3.1	33
Bone defect volume (mm ³)	11.6	3.4	70	12.4	5.6	55	11.0	2.1	81



Figure 4. Postoperative (9 months) Dentascan Images. A: sagittal section; B: axial section; C: coronal section; D: defect volume obtained; E: linear bone defect measurements; F: 3D Reconstructed model

tomography (CT) has been introduced, to overcome the difficulties caused by the nature of conventional radiography.^[9] Recently, multi-slice Spiral tomography has replaced conventional Computed tomography. Dentascan, a dental computed tomography software program, is an extension of Computed tomography technology, which improves specificity and sensitivity over standard imaging.^[10] The limitation to the use of CT scan is, it being an expensive mode of radiographic assessment, along with higher amount of radiation exposure than conventional IOPAs.

Conclusions

The autologous mode of obtaining PRF is cost effective and less chaotic. To the best of our knowledge, use of PRF along with PEPGEN P-15 in the regenerative treatment of periodontal intrabony defects in humans, has not been previously reported. Also a new technique of volumetric analysis using DENTASCAN has been introduced here.

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Self-injurious Behaviour & Foreign-body Entrapment - Case Report

Abstract

In clinical situations presence of foreign body in oral cavity of a child is usually associated with accidental etiology; none think about the role of self inflicted injury. Self Injurious Behavior (SIB) is a deliberate alteration or damage to oneself without a suicidal intent. Self inflicted injuries are very common and range from simple to severe forms of self-mutilation. Foreign bodies can be placed anywhere in the mouth or even beyond it- like the pharynx, trachea and the esophagus (oro-aero-tracheo-esophageal). Self inflicting injuries can lead to accidental grave problems depending on the site of placement. Absence of positive history, inconsistent clinical features and uncoherent radiographic features cause difficulty in diagnosis of SIB. Prompt diagnosis and early treatment can decrease morbidity in children.

Key Words

Self Injurious Behaviour, Self Mutilation, Habits, Foreign Body, Radiography.

Introduction:

Self Injurious Behavior (SIB) is a deliberate alteration or damage to oneself without a suicidal intent.^[1] SIB is the deliberate alteration to one's own body part without suicidal intent. Self Harm, Deliberate Self Harm, Self Injury, and Self Poisoning are other terms used to describe the same condition. Self mutilation patients violently inflict lesions to their own bodies with no intent to commit suicide.^[2]

Self inflicted injuries are very common and range from simple to severe forms of mutilation. Various foreign objects are reported to be lodged like pencil leads, darning needles, metal screws, beads and stapler pins.^[3] Self inflicting injuries can lead to accidental grave problems. Several aero-digestive accidents can result and accidental inhalation of foreign bodies can lead to accidental death during childhood.^[4] Foreign bodies in pediatric airway is potentially life-threatening. Coughing, choking, and wheezing are some of the presenting symptoms seen for 95% of the patients.^[5] The manifestations again depends on type and severity of etiology.

Case Report:

A 5 year old boy presented with the chief complaint of pain in the upper front tooth. Pain was present and severe past 2 days. Past history revealed dull aching constant pain past 1 year in the same tooth and occasional pus discharge from adjacent gum region. General examination

revealed an otherwise healthy child. Child's behavior assessment showed a definitely negative behavior which could be related to severe pain at the time of presentation to clinic.

Intra-oral examination showed dentition corresponding to 6 years, tooth number 51 showed intrinsic black discoloration, grade II mobility, tenderness to percussion and presence of a yellow metallic object in the lingual aspect of tooth number 51. The metallic object was tightly wedged preventing easy removal and attempts to touch the tooth caused severe pain leading to behavior problems in the child. Tooth 21 had erupted but 11 was missing due to retained 51 (**Figure 1-labial view & Figure 2- Palatal view**). Soft tissue findings included presence of gingival-vestibular abscess surrounding tooth number 51.

When the child was enquired regarding the placement of metallic object, he was initially reluctant to inform regarding the incident due to shame. Once the parents were separated; the child revealed that he regularly indulged in placement of metallic objects like pins into the tooth to remove impacted food particles.

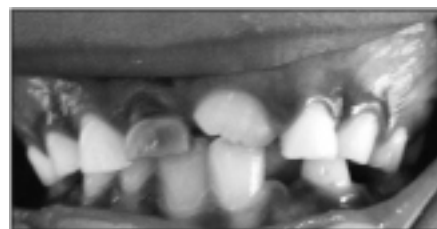


Figure 1 - Labial View

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Unfortunately the last act resulted in tight wedging of the metal; self removal of which was unsuccessful. The child did not notify parents regarding the mischief as he feared punishment by parents.

Intraoral-IOPA view was advised (**Figure 3-IntraOral Periapical Radiograph of maxillary anterior segment**). IOPA view revealed presence of sharp radio-opaque mass wedged within the pulpal outlines of the tooth 51. Presence of peri-apical radiolucency surrounding tooth 51, high amount of bone loss apically and laterally to the tooth indicative of peri-apical pathology.

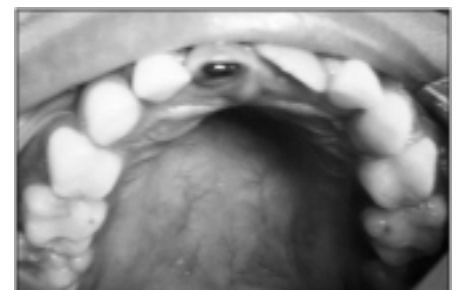


Figure 2 - Palatal Intra-oral View



Figure 3 - Intraoral Periapical Radiograph Of Maxillary Anterior Segment

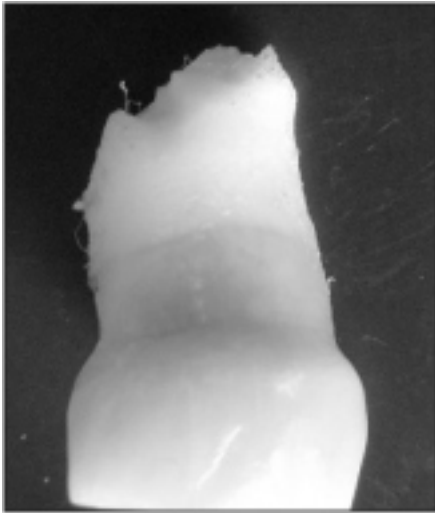


Figure 4 - Labial And Palatal View Of Extracted Teeth

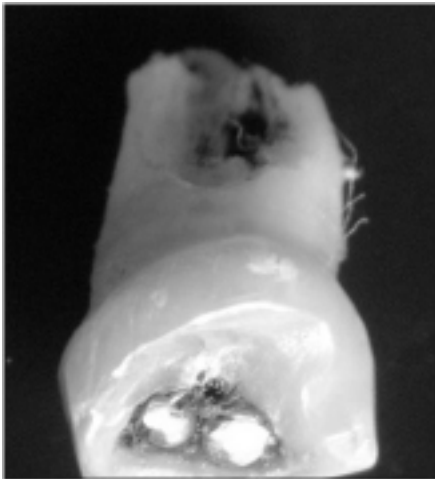


Figure 5 - Labial And Palatal View Of Extracted Teeth

Tooth 11 was impacted. A diagnosis of foreign body impaction and periapical abscess with respect to retained tooth 51 was given.

Treatment: Vaccination history was enquired and tetanus booster dose was administered to the patient. Based on prognosis of the tooth and dental age of

the patient, extraction of the tooth was carried out followed by drainage of the abscess. Since the patient indulged in the habit for a very long time, care was taken to carefully inspect the local site for presence of any other foreign bodies. Careful debridement of socket was carried out to clear any other foreign body remnants (**Figure 4 & 5- Labial and Palatal view of extracted teeth**). Patient was followed at 1 week interval. At follow-up period there was absence of symptoms and there was presence of good healing socket. Child was counseled regarding the ill effects of placing foreign bodies in the mouth.

Discussion:

In clinical situations presence of foreign body in oral cavity of a child is usually associated with accidental etiology; none think about the role of self inflicted injury. Foreign bodies get deposited accidentally due to trauma or sometimes due to self mutilation.^[2] Foreign bodies can cause acute problems like atelectasis, bleeding into tracheo-bronchial tree or act as potential source of chronic infection.^[4] Although accidental deposition of foreign body occur at all ages, self-mutilation type is more common in childhood because children have the habit of placing various foreign bodies in the mouth.

Presence of self mutilation or self-injurious behavior might go un-noticed if history is not enquired properly, in such conditions clinicians usually tend to regard presence of foreign body as accidental injury rather than self-mutilation injuries.^{[6],[7]} Rarely parents are aware of child's self injurious habit; Parental narration does not ascertain the condition. Initial misdiagnosis can lead to delay in treatment, complications or worsening of the situations.^[8] Early diagnosis and treatment can decrease morbidity and length of hospital stay in these children.^[8]

Radiographic examination is very useful especially when the foreign body is metallic or radio-opaque. Various radiographic techniques can come handy in diagnosis & treatment. Importantly, a negative radiographic finding does not rule out the absence of foreign body in aero-digestive tract foreign body as many of these foreign bodies are radiolucent.^[9] Clinician should not totally rely on the use of radiography to detect foreign bodies.

As a whole, absence of positive history, inconsistent clinical features and radiolucencies of objects cause difficulty in diagnosis.^[10] Since the aetiology of both differ, the treatment also differs- In accidental foreign body impaction treatment is only limited to symptomatic treatment but in the SIB, a psychological counseling of patient might be required to prevent repetition of the habit.^[11]

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Loop Connector – A Bond That Bridges The Gaps. A Case Report

Abstract

Midline diastema present before extraction may result in excessive width of the space available for the pontic. This is a challenging clinical situation for the prosthodontist and leaves him in a dilemma whether to close the space or maintain it in the restoration to simulate natural tooth appearance. If an implant-supported prosthesis is not possible or not selected as a treatment option, loop connector fixed partial denture may be the simplest and best solution to maintain the diastema and provide optimum restoration of esthetics. This article describes the procedure for the fabrication of a loop connector fixed partial denture to restore an excessively wide anterior edentulous space in a patient with existing spacing between the maxillary anterior teeth.

Key Words

Anterior edentulous space, Esthetics, Diastema, Loop connector, Pontic space

Introduction

Different esthetic treatment options are available for replacement of single anterior tooth i.e. implant supported restorations as well as conventional porcelain fused to metal and resin-bonded fixed partial dentures.^[1] Most of the times, drifting of teeth into the edentulous area occurs which causes reduction of the available pontic space, but sometimes a diastema which exists before an extraction may result in excessive mesiodistal dimension to the pontic space.^[2] This is a challenging clinical situation for the prosthodontist and leaves him in a dilemma whether to close the space or maintain it in the restoration to simulate natural tooth appearance. If diastema is to be maintained and implant-supported prosthesis is not selected as a treatment option, loop connector fixed partial denture may be the simplest and best solution which also provides optimum restoration of esthetics.^[3] Connectors are basically components of the fixed partial denture that joins the retainers and the pontics together.^[4] Loop connectors are non rigid type of connectors required to maintain the existing diastema in a planned fixed prosthesis.^[5] Loop connectors consist of a loop on the lingual aspect of the prosthesis that connects adjacent retainer and/or pontics. The loop connectors may be cast from sprue wax that is circular in cross-section or shaped from platinum-gold-palladium (Pt-Au-Pd) alloy wire.^[6] This article

presents a case with excessive space in the anterior region treated with a loop connector to achieve ideal esthetic results in the maxillary anterior segment.

Case Report

A 37-year-old male patient reported to the department of prosthodontics, with the chief complaint of missing teeth in upper right front region. On intraoral examination, it was seen that right maxillary central incisor was missing and the edentulous space was large (**Fig.1**). A conventional FPD was not possible due to large spaces between the anterior teeth. Patient was neither willing for implant placement nor a removable partial denture. He wanted a fixed alternative for his missing tooth. Spring cantilever FPD was not planned as no posterior tooth needed a crown.^[7] So treatment plan chosen was a loop connector FPD with the right central incisor as pontic and left central incisor and right lateral incisor as the abutment teeth, maintaining diastema between the pontic and the retainers.

Procedure

Tooth preparation was done in relation to the left central incisor and right lateral incisor, with slight subgingival finish line. Retraction procedures were carried out, a polyvinyl siloxane (Aquasil soft putty and Aquasil LV) impression was made using putty reline technique in a rim-lock impression tray and removable dies were fabricated. Die ditching was done to expose the restoration margins.

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Wax pattern for the retainers were fabricated with blue inlay wax. The palatal loops connecting the pontic to the retainers on the left central incisor and the right lateral incisor were made with round 14 gauge wax (**Fig.2**). Care was taken to keep the loops away from rugae. Rest of the laboratory procedures were common with the conventional metal-



Fig. 1 - Pre-treatment view



Fig. 2 - Wax pattern with palatal loops



Fig. 3 - Post treatment view

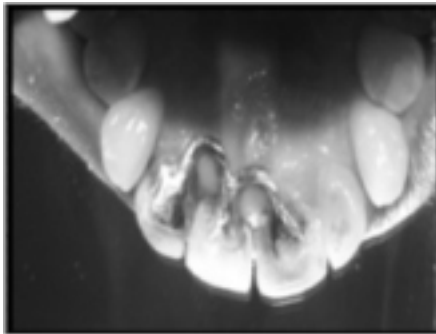


Fig. 4 - Occlusal view of final prosthesis

ceramic FPD construction. The loop connectors in the final prosthesis were polished to high shine (Fig. 3 & 4).

Discussion

The presence of the anterior extensive diastema is a difficult esthetic problem to resolve with conventional fixed partial dentures. Maximum esthetic results may be obtained only if the natural anatomic forms of the teeth are protected and the diastema is maintained.^[8] Although implants and removable partial denture are also the options but loop connector fixed partial denture is used in cases of excessive mesiodistal width of pontic space when fixed partial dentures are planned. In rare cases when the posterior teeth are healthy and sound, they are used as abutments to replace a maxillary anterior tooth with diastema, using resin bonded spring cantilever fixed partial denture.^[9] The palatal connector in spring cantilever fixed partial denture acts as a loop connector. However, the connector here is long, thin and resilient bar, closely adapted to the palate so that it is partly supported by soft tissue.^[10] It may deform, if thin, and produces coronal displacement of the pontic. It may also interfere with speech and is often poorly tolerated.

The size, shape and position of connector affects the success rate of the prosthesis.^[11] In a loop connector fixed partial denture, the connector consists of a loop on the lingual aspect of the

prosthesis that connects adjacent retainer and/or pontic. The loop may be cast from sprue wax that is circular in cross-section or shaped from platinum-gold-palladium (Pt-Au-Pd) alloy wire. Designing of loop connector should be such that it does not interfere with plaque control. Thickness of the connector should be adequate to prevent deformation but not so much that it becomes conspicuous to the tongue. Connector should have an intimate contact with overlying mucosa else the space created causes irritation to patient's tongue.

In the above case, the loop connector FPD not only addressed the problem of excessive mesio-distal width pontic space, but it also corrected the axial alignment of the left central incisor and the plane with respect to the right lateral incisor.

Conclusion

Although they are rarely used, loop connectors are sometimes required when an existing diastema is to be maintained in a planned fixed prosthesis, as in the above case. A loop connector FPD offers a simple solution to a prosthodontic dilemma involving an anterior edentulous space.

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Understanding Ectodermal Dysplasia

Abstract

Ectodermal Dysplasia are congenital, diffuse and non progressive group of disorders. X-linked recessive hypohidrotic Ectodermal Dysplasia (Christ-Siemens-Touraine syndrome) and hidrotic Ectodermal Dysplasia (Clouston Syndrome) are the most common Ectodermal Dysplasia reported.

Key Words

Ectodermal dysplasia, hypohidrotic, hypodontia.

Introduction

The Ectodermal Dysplasia's compromise a large, heterogeneous group of inherited disorders that are defined by primary defects in the development of two or more tissues derived from embryonic ectoderm. The tissues primarily involved are the skin, hair, nails, eccrine glands and teeth. It was first described by Thurman in 1848 and the term Ectodermal dysplasia was coined in 1929 by Weech. To date, more than 192 distinct disorders have been described. The most common ED are X-linked recessive hypohidrotic ectodermal dysplasia (Christ-Siemens-Touraine syndrome) and hidrotic ED (Clouston syndrome).

The first classification of ED was proposed by Freire-Maia and Pinheiro in 1982^[4] with additional updates in 1994 and 2001^{[5],[6]}. Originally classification stratified the ED into different subgroups according to the presence or absence of

- Hair abnormalities or trichidysplasia
- Dental abnormalities
- Nail abnormalities or onychodysplasias
- Eccrine gland dysfunction or dyhidrosis.

Overall the ED were classified into either group A disorders, which were manifested by defects in at least 2 of the 4 classic ectodermal structures and group B disorders which were manifested by a defect in one classic ectodermal structure (1-4 from above) in combination with (5) a defect in one other ectodermal structures (i.e. ears, lips dermatoglyphics). Eleven group A subgroups were defined, each with a

distinct combination of 2 or more ectodermal defects (e.g. 2-4, 1-2-3, from above). The group B disorders were indicated as 1-5, 2-5, 3-4, 4-5 from above. In 2003 Lamartine^[7] reclassified ED into four functional groups based on the underlying pathophysiologic defect:

1. Cell to cell communication and signaling
2. Adhesion
3. Development
4. Other

Similarly in 2001, Priolo and Lagana^[8] reclassified the E.D into 2 main functional groups:

1. Defects in developmental regulation / epithelial mesenchymal interaction and
2. Defects in cytoskeleton maintenance and cell stability,

Several ED may manifest in association with midfacial defects, mainly cleft lip, cleft palate or both. The 3 most commonly recognized entities are:

1. ED, ectrodactyly or clefting (EEC syndrome).
2. Hay Wells Syndrome or ankyloblepharon, ED and cleft lip / palate (AEC syndrome) and
3. Rapp-Hodgkin Syndrome, all of which are caused by mutations in the TP63 gene.

Although more useful is the clinically relevant classification that divides Hereditary ED into 2 broad categories^[8].

1. X-Linked Hypohidrotic form (Christ-Siemens-Touraine Syndrome), characterized by classic triad of hypodontia,

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hypohidrosi, hypotrichosis and by characteristic dysmorphic facial features:

- a. The typical facies, which is often not recognized until infancy, is characterized by frontal bossing, sunken cheeks, saddle nose, thick everted lips, wrinkled hyperpigmented per orbital skin and large low set ears.
- b. Dental manifestation include conical or pegged teeth, hypodontia or complete anodontia and delayed eruption of permanent teeth.
- c. Most patients have fine sparse lusterless, fair hair, therefore either pigmentation in the hair shaft is observed microscopically and the medulla is often discontinuous. When medullation is present "bar code" appearance is seen.
- d. Onychodystrophy may occur but is not common.
- e. Extrinsic scaling of the skin and unexplained pyrexia secondary to anhidrosis may occur in the neonate period. The development

of a chronic eczematous dermatitis is common.

- f. Other common signs are short stature, eye abnormalities, decreased tearing and photophobia.

- 2. Hidrotic form (Clouston Syndrome): it usually spares the sweat glands but affects the teeth, hair and nails. Most of other clinical features are similar to that seen in the hypohidrotic form. It has an AD inheritance and is common in persons of French-Canadian ancestry.

Christ-Siemens-Touraine Syndrome with X-linked recessive inheritance is the most frequently reported manifestation of ED. Depending on the severity of clinical manifestation; Christ-Siemens-Touraine syndrome can be classified as either hypohidrotic or anhidrotic ED1.

We present a case of X-linked recessive hypohidrotic ED.

Case Report

Parents of 3 yr old male patient reported to the Department of Oral Medicine and Radiology, Inderprastha Dental College with a chief complaint of missing teeth. On further questioning, parents revealed that only two front and back teeth were present, that caused difficulty in chewing food. Also the shape of upper front teeth was abnormal. There was no past history of trauma and dental extractions. Parents did not report of any diseases or drugs taken; although the parents complained of frequent history of pyrexia and inability to bear heat. The condition aggravated in the hot summer months and the patient had to be kept in an air-conditioned room. Patient was youngest of the 3 siblings, other siblings were females aged 11 and 7yrs. None of the siblings reported any problems. There was no previous family history in either of the parents. The child had normal intelligence and no visual and auditory problems. On extra oral examination, patient had a typical facies, frontal bossing, saddle nose, protruberant lips (Fig 1), thinning and light colored scalp hair (Fig 2), absence of hair on arms and legs (Fig 3). On intraoral examination, peg shaped maxillary deciduous central incisors were present (Fig 4). Maxillary second deciduous molars were the only teeth present, mandibular ridge was edentulous (Fig 5); loss of vertical bone height was noticed. Panoramic



Figure 1 : Shows Profile View Of The Patient.



Figure 4 : Shows Peg Shaped Maxillary Central Incisors.

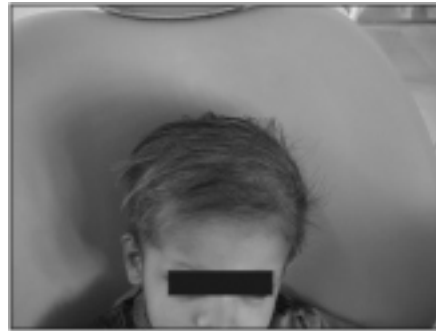


Figure 2 : Shows Thinning Of Scalp Hair.



Figure 5 : Shows Edentulous Mandibular Ridge.



Figure 3 : Shows Absence Of Hair On Hands And Feet.

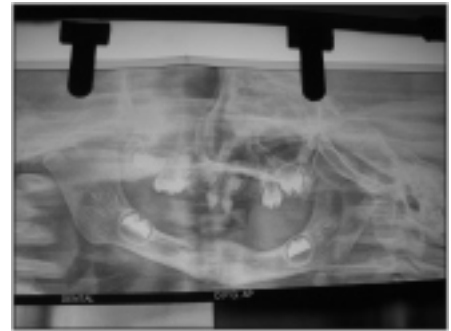


Figure 6 : Shows Opg With Missing Teeth.

radiograph was taken that revealed the absence of deciduous and permanent teeth (Fig 6). Based on the history, clinical examination and radiological examination we arrived at a diagnosis of X-linked hypohidrotic Ectodermal Dysplasia. Was advised a prosthetic rehabilitation to improve appearance and function.

Discussion

The genetic defects responsible for approximately 30 of ED have been identified. Genetic studies regarding the etiology of ED reveal that mutation in the ectodysplasin A and ectodysplasin A receptor genes are responsible for X-linked and autosomal hypohidrotic ED1. Ectodysplasin is important in promoting cell survival, growth and differentiation. AD and AR Hypohidrotic ED are caused by mutation in the DL gene, which encodes EDA receptor (ectodysplasin). AR hypohidrotic ED may

result from mutations in the EDARADD gene, which encodes a protein that interacts with EDA receptor.

Hidrotic ED (Clouston syndrome) which is an AD disorder is caused by mutation in GJB6 which encodes connexin 30, a component of intercellular gap junction. X-linked recessive hypohidrotic ED has full expression only in males. Female carrier outnumber affected men, but females show little or no signs of these conditions; as in our case. The diagnosis of ED is made when at least 2 types of abnormal ectodermal features occur such as malformed teeth and extremely sparse hair.^{[2],[3]} Like in present case. Lab studies are useful in the diagnosis or management of ED. Although to evaluate dental abnormalities, OPG can be done at an early age. Sweat pore counts using yellow starch iodine, pilocarpine iontophoresis and skin biopsy may

document hypohidrosis and a reduction in the number of eccrine glands. Genetic testing is available through GeneDx.

Differential diagnosis includes alopecia areata, aplasia cutis congenita, focal dermal hypoplasia syndrome, incontinentia pigmenti, Naegeli Francheschetti Jadassohn syndrome and Pachyonychia Congenita.

At present, no pharmacological treatment is available for ED. However patients with hypohidrosis/anhydrosis; airconditioning for home, school and work is advised. Avoid vigorous physical activities. Antipyretics are not effective in treatment of hyperpyrexia. Similar was the case with our patient who had frequent bouts of hyperpyrexia and heat tolerance. Patients affected by anodontia may show shrinkage of bone supporting the denture after long term denture use. The prognosis for most patients with ED is very good. Oral rehabilitation is necessary to improve both the sagittal and vertical skeletal relationship during craniofacial growth and development as well as to provide improvements in esthetics, speech and masticatory efficiency^[9].

Conclusion

The clinical manifestations of ED cause considerable social problem in individual affected by the condition. Treatment should be administered by a multidisciplinary team involving pediatric dentistry, orthodontics, prosthodontics and oral surgery.

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Oral Ulcers - Revealing The Unrevealed

Abstract

Mouth is the mirror of the body. A variety of systemic conditions exhibit oral lesions as a part of their disease spectrum. At times oral lesions might be the only presenting symptom of a systemic disease. We present a case of a 42 year old female with oral ulcers. Histopathological examination of the lesional tissue mimicked both lichen planus and lupus erythematosus. Further clinical and laboratory investigations confirmed the diagnosis of discoid lupus erythematosus.

Key Words

Oral ulcer; Discoid lupus Erythematosus

Introduction

Lupus erythematosus (LE) is a prototypic autoimmune disease characterized by the production of antibodies to components of the cell nucleus in association with a diverse array of clinical manifestations'. Discoid lupus erythematosus (DLE) occupies a benign spectrum of LE that is usually restricted to the skin and about 5-25% of the cases may develop SLE during its chronic course. Both genetic and environmental factors play a major role in the pathogenesis of DLE. With a prevalence rate of 17-48 per 1, 00,000, the disease has a greater female preponderance and mostly occur between the third to fifth decade of life. DLE most commonly occurs in African Americans compared to whites and Asians. Though the lesions can be clinically diagnosed, histopathology and an adjuvant immunofluorescent study helps in confirmation of the disease. Early diagnosis and prompt treatment of the lesions is mandatory as they lead to severe complications such as atrophy, scarring, alopecia and hyper pigmentation of skin thereby considerably affecting the quality of life^[2].

Case Report

A 42 year old female patient was referred to the department of oral pathology with a chief complaint of ulcers in the lip and oral cavity for one month duration. She also complained of pain and severe burning sensation on eating. The lesions initially appeared as a vesicle and ruptured to form an ulcer. On examination a single ulcer measuring 1 X1.5cm was evident on the lower

vermilion zone of the lower lip. The central portion of the ulcer showed slight sloughing that was surrounded by a irregular erythematous area with keratotic margins. A similar ulcer was evident on the left buccal mucosa opposite to the upper premolar and molar region (Fig 1 & 2). A thorough systemic examination revealed a coin shaped pigmented macule on the right side of the nose and right shoulder (Fig 3) which was asymptomatic. Other relevant systemic illnesses were ruled out.

Histopathology of the lesions revealed a



Figure 1 : Extra Oral View Showing The Ulcer On The Lip.



Figure 2 : Intra Oral View Showing The Ulcer In The Buccal Mucosa.

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parakeratotic epithelium of varying thickness with liquefaction degeneration of the basal cells (Fig 4). Interface mucositis and perivascular inflammatory infiltration was evident. PAS (Periodic acid Schiff) staining of the sections revealed a thickened basement membrane of the epithelium and endothelium (Fig 5). With the above findings a diagnosis of lupus erythematosus was given. On review a history of photosensitivity was elicited from the patient. Histopathology of the skin biopsy from the pigmented macule



Figure 3 : Pigmented Macule On The Right Shoulder From Which The Skin Biopsy Was Taken

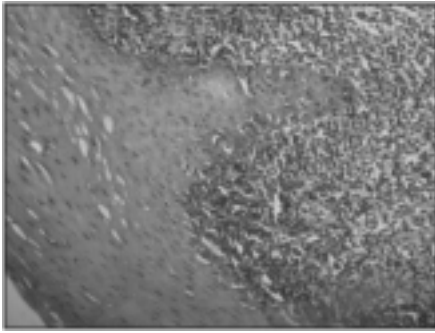


Figure 4 : Photomicrograph Showing Liquefaction Degeneration Of The Basal Cells With Interface Mucositis. (H&e 20x)

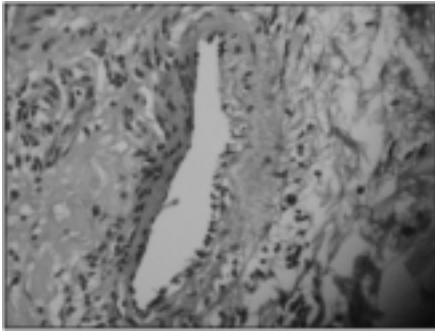


Figure 5 : Photomicrograph Depicting Thickened Blood Vessel Wall. (H&e 40x)

histopathology was suggestive of LE, history of photosensitivity and laboratory investigations demonstrating antinuclear antibodies helped us in diagnosis. Thus DLE should be considered in differential diagnosis of middle age female patients with oral ulcers, asymptomatic pigmented macules and history of photosensitivity. A thorough blood and urine investigation should be performed to rule out systemic disease in such patients. Knowledge of such conditions among physicians and dentist helps in early diagnosis and treatment which would thereby prevent potential disfiguring and improve the quality of life in such patients.

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resembled the oral lesions. Further serological investigations revealed microcytic hypochromic anemia (Hb-8.2gm/dl), leukopenia and antinuclear antibodies. However urine analysis showed no abnormal findings. By ruling out the systemic findings of SLE, the patient was diagnosed with discoid lupus erythematosus.

Discussion

Discoid lupus erythematosus is a chronic, scarring, atrophy producing, photosensitive dermatosis. The disease is usually categorized into three groups based on the severity. Group 1: Lesions limited to skin, Group 2: Patients with active discoid skin lesions plus visceral involvement and Group 3: OLE patients with glomerulonephritis^[3]. Oral manifestations of DLE include ulcers surrounded by white striae and red plaques commonly occurring in the buccal mucosa, lips and hard palate^[4]. Diagnosis of DLE in cases with minimal or asymptomatic skin lesions, pose great difficulty as the histologic features of LE mimic that of lichen planus. Most of the time the white striae around the ulcers in LE are mistaken for lichen planus. In our case the patient presented with asymptomatic hyper pigmented macules in skin; and oral ulcers were the only presenting symptom. Though the

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Prosthetic Ear Fabrication Using A Customized Three Piece Mould : A Case Report

Abstract

This article presents an outline of the procedures involved in constructing an ear prosthesis employing a customised three-piece stone mould for processing room temperature vulcanized silicone. The critical steps are emphasized in making the impression, sculpturing, and processing procedures to insure the quality of the prosthetic replacement.

Key Words

Ear Prosthesis, fabrication, three piece mould

Introduction

An auricular defect can be caused by any of several conditions, including trauma, congenital

Malformation, or surgical removal of a neoplasm^[1]. One treatment option is to fabricate an auricular prosthesis, a procedure requiring impressions of both the affected and unaffected ears. Several impression techniques have been advocated, including the use of plaster in a 2-piece mold, reversible hydrocolloid enclosed by a wax collar, irreversible hydrocolloid reinforced by a plaster matrix, and irreversible hydrocolloid contained in a wax or thermoplastic ring.¹⁻⁶ Minimal distortion of the impression and cast accuracy are important criteria for achieving a successful prosthesis.

This article presents an outline of the procedures involved in constructing an ear prosthesis employing a customised three-piece stone mould for processing room temperature vulcanized silicone. The critical steps are emphasized in making the impression, sculpturing, and processing procedures to insure the quality of the prosthetic replacement.

Case Report

A 8 year old patient registered to the Department Of Prosthodontics, A.B. Shetty Memorial Institute of Dental Sciences with history of bilaterally missing ears since birth (**Figure 1**) The option chosen was direct adhesive fixation of the prosthesis due to economic

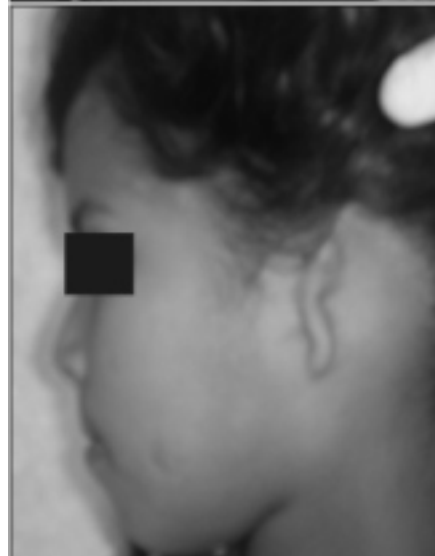


Figure 1

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and age of the patient.

The prosthesis was fabricated in following steps.

Impressions

The patient was seated in dental chair in a near supine position and draped to protect her clothing during impression procedure^[2].

The vertical and horizontal coordinates were marked with an indelible pencil on both of the defect side (**Figure 2**). These will help in proper orientation of wax form of prosthetic ear. Petroleum jelly or other lubricants were applied to the hair surrounding the area. The external auditory meatus was blocked with a cotton pellet or small sponge. The head was rotated so that the defect lies in the horizontal plane.

An irreversible hydrocolloid impression

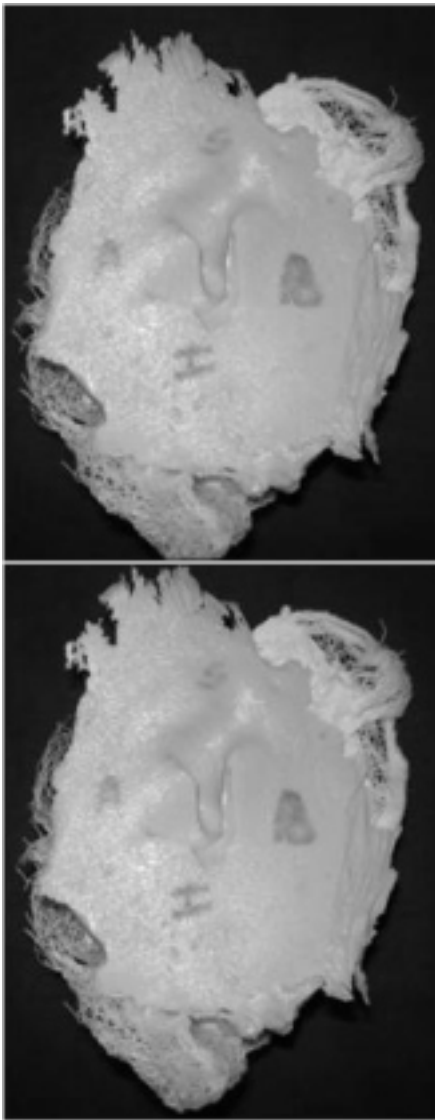


Figure 2

material (DeTrey Zelgan 2002, Dentsply, UK) was used to record the defective side ear. A rigid impression tray was fabricated using either a plastic tub (Reprosil Putty container; Dentsply International Inc, Milford, DE) with the bottom removed or a piece of polyvinyl chloride (PVC) tube which was used to cover at least 6mm of space around the ear³ The material was mixed using 50% more water than the recommended ratio for good flow⁴. The material was gently painted over the defect with a brush. The impression material was allowed to set and then carefully removed with a twist motion, away from the undercut area and inspected for accuracy. The impression of the ear on the other side was made in similar manner.

Wax Pattern

The impressions were poured in a type IV

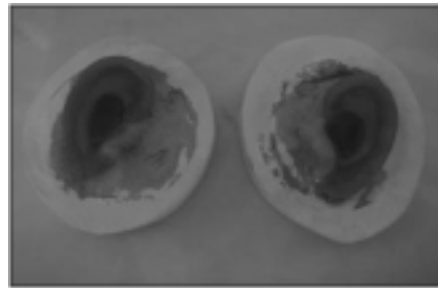


Figure 3

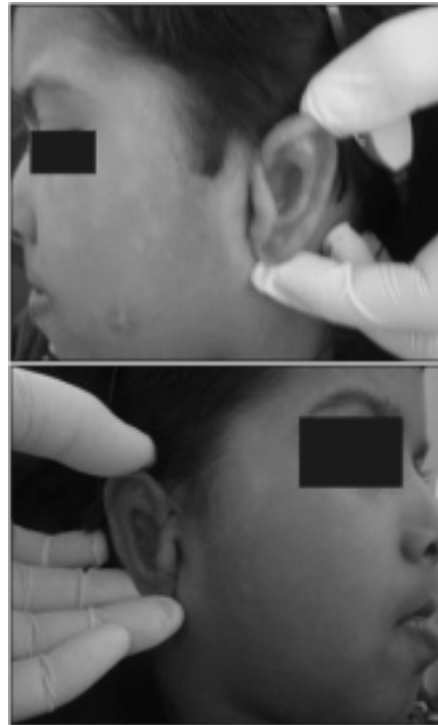


Figure 4

dental stone (Kalrock, Kalabhai Karson Pvt Ltd, Mumbai, India). The previously marked coordinates got transferred on to the cast from the impression (**Figure 3**). The coordinates provided the necessary orientation around which carving was begun. Before the carving is begun, the model was soaked in water to allow easy removal of wax pattern.

Type 3 base plate wax (Modelling wax; Deepti, Dental Products of India Pvt Ltd, Ratnagiri, Maharashtra, India) was used to sculpt the wax pattern for ear prosthesis. A hot water bath was used to soften and mould the wax. A uniform layer of modelling wax was adapted on to the defective ear models. The helix was formed by adapting a rolled length of wax. The projection of ear was measured to achieve the correct distance. Taking the cast of the normal ear as guideline, the shape, size and contour of defective ear were sculpted in wax. The sculpted ear

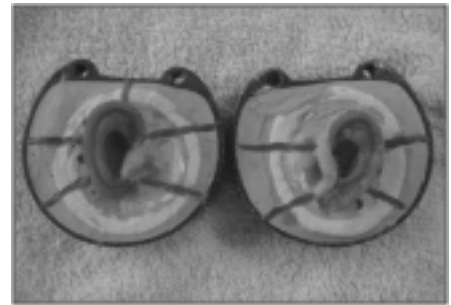


Figure 5



Figure 6

should simulate the mirror image of other sculpted ear.

Try in

After the ears were sculpted, the patient was called for try-in and following things were verified^[5] –

- The fit of the prosthesis on the tissue. Some distortion was allowed due to rigidity of wax.
- The correct horizontal alignment.
- The projection of ear in relation to side of head
- The integrity of margins during simple jaw movements.

Any changes required were carried out at this stage and the sculpted ear was prepared for flasking (**Figure 4**)

Investment Technique

The wax prosthesis was sealed to the model and leading edge thinned as much as possible so as to allow silicone edges to feather into natural skin. For easy placement and retrieval a three part mould is necessary.

The first part of the mould was fabricated by embedding the ear model in a block of thick consistency type III dental stone.(Figure 5) The mould was soaked in soap solution. Locations were cut around the helix area in the first piece of the mould which would allow the second piece of the mould to be oriented accurately around the helix. Channels were made for the escape of the excess material during packing. These were filled with base plate wax before fabricating the second part. The second part was fabricated by filling the gap between the helix and the model. At the edges, orientation boxes were made to align the third part of the mould. The mould was soaked in soap solution. The pattern was painted with soap solution to reduce the surface tension. To fabricate the third part, the mould was boxed with modelling wax (Deepti) and type III dental stone (Kalstone; Kalabhai Karson Pvt Ltd, Mumbai, India) was poured to cover the waxed ear completely.

The stone was allowed to set and wax was boiled out leaving a three piece mould

(Figure 6).

Intrinsic and extrinsic staining

The patient was called for shade matching. Room temperature vulcanized silicone(RTV) (Cosmesil, Principality Medical Limited, UK) was used to fabricate the prosthesis. First the basic skin shades were mixed by matching with patient's skin. Intrinsic staining of the prosthesis using flocks was done. The mould was then packed with silicone, taking care to avoid air bubbles. The mould should not be overpacked as it will make the margins thick and more conspicuous.

The mould was closed under slight pressure in a bench press. The material is allowed to set for a 24 hours. The prosthesis was carefully retrieved without tearing. The flash was trimmed and modifications of shade were done using extrinsic stains and the prosthesis was allowed to dry. Ear rings was given in prosthesis for better esthetics. At the final appointment, the patient was educated about insertion, removal, maintenance and care of the prosthesis.

Conclusion

The use of addition curing (platinum) silicones for fabrication of ear prosthesis is a good choice. The difficulty in packing of the material into the mould

and retrieval of the prosthesis after curing can be solved by fabricating a customized three piece mould.

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Paradental Cyst, Buccal Cyst, Hidden Cyst Or Lateral Radicular Cyst? Still Finding Its Existence! Report Of Two Cases.

Abstract

Paradental cyst is an inflammatory odontogenic cyst arising in association with partially erupted third molars associated with pericoronitis. It is generally found on the buccal aspect of the teeth. Radiographically they presented as well-defined radiolucency superimposed on the roots. Histologically cysts were lined with non-keratinized epithelium. Paradental cyst is a unique term to explain the unique clinical, radiographic & histopathological characteristics of this lesion.

Key Words

non-keratinized epithelium, pericoronitis, Paradental cyst

Introduction

Odontogenic cysts can be of inflammatory or odontogenic origin^[1]. Till 1971 classification of World Health Organization, jaw cyst of inflammatory origin included only one variety which was radicular cyst.^[2] But in 1970 Main reported a new variant of inflammatory jaw cyst which he referred to as "Inflammatory Collateral cyst".^[3] He reported eight cases of same out of which seven were related to mandible third molar, which was also described by Conklin as "hidden cyst."^[4] Later in 1976 Craig also reported a similar cyst and named as "Paradental cyst". He reported a series of 49 cysts which he said were found on the buccal & distal aspect of partially erupted mandibular third molar associated with pericoronitis.^[2] In 1983 Stoneman & Worth described a new variety of inflammatory jaw cyst which he referred as "mandible infected buccal cyst-molar area". These lesions were generally found on the buccal surface of mandibular first molar in young children.^[2] Eventually, second edition of WHO classification of odontogenic tumours included these cysts as separate entity. The nomenclature given to such cyst was "Paradental cyst" (Inflammatory Collateral, Mandibular Infected Buccal) cyst.^[5]

Pathogenesis of these cysts is uncertain but still it is believed that they have a strong inflammatory component. Small enamel projection into the bifurcation area of roots on the buccal aspect of the

teeth has been considered as the culprit for the same by many authors.^{[6],[7],[8]}

Extension of the enamel into the bifurcation area may be instrumental in the development of the cyst by acting as stagnation area which triggers bone destruction.^[9] The origin of the lining is believed to be from the reduced enamel epithelium over the cell rests of malassez as the source of epithelium.^[4]

Radio graphically they usually presented as well defined radiolucency's super imposed on the roots of affected teeth.^[5] Clinically most of the lesion were found on the buccal and distal aspects of partly erupted mandibular 3rd molars the history of pericoronitis.^[2] Clinically the cyst is usually infected although the tooth is vital.^[1]

Here we present two cases of patients with partially erupted mandibular 3rd molars with the diagnosis of atypical odontogenic cyst and histological features of paradental cyst.

Case Report

In our first case, a 23 year old female reported with the chief complaint of pain and swelling with respect to her right mandibular 3rd molar for past few days for which she was under medication from a local dentist. On clinical examination firm ovoid swelling of approximately 5cm diameter was seen on right mandibular angle region extra-orally & intra-orally a partially erupted tooth with pericoronitis was seen. The

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orthopantomogram (OPG) showed a well defined ovoid radiolucency extending from the cervical region of the distal root of the 3rd molar up till the distal cusp (FIGURE 1). The radiolucency was about 12mm x 6mm.

Patient underwent the surgical treatment under local anaesthesia. Buccal mucoperiosteal flap was raised with Ward's I incision, after a little buccal bone cutting tooth was elevated out. On doing so, a cystic lesion was found attached to the distobuccal surface of the tooth which was also enucleated and sent for histopathological examination.

Histopathological examination of the lining revealed a scanty, disrupted, non-keratinized stratified squamous epithelium. The superficial cystic capsule was densely infiltrated with

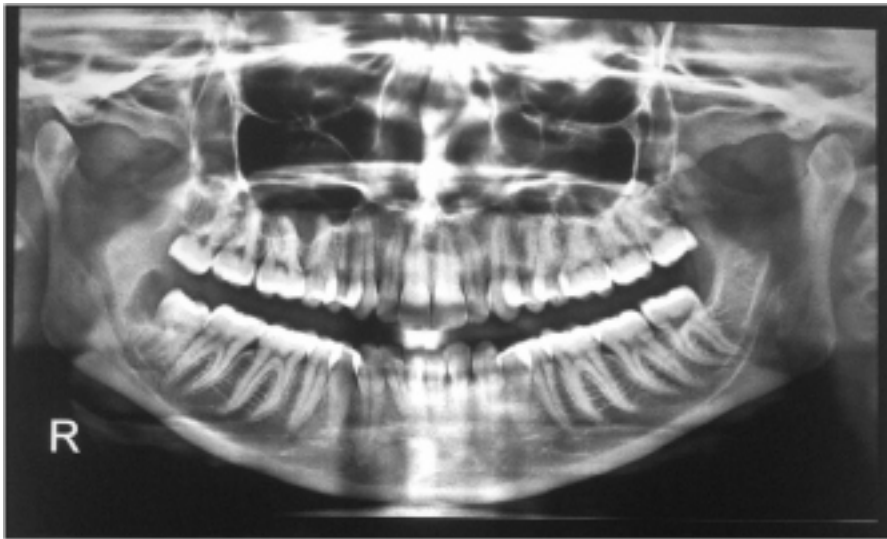


Figure 1. Panoramic Radiograph Shows Unilateral Radiolucency Associated With Lower Right Third Molar.

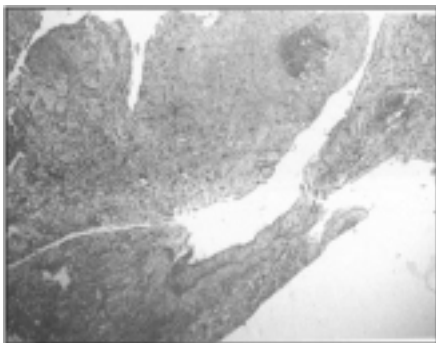


Figure 2. Histologic Features Of The Cystic Lining Showing Non-keratinized Stratified Squamous Epithelium With Chronic Inflammatory Cells.

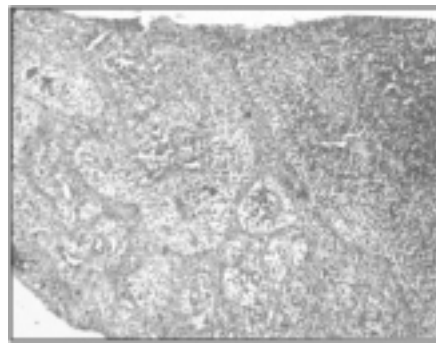


Figure 4. Histologic Features Of The Cystic Lining Showing Numerous Chronic Inflammatory Cells.

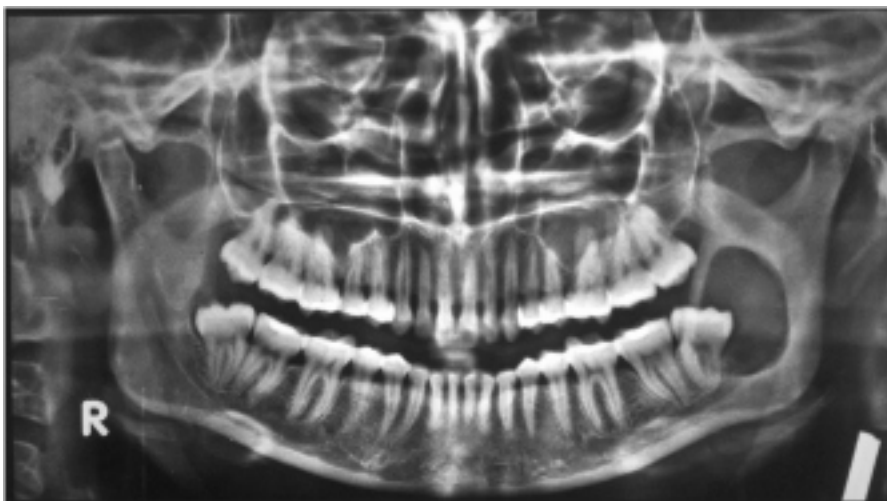


Figure 3. Panoramic Radiograph Shows Radiolucency Associated With Left Mandibular Third Molar Region.

chronic inflammatory cells. The deeper cystic capsule was made up of condensed collagen and exhibited numerous chronic inflammatory cells (FIGURE 2).

Our second case a 25 year old female, presented with the history of swelling on left side of her mandible since past 6 months which usually subsided after

taking medications. When the patient reported to us she had swelling in the same region with superadded infection due to which she had trismus.

On extra-oral examination an ovoid swelling of approximately 3cm x 4cm was seen which was tender on palpation on the left mandibular angle region.

Intra-orally a partially erupted third molar with pericoronitis with pus oozing out. Patient was put on I.V antibiotics and was operated for her impacted third molar on the third day after mouth opening improved. The orthopantomogram (OPG) showed a well defined ovoid radiolucency of approximately 2cm x 3cm, extending from apical third of the distal root of the 3rd molar involving angle region up to the mesial cusp of the involved tooth (FIGURE 3).

Patient underwent the surgical treatment under local anaesthesia. Buccal mucoperiosteal flap was raised with Ward's I incision, after a little buccal bone cutting tooth was elevated out. On doing so, a cystic lesion was found attached to the mesiobuccal surface of the tooth involving both the roots also which was also enucleated and sent for histopathological examination.

Histopathological examination of the lining consisted of a lumen lined with non-keratinized stratified squamous epithelium. Focal aggregates of chronic inflammatory cells were observed in adjacent fibrous connective tissue. (FIGURE 4).

Discussion

The review of literature showed that paradental cyst is accepted inflammatory odontogenic cyst that arises in association with partially erupted vital mandibular 3rd molars with history of pericoronitis.^[9] the most common site of paradental cyst is the area of mandibular molars, generally the 3rd molars.^{[7],[8],[9]}

Many hypothesis has been postulated regarding origin of cyst. Previously it was said that cyst could have originated from 1) dental follicle, 2) cell rests of Malassez, 3) reduced enamel epithelium, 4) crevicular epithelium.^[11] The most accepted being one proposed by Craig and Robert^[10] that reduced enamel epithelium over the enamel spur in furcation of the roots proliferates and undergoes cystic degeneration in response to inflammatory response.

The literature showed that a positive electric pulp test as a diagnostic criteria for paradental cyst. If the associated tooth is nonvital the diagnosis could be lateral radicular cyst.^{[2],[11],[12]} However, the

electric pulp testing was not done in all the cases reported. The vitality of the tooth should not be the diagnostic criteria for paradental cyst.^[1]

The relation between paradental cysts and dentigerous cysts is worth discussion, because these lesions may be confused when seen in radiographs. Shear described different radiological variation of dentigerous cyst : a circumferential type where the entire tooth appears to lie within the cyst ; a central type enveloping the crown of the affected tooth symmetrically; a lateral type commonly seen when an impacted mandibular 3rd molar is partially erupted so that its superior aspect is exposed.^[13] The presence of Colgan's sign which is the preservation of the distal follicular space in a radiograph is useful diagnostic feature to distinguish paradental cyst from dentigerous cyst.^[4] In our case report the paradental cysts appeared as a well- delineated radiolucency associated with the root of the affected teeth extending up the crown area.

The relation between angulation of tooth impaction and location of cyst has also been given significant criteria in the development of the cyst. It is believed that food is deflected by the occlusal surface of the lower 3rd molar during chewing, so that it is forced into the gingival soft tissues around the crown of the tooth. The direction of deflection is dependent on the angulation of the tooth to the occlusal plane. In mesioangular impacted tooth, food is forced into the space between the distal surface of the 2nd molar and the occlusal surface of the 3rd molar. In contrast to the vertical or distoangular impactions, the vulnerable area for development of a cyst seems to be on the buccal and distal or distobuccal aspects respectively. Other anatomic factors such as crown form, fissure pattern, adjacent teeth, and gingival pattern also influence the location of the cyst.^[4]

Most reports agreed with the treatment choice of enucleation of the cyst followed by extraction of the associated tooth if the tooth is 3rd molar.^{[3],[10],[14],[15]} however the tooth involved is 1st or 2nd molar

enucleation of the cyst without extraction of the tooth is recommended.^{[2],[7],[16]} Recurrence of the cyst has not been reported and is not likely to occur provided the cyst has been completely removed.^[9]

To conclude, paradental cyst is an inflammatory odontogenic cyst commonly associated with partially erupted vital mandibular 3rd molar with pericoronitis, grossly most commonly attached to the buccal root surface overlying the bifurcation, developmentally arising from the enamel projection seen on the buccal root surface, radiographically distinct from the traditionally described dentigerous cyst.

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Creating A Denture Using Customized Multi-Step Approach: A Case Report

Abstract

Providing complete denture therapy to patients with atrophic residual ridge is challenging. These patients frequently suffer ongoing diminution of denture foundation, loss of support of facial musculature.¹ This article presents a multi-step treatment approach, at every step of complete denture fabrication, which involves physiologically extending the denture bases adequately to cover all of the available supporting tissues,² followed by using neutral zone technique to maximize stability of the denture, with special consideration to aesthetics, by supporting the slumped sunken cheeks with cheek plumpers.³

Key Words

Resorbed mandibular ridge, Sunken hollow cheeks, Preliminary functional impression, Neutral zone, Cheek plumpers.

Introduction

The highly resorbed residual ridge is the scourge of prosthodontists. Swenson stated, "The ideal ridge is one that is broad on its bearing surface and has practically parallel sides".^[1] Seldom are such ridges encountered by prosthodontists. Deterioration of this ideal ridge is frequently encountered, because of multiple factors, which may be local or systemic. Stability of lower denture in such cases is usually the distinguishing factor between success and failure.

The natural teeth and ridges or dentures provide support which is responsible for the external form of the lips and cheeks. The muscles become weak and do not function properly, if the lips and cheeks are unsupported, due to which there will be wrinkling of skin and sagging of lips and cheeks. Due to aging, a prosthodontist has to handle a whole lot of problems like loss of teeth, alveolar process, tonicity of musculature, elasticity of skin as well as impairment of function.^[3]

Time to time, dentists have come up with various techniques to overcome these problems in some way or the other. This article describes a clinical report whereby, a customized treatment approach was used at every step of complete denture fabrication for a patient presenting with resorbed ridges, so as to provide him with a successfully functioning prosthesis

A Case Report

A seventy year old male patient reported to Department of Prosthodontics at D.A.V (C) Dental College and Hospital, Yamunanagar with chief complaint of unstable lower complete denture and inability to chew food and was also insisting on improving his aesthetics. History revealed that he was wearing that denture since last ten years. On examination, it was found that the patient had highly resorbed mandibular ridge (Class IV) with poor aesthetics, unsupported oral musculature and slumped cheeks. After thorough evaluation of the patient's history, radiographs and existing clinical conditions, an appropriate and detailed treatment plan was formulated, keeping in mind all the patient's needs and desires.

Since the patient had severely resorbed mandibular ridge, the complete denture should be such, that it should cover as large area as possible to distribute masticatory forces and at the same time, it should not conflict with the adjacent muscles, which otherwise tend to displace it. Thus, a primary functional impression was made without using tray, so as to have an impression free from distortion that stock tray may cause.

To overcome the problem of denture instability, physiologically appropriate teeth arrangement within neutral zone was done, so that teeth don't interfere with normal oral and peri-oral muscle activity. This stabilizes and retains the denture rather than displacing it.

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Special considerations were given for aesthetics to overcome the problem of sunken cheeks, by supporting them with removable cheek plumpers. Instead of conventional cheek plumper as a single unit prosthesis with extensions on either side on the buccal surfaces of the denture, magnet retained plumpers as separate portions were planned to compensate for the loss of buccal pad of fat in cheek region.

Technique

1. Impression using metallic core: A 2-mm thick metal wire was adapted to the curve of the mandibular arch from one retromolar pad to the other, to serve as core for impression and a small loop was incorporated in the anterior part to serve as a handle. To confirm its stability, the wire was seated in the mouth, and the patient was asked to pronounce certain speech sounds, principally /S/ sounds.^[4] (Fig. 1a)

Then the adhesive was applied on the wire and extra heavy-viscosity impression (Addition Vinyl Polysiloxane, Dentsply) material was formed into a roll around the wire and the prepared core was placed in the patient's mouth. After confirming the correct



Fig.1 a: Metallic core adapted along the residual ridge b. Final preliminary functional impression



Fig. 2 : Recording neutral zone with tissue conditioner



Fig. 3 : Teeth arrangement according to neutral zone index

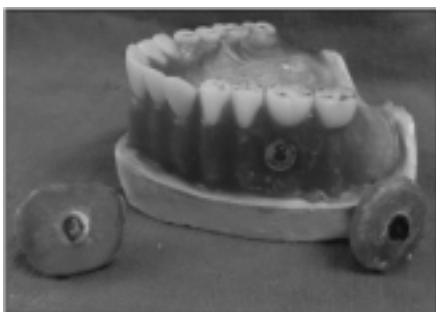


Fig. 4 : Wax up of the denture with magnets attached to wax rolls

position, the patient was asked to close the mouth slowly and gently push the tongue forward to touch the lower lips, and the fingers were withdrawn. Patient was then asked to recite the days of the week several times slowly and clearly, to functionally mould the material by muscles.

Following polymerization, after the stability was obtained, additional material was added and adapted to those regions which were not captured in the first impression and molded to create extensions by phonetic molding as done earlier. After a properly extended impression was obtained, its stability and retention was checked and confirmed. A final wash impression was made using a low-viscosity silicone material. Thus the impression was completed in three phases: main body, extension and surface wash (Fig. 1b). Then, the maxillary impression was made in usual manner using impression compound. The impressions were then boxed, poured and casts were obtained. Then, custom trays were constructed on these casts, followed by border molding and final impression with admix technique.

2. Jaw Relation and Neutral Zone: The impressions were poured in dental stone and denture bases were made on the master casts, over which wax occlusion rims were constructed. The vertical dimension of occlusion was registered by conventional methods and casts were articulated. The upper occlusion rim was returned to the articulator. On lower record base, the wax was removed and superstructure was constructed using auto polymerizing acrylic resin, comprising two pillars in the premolar region with short vertical fin between them along the centre of denture base. This helped to provide even occlusal stops at the correct vertical dimension of occlusion and support the neutral zone impression material.^[5]

Tissue-conditioning (Visco-gel temporary soft denture liner, Dentsply) material was used according to the manufacturer's instructions along the denture base and superstructure to cover acrylic fin and the rim was placed in the patient's mouth along with maxillary wax rim. The patient was instructed to close in centric occlusion as guided by the acrylic shin stops. During this period the patient was instructed to: smile, grin, pout/purse lips, count from 60 to 70, talk aloud, pronounce the vowels, sip water,

swallow, slightly protrude the tongue and lick the lips. Forces exerted mold tissue conditioner into the shape of the neutral zone (Fig.2). These actions were repeated until material had set. The rim was removed from the mouth and minor deficiencies were corrected by the addition or removal of tissue conditioner.^[5]

The neutral zone impression was then replaced on the master model, locating grooves were cut and a silicone putty index was prepared around the impression. The tissue conditioner impression was then removed from denture base and wax was poured into this space, giving an exact representation of neutral zone. Teeth arrangement was completed according to the index and their position was checked by placing the index around the wax try-in (Fig. 3).^[6]

3. Try-in and cheek plumpers; After satisfactory try-in was done, wax rolls were placed in the disto-superior aspect of maxillary buccal flanges. Cheek fullness and vestibular extension was evaluated and patient approval was taken for comfort, function and aesthetics. Magnets (cobalt-samarium; Master Magnetics, Inc., The Magnet Source) were attached to the wax rolls and waxed up (Fig 4). The maxillary and mandibular trial dentures were waxed up, flaked and dewaxed. The heat cure acrylic resin was packed by taking care not to dislodge the magnets.^[7]

4. Insertion: During final insertion, the denture was fully inspected and a check record was made to eliminate any minor occlusal errors. The denture provided the patient with improved facial appearance, stability and retention during function as they have been constructed in anatomic and functional harmony with their surroundings (Fig.5 & 6).

Discussion

Making a definitive impression of an



Fig. 5 : Finished prosthesis with magnetic cheek plumpers



Fig. 6 : Pre-rehabilitation and post rehabilitation intra-oral view

edentulous arch can be challenging when the residual ridges present with less-than-ideal conditions, especially when there is minimal bone height, unfavorable residual ridge morphology and/or unfavorable muscle attachments. Due to the anatomical differences between the maxilla and the mandible, as well as the differences in primary and secondary load-bearing areas, impressions of mandibular ridges with resorbed ridge require special considerations.^[8]

Mandibular primary impressions of severely resorbed edentulous ridges are difficult to manage well with stock trays. So a functional impression technique was used whereby, the impression material was formed by the patient's own musculature without any distortion from the stock tray or the operator's fingers. Such a functional impression gains support area that is as large as the active surrounding muscles permit, without any constraint imposed by fingers or borders of stock trays.^[4] Thus, it avoids undue displacement of soft tissues and unbalanced extensions and also provides stability with the resulting denture. Moreover, since the patient takes an active part in the procedure, he feels relaxed, comfortable, and confident because of the stability of the completed impression.^[4]

Next, neutral zone was recorded with an aim to construct a denture in muscle balance, as muscular control will be the main stabilizing and retentive factor during function. This technique enables

to construct a denture that is shaped by muscle function and is in harmony with the surrounding oral structures.

As the patient ages, the loss of support of the facial musculature is of great concern to the patient and carries a great social stigma. Aging causes tissue atrophy, folds and creases of face become exaggerated which is due to loss of support by the alveolar bone and teeth in particular leading to collapse of lower third of face. There is deepening of nasolabial folds, drooping of corner of mouth, loss of vermilion border, depression of lips with exaggerated wrinkling^[9]. Teeth loss in posterior region results in loss of support to the cheeks, which tend to move medially to meet lateral expanding tongue.^[10] Cheek contour changes as a result of loss of vertical dimension of occlusion due to anterior teeth loss. Loss of subcutaneous fat and elasticity of connective tissue produces the slumped cheeks.^[3]

This clinical report indicated that a magnet retained cheek plumper prosthesis has potential as a treatment method to alleviate the problems caused by aging and the resultant loss of muscle activity associated with such aesthetic impairment. It improves the appearance of the patient by reducing sagging of cheeks and improving the muscle tone and has the greatest advantage of boosting the self esteem of the patient. The advantages of using magnet retained removable cheek plumpers over conventional are that these are smaller in size, easy to place within dentures, do not cause excessive muscle fatigue and can be easily removed and cleaned.

Thus, an attempt was made to create dentures that were in harmony and dignity of the aging patient, which would compliment, not eradicate the stigma of aging in him.

Summary

As the life expectancy of general Indian population is increasing, the number of complex complete denture cases is also increasing. So, the treatment of these complex cases needs to move away from traditional denture construction to an alternative approach to have a satisfactory denture. Thus, a customized approach was used for this patient to cater

his problems faced in the previous denture. This article has shown relatively simple yet effective clinical techniques whereby a denture resting on an atrophic mandibular ridge may be modified to improve function, comfort, appearance and health to have a successfully functioning prosthesis, complying with the definition of prosthodontics. All this have an enormous impact on the patients' personal lives and are rewarding for the prosthodontist who is providing this care.^[3]

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Rehabilitation Of A Patient With Implant Supported Overdenture

Abstract

Patients with resorbed ridges often have difficulty retaining conventional dentures. An implant-supported overdenture is a good alternative treatment to a conventional denture for patients with complaints about the retention and stability of their removable complete denture. These complaints more often have to do with the mandibular than the maxillary denture. Implant-supported overdentures offer better results in the mandible than in the maxilla. The 2 implant overdenture in the mandible has since become standard for edentulous patients. This article describes a clinical procedure for an implant supported mandibular overdenture.

Key Words

Implants, overdenture, retention.

Introduction

In modern dentistry implants play revolutionary role. Implant-retained overdentures can be a simple treatment option to restore the edentulous mandible.^[1] Even full mouth oral rehabilitation can be done with the help of implants. In removable prosthesis implants are used for retention and stability. When height of residual ridge is low, then retention is compromised, but with the help of implants retention can be easily improved. The literature indicates that implant-supported overdentures in the mandible provide predictable results with improved stability, retention, function and patient satisfaction compared with conventional dentures.^[2]

Case Report

A 55year old female patient reported to the department of prosthodontics, M.N. DAV dental college and hospital, Solan, Himachal Pradesh, with complaint of mandibular edentulous jaw and partially edentulous maxillary jaw. Her mandibular ridge had good bone volume and inverted U shape as in **Figure: 1** and unable to provide good retention and support. So implant supported overdenture was planned. Implants are placed in her mandibular jaw in canine region as is shown in **Figure: 2**. **Figure: 3** depicts o-ring with sleeve and complete mandibular denture was given to the patient as shown in **Figure: 4**. Removable partial denture was given in maxillary denture.

Discussion

Anterior alveolar ridge resorbs slower than posterior. So, in anterior region, ridge height is high and there is absence of any limiting structure. After first premolar mental foramen is present, from where mental nerve passes. Two implants were placed in canine region in this case. Positioning of the implants in canine region is better than positioning of

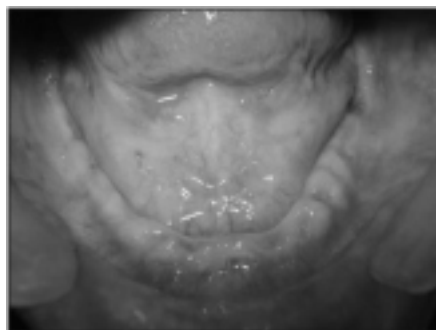


Figure: 1: Inverted U Shape Mandibular Ridge



Figure: 3: O-ring With Sleeve



Figure: 2: Implants Are Placed In Canine Region



Figure: 4: Complete Mandibular Denture

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implants in premolar region. Kennedy Class 1 patient with bilateral distal extensions and anterior missing teeth often are restored with a fixed partial prosthesis anteriorly and Class I removable partial denture. This eliminates the unfavorable rocking leverages that exist when replacement denture teeth are anterior to the fulcrum line. If only two canines are remaining, a cross-arch tissue bar can be placed to gain favorable distribution forces. Likewise, independent implants in the premolar region allow greater amplitude of rocking of the restoration compared with implants in canine regions. When implants are placed in canine region, the anterior movement of the prosthesis is reduced, and the prosthesis even may act as a splint for the two implants, thereby decreasing some of the stress to each implant.^[3]

When denture was placed on implants, soft liner was placed in denture to prevent the extra load on implants. After three months soft liner was replaced with o ring and sleeve. Three months time was taken for osseointegration. After osseointegration implants are ready for loading.

Summary & Conclusion

After one year, patient is happy with the denture. There is good retention and not any dislodgement of denture during any movement. An implant-retained complete lower denture is considered by many as the gold standard in the oral rehabilitation of the edentulous mandible. Its relative simplicity, minimal invasiveness, predictability, efficacy and affordability make it an attractive treatment option.^[4] Mandibular implant-retained overdentures may be more satisfying for edentulous patients than new conventional dentures.^[5] There are many good reasons why this treatment should be selected in preference to using fixed dentures. However, as with any treatment, there must be a strong commitment to after care if the overdenture is to remain successful.

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Rushton Bodies In Radicular Cyst – A Case Report And Review Of Literature

Abstract

Radicular cysts are the most common inflammatory odontogenic cysts and arise from the epithelial rests of Malassez as a result of periapical periodontitis following death and necrosis of the pulp. These are found most commonly at the apices of the involved teeth, but may also be found on the lateral aspects of the roots. In approximately 10% of radicular cysts, hyaline bodies, often referred to as Rushton bodies, are found in the epithelial linings and very rarely, in the fibrous capsule. In the routine hematoxylin and eosin staining they appear as linear, straight, curved or hairpin shape eosinophilic structures. In this article, we report a case of two radicular cysts in a patient with presence of rushton bodies in the histological sections.

Key Words

Odontogenic, Radicular cyst, hyaline bodies, rushton bodies, arcading pattern.

Introduction

Inflammatory jaw cysts comprise a group of lesions that arise as a result of epithelial proliferation within an inflammatory focus due to a number of causes. Radicular cysts are the most common inflammatory cysts and arise from the epithelial residues in the periodontal ligament as a result of periapical periodontitis following death and necrosis of the pulp. Cysts arising in this way are found most commonly at the apices of the involved teeth, but may also be found on the lateral aspects of the roots in relation to lateral accessory root canals. Quite often a radicular cyst remains behind in the jaws after removal of the offending tooth and this is referred to as a residual cyst.^[1]

About 60% of all odontogenic cysts are comprised of radicular and residual cysts.^[2] These cysts can occur in all tooth bearing areas of jaws, although more frequent in maxillary than mandibular teeth.^[1] Maximum number of cases are seen in 4th and 5th decade and a slight male predilection is seen.^[2] Most of the radicular cysts are symptomless unless infected.

Histologically, it is a true cyst and is lined wholly or in part by stratified squamous epithelium supported by fibrous connective tissue wall. About 10% of the radicular cyst shows presence of eosinophilic bodies known as hyaline or

rushton bodies in the epithelial lining of the cyst. Very rarely they are present in the fibrous capsule. The bodies measure up to about 0.1mm and are linear, straight or curved or of hairpin shape and sometimes they are concentrically laminated. They take eosin stain in routine hematoxylin and eosin (H&E) stained sections. Circular or polycyclic bodies are also seen with a clear outer layer surrounding a central granular body.^[1]

Here, we present a case describing presence of two radicular cysts in a patient that showed presence of rushton bodies within the epithelial linings of both the cysts.

Case Report

A 32 year old female patient reported to the outpatient department of our institute with a chief complaint of pain and pus discharge in upper left front tooth region since one month. The patient gave history of trauma to the same region about 8 years back but no treatment was taken. On intraoral examination, maxillary left lateral incisor had discoloration and was tender on percussion. Also, maxillary left first molar was found to be grossly carious. The patient was advised for intraoral periapical (IOPA) radiographs for both the teeth. IOPA radiograph for maxillary left lateral incisor (**Fig. 1**) revealed radiolucency with respect to apical third of the root. IOPA radiograph

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with respect to maxillary left first molar (**Fig. 2**) showed furcation involvement with small radiolucency in relation to mesiobuccal root apex. A provisional diagnosis of periapical cyst was given. The treatment plan for maxillary left lateral incisor was root canal therapy with

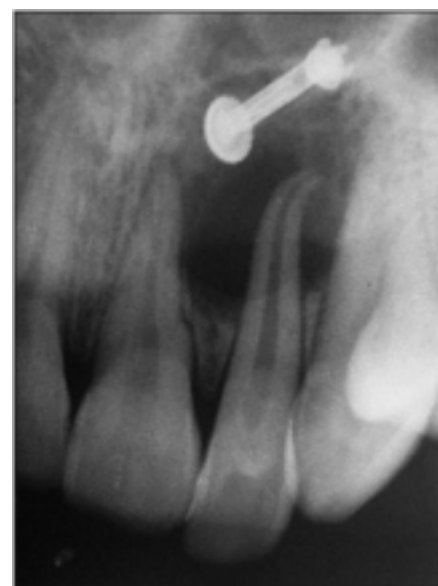


Fig 1. IOPA radiograph of maxillary left lateral incisor showing radiolucency at the root apex.



Fig 2. IOPA radiograph of maxillary left first molar showing radiolucency at the mesiobuccal root apex.

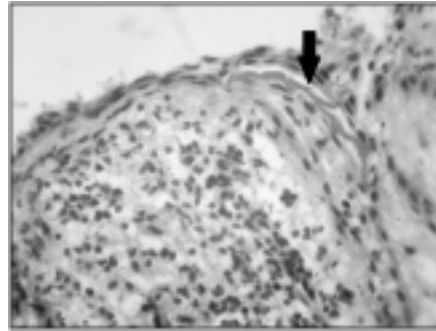


Fig 4. Photomicrograph of radicular cyst in relation to maxillary left first molar showing rushton bodies (arrow), (b) H&E, 40x

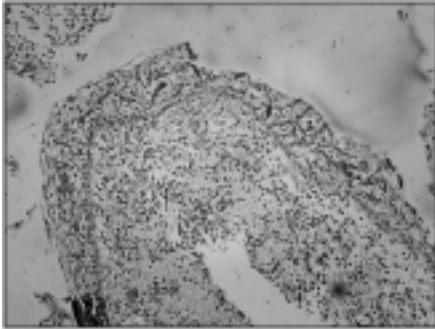


Fig 3. Photomicrograph of radicular cyst in relation to maxillary left lateral incisor showing rushton bodies (arrow), (a) H&E, 10x.

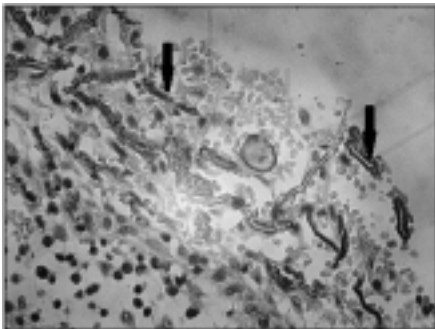


Fig 3. Photomicrograph of radicular cyst in relation to maxillary left lateral incisor showing rushton bodies (arrow), (b) H&E, 40x

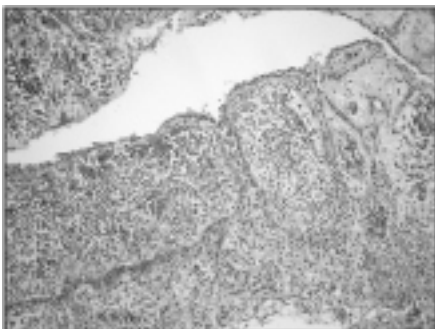


Fig 4. Photomicrograph of radicular cyst in relation to maxillary left first molar showing rushton bodies (arrow), (a) H&E, 10x.

Vascularity was moderate. The histopathological diagnosis of radicular cyst was given.

Discussion

The epithelial linings of the radicular cysts are derived from the epithelial cell rests of Malassez in the periodontal ligament which come to lie in periapical granulomas associated with teeth with necrotic, often infected, pulps. Thus, the epithelial cell rests are initiated to proliferate by inflammation as a result of necrotic debris and bacterial antigens derived from the dead pulp.^[3] A cyst cavity forms within a proliferating epithelial mass in an apical granuloma by degeneration and death of cells in the centre.

The epithelial linings may be discontinuous in part and range 6–20 cell layers thick in majority of cases. In early cysts, the epithelial lining may be proliferative and show arching with an intense associated inflammatory process but as the cyst enlarges the lining becomes quiescent and fairly regular with a certain degree of differentiation to resemble a simple stratified squamous epithelium. Keratin formation (mainly orthokeratinisation) may be seen affecting part of the lining epithelium and is seen in about 2% of radicular cysts.^[11]

Hyaline bodies were first described by Dewey^[4] in 1918 and later by Rushton^[5] in 1955 in the epithelial lining of radicular cyst and hence are now referred to as Rushton bodies.

Since its discovery, there has been a continuous debate regarding the origin of Rushton bodies. Rushton^[5] believed that they resembled the keratinised secondary enamel cuticle of Gottlieb in appearance and the liability to fracture. Shear^[6] indicated that they were of odontogenic epithelial origin and probably a form of keratin depending upon histochemical studies and his view was supported by Takeda et al.^[7]

Hematogenous origin was also proposed by few authors who suggested that these were derived from thrombi in venules of the connective tissue that had become varicose and strangled by epithelial cuffs which encircled them.^{[8],[9]} Later, Browne and Matthews^[10] stained cysts containing hyaline bodies for keratin, Factor VIII-related antigen, haemoglobin and

apicoectomy of the cystic lesion and extraction of left maxillary first molar along with periapical curettage. The cystic lesion obtained following apicoectomy as well as the extracted maxillary left first molar with soft tissue attached to its mesiobuccal root was sent to the Deptt of Oral Pathology & Microbiology for histopathological examination.

Both the soft tissue specimens were fixed in 10% buffered formalin and processed using routine manual processing technique. After paraffin embedding, 4 μ m thin sections were cut from each specimen and stained with routine manual H & E technique.

The H & E stained section from the soft tissue associated with maxillary left lateral incisor (Fig. 3a, 3b) showed non keratinized stratified squamous epithelium supported by a connective tissue wall. Arcading pattern was seen in the epithelium. Many eosinophilic, linear and curved rushton bodies were seen throughout the lining epithelium. The connective tissue wall was densely infiltrated with chronic inflammatory cells. Areas of extravasated red blood cells were seen. The features were suggestive of radicular cyst and hence the diagnosis.

The H & E stained section of the tissue from left maxillary first molar (Fig. 4a, 4b) showed a cystic lumen lined by non keratinized stratified squamous epithelium which was supported by a connective tissue wall. The epithelium showed proliferation in arching pattern. Few eosinophilic, linear and slightly curved rushton bodies were seen within the epithelial lining in one area. The connective tissue wall was moderately collagenous showing dense chronic inflammatory cell infiltration.

fibrinogen, using immunoperoxidase methods. The hyaline bodies were negative for all these antigens but fibrinogen was detected in the cores of some circular and polycyclic forms. They tentatively proposed that the presence of fibrinogen in the cores of some hyaline bodies could support the notion of a haematogenous origin of the granular bodies.^[10]

However, the ultrastructural studies failed to demonstrate any relation of rushton bodies either to RBCs or blood vessels. Rather it was suggested that the bodies are a secretory product of odontogenic epithelium deposited on the surface of particulate matter such as cell debris or cholesterol crystals in a manner analogous to the formation of dental cuticle on the unerupted portions of enamel surfaces.^[11]

Scanning electron microscopy showed that the hyaline bodies were more or less spherical structures consisting of concentrically laminated layers which on section resembled a cut onion. The surface of each layer had a fine-grained texture.^[12]

Few authors have reported the presence of rushton bodies in odontogenic keratocyst, dentigerous cyst, glandular odontogenic cyst and in ameloblastoma.^{[7],[13],[14]} They appear to be restricted to odontogenic lesions.

Hence, although the origin of hyaline bodies remains obscure, it is generally now thought that they represent a secretory product of odontogenic epithelium.

Conclusion

Radicular cysts being the most common odontogenic inflammatory cysts are very frequently encountered in dental clinics whereas rushton bodies are seen in only 10% of radicular cysts. In our case, the patient had two radicular cysts and rushton bodies were seen in the epithelial lining of both the cysts which is unique. Their presence in few other oral lesions has been reported but it is limited to lesions of odontogenic origin. These are now believed to be secretory products of odontogenic epithelium.

Acknowledgement

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A Case Series Of Gingival Melanin Pigmentation (GMP) Treated By Surgical Excision Technique: An Esthetic Approach

Abstract

Esthetics has become a significant aspect of dentistry and clinicians are faced with achieving acceptable gingival esthetics and functional problems. The harmony of smile not only depends upon the shape, the position and the color of the teeth but also on gingival colour & health which play important role for an attractive smile. Gingival melanin pigmentation (GMP) hampers the gingival esthetic of patients with gummy smile or excessive gingival display that cause physiological disturbances & embarrassment, so patients demand cosmetic therapy for the same. Four case of gingival melanin pigmentation treated by surgical excision technique especially for esthetic purposes. The technique is relatively simple and versatile and requires minimum time and effort. If repigmentation occurs, the procedure can be done repeatedly in the same area without limitation or causing any permanent damage. After 4 month follow up none of the cases showed reoccurrence of GMP.

Key Words

Gingiva, Melanin, GMP, Excision, Depigmentation, Aesthetics.

Introduction

Gingival pigmentation is mostly caused by the physiologic deposition of melanin by melanocytes mainly located in basal & suprabasal cell layer of epithelium.^{[1],[2]} Gingival hyper pigmentation is seen as a genetic trait in some populations irrespective of the age and gender hence termed physiologic or racial gingival pigmentation.^{[3],[4]} The degree of Gingival Melanin Pigmentation varies from individual to individual but directly related to the Melanoblastic activity,^[5] High level of oral melanin pigmentation usually is encountered among African, East Asian or Hispanic Ethnicity^{[6],[7]}, as well as in certain medical diseases like Addison's disease, Peutz-jegher's syndrome, Neurofibromatosis, Antimalarial therapy, Heama chromatosis, chronic pulmonary diseases etc.^[8] In dark skinned individuals, increased melanin production in skin, gingiva & oral mucosa occur as a result of genetically determined hyperactivity of melanocytes as compared to light skinned individuals. Past studies have shown that no significant difference exists in the density of melanocytes between light and dark skinned individuals. However, melanocytes of dark skinned individuals are uniformly

highly reactive than the light skinned individuals.^[9]

Melanin pigmentation of gingiva most often is physiological rather than pathological. Although patient complains of "black gums" which may pose aesthetic problems & embarrassment, especially in patients who are smile conscious, with a "gummy smile" or with excessive gingival display.^{[10],[11]} Gingival depigmentation is a periodontal plastic surgical procedure where by the gingival hyper pigmentation is removed by various techniques but the results of these techniques are almost similar. One of the earliest & still most accepted techniques is surgical removal of undesired gingival pigmentation with scalpel.^[12]

The case series presented here employed surgical (scalpel) excision technique for the management of gingival melanin pigmentation exclusively for esthetic purpose. Technique is simple, versatile & cost effective and does not require sophisticated instrument or apparatus but still providing satisfactory outcome.

Case Report 1

A young female patient age 17 years reported in the department of

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Quick Response Code



Periodontics & Oral Implantology, with a chief complaint of "Brownish black gums" that esthetically interfered with her smile (**Fig.1**). Patient requested for a Cosmetic therapy which will improve the esthetics on smiling. In general, skin pigmentation correlates with gingival melanin pigmentation^[13], but in this specific patient gingival melanin pigmentation was observed on the anterior labial surface that moderately predominated over the skin



Fig.1. Patient With "Brownish Black Gums"

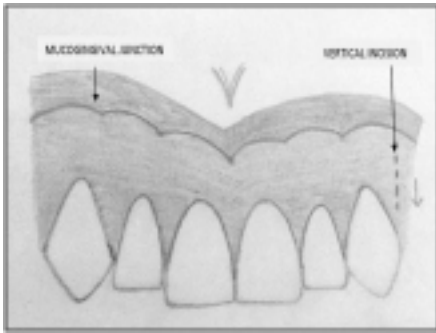


Fig.2. Vertical Split Thickness Incision

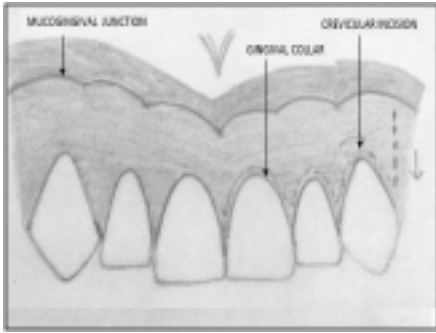


Fig.3. Horizontal Split Thickness Incision

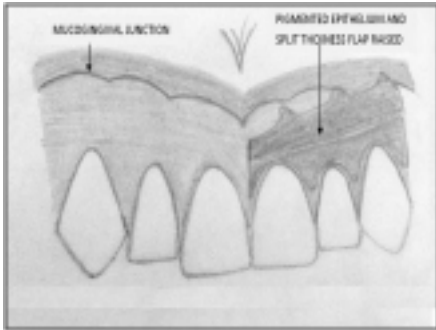


Fig.4. Periodontal Flap Raised To Remove Epithelium And Part Of Underlying Connective Tissue



Fig.5. Healing After 1 Week



Fig.6. Healing After 4 Weeks

pigmentation. Patient's clinical & medical history confirmed that the pigmentation was Physiological. On clinical examination, gingiva was found healthy state & free of any visible clinical inflammation. Thus, bearing in mind patient's chief complaint, a surgical gingival depigmentation procedure with the help of scalpel was planned. The procedure was explained verbally to the patient in clear and simple language, after which the patient signed the informed consent form.

Surgical Procedure:- Thorough medical history was taken & routine investigations were carried out to rule out any surgical contraindication. Following the administration of local anesthetic solution (2 ml of Lignocaine with adrenaline in the ratio 1:100000 by weight) the following surgical steps were carried out.

Step.1 A Vertical split thickness incision was given from the most apical area of gingival pigmentation i.e 1-2mm coronal to mucogingival junction & directed coronally towards the marginal gingiva 0.5-1mm short of base of gingival sulcus **(Fig.2)**

Step.2 A Horizontal split thickness incision was given from .5 - 1mm apical to the base of gingival sulcus following the gingival scalloping meeting the first incision. **(Fig.3)**

Step.3 A split thickness flap was raised to remove entire pigmented gingival epithelium along with a thin part of underlying sub epithelial connective tissue with the help of no. 11 & 12 scalpel blades. This removed the all the remnants of the melanin pigment in the connective tissue to prevent possible relapse of the problem. **(Fig.4)**

Step.4 Gingival Shaving was carried out around the Preserved gingival colar with the help of Kirkland knife.

Step.5 Periodontal pack was applied over the surgical site to prevent post operative discomfort as well as excessive granulation tissue formation during healing.

Post operative instruction, including analgesics, antibiotic were prescribed to



Fig.7. No Recurrence After 5 Months



Fig.8. Patient With Dark Colored Gums

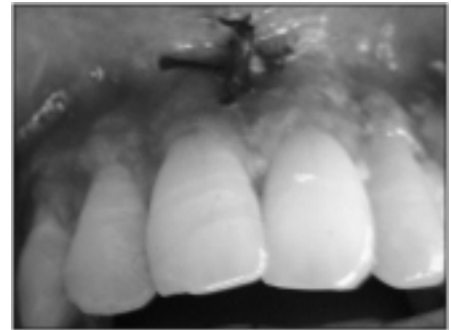


Fig.9. Healing After 1 Week Of Surgery

the patient (Ibuprofen, Amoxicillin 500mg \times thrice day for 3 days) . Chlorhexidine mouth rinse (0.2%) was advised to the patients for 2 weeks immediate post operative phase to aid in plaque control.

The surgical site healed well and uneventfully in 1 week without any post operative complication.

(Fig.5) The gingiva appeared pink, firm & healthy after 4 weeks **(Fig.6)**. On follow up at 5 month gingiva represent no reoccurrence of gingival melanin pigmentation. **(Fig.7)** The Patient was very impressed with pleasing esthetic outcome.

Case Report 2

A young male patient aged 20 years complained of dark colour gums. **(Fig.8)**

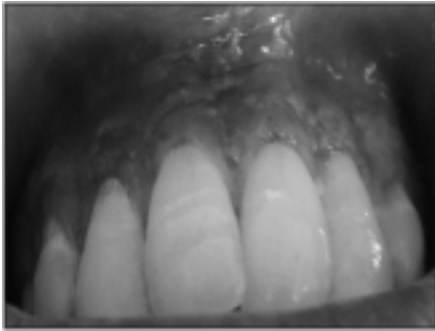


Fig.10. Healing After 2 Weeks Of Surgery



Fig.11. No Recurrence After 5 Months



Fig.12. Patient With Unaesthetic Gingiva



Fig.13. Esthetic Outcome After 5 Months Of Surgery

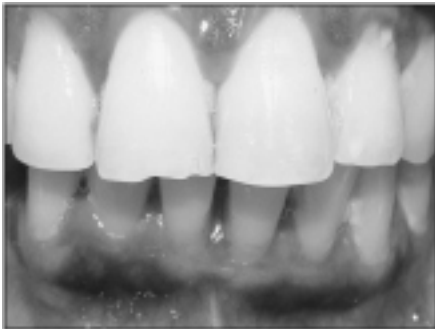


Fig.14. Patient With Dark Anterior Gums

On clinical examination periodontium was healthy with high frenal attachment. So, after phase I therapy same surgical procedure was carried out initially, followed by a frenectomy. Instructions & medical prescription were given to the patient. Healing was uneventful after 1 week (Fig. 9). Patient was recalled after 2 weeks (Fig.10) and followed upto 5 months with no evidence of Gingival repigmentation. (Fig.11)

Case Report 3

A 22 years young female patient had a chief complaint of unaesthetic gingiva. (Fig.12) Patient's history was non contributory same surgical depigmentation treatment carried out in this patient. At 5 months follow up patient had a pleasing esthetic outcome without any clinical melanin repigmentation (Fig.13).

Case Report 4

A Young female patient age 30 years reported to the department with complaint about dark lower & upper gums (Fig.14). Same surgical technique described was carried out in mandibular anterior segment in this patient (Fig.15). Gingival healing was good at 1week post operatively.(Fig.16)

The patient was followed up to 5 months with no evidence of reoccurrence. (Fig.17)

Discussion

Different gingival depigmentation techniques have been tried in the past but all provide an almost similar outcome. Selection of depigmentation procedure should based on clinical experience & clinician preference. One of the earliest & most popular depigmentation procedure that is still widely used is Scalpel surgery, however it causes unpleasant bleeding during and after procedure. Therefore, it is necessary to apply periodontal dressing for 7-10 days.

Scalpel Gingival Depigmentation procedure not only involve the surgical removal of gingival epithelium but also the part of underlying connective tissue & leave exposed connective tissue for healing by secondary intention. The new epithelium that forms is devoid of melanin pigmentation.

Electrosurgeryhas its own limitations. Repeated & prolong use induces heat accumulation and undesired tissue



Fig.15. Surgical Site In Mandibular Anterior



Fig.16. 1 Week Post Operative Healing



Fig.17. Healing After 5 Months

destruction. Cryo surgery & Chemical cauterization is followed by considerable swelling and it is also accompanied by increased soft tissue destruction as the depth of penetration cannot be controlled.

Free gingival graftcan also be used for elimination of gingival pigmented area.However, it requires an additional surgical site (donor site) and color matching. Furthermore, the presence of a demarcated line commonly observed around the graft in the recipient site may itself pose an esthetic problem.

Nowadays LASER is widely used in Contact & Defocused mode respectively for gingival depigmentation procedure with documented advantages including less bleeding, reduced post operative pain & no requirement of periodontal dressing. Due to this reason LASER is being preferred by some clinician over

the scalpel surgery but it is highly expensive, sophisticated equipment & technical expertise is required. No scientific evidence of early wound healing is documented till date with laser.

Among the above mention techniques, we found Scalpel excision technique relatively simple, versatile which required minimum time & effort.

Conclusion

The present Case Series concluded that Surgical (scalpel) excision technique for the treatment of moderate Gingival melanin pigmentation provide excellent results in term of improving esthetic & cosmetic appearance. Patients were satisfied with the outcome, which is the ultimate goal of the any therapy that is carried out. Further, at 5 month follow up no evidence of repigmentation of gingiva observed.

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Esthetic And Functional Rehabilitation Of Patient With Amelogenesis Imperfecta

Abstract

Amelogenesis Imperfecta (AI) is a heterogenous genetic disorder that disturbs the developing enamel structure. It can have major esthetic and functional impact on the patient. The present case highlights the treatment in such a scenario

Key Words

amelogenesis imperfecta esthetics rehabilitation

Introduction

Amelogenesis imperfect is a condition we routinely encounter in our clinical practice

The degree of defect varies from patient, a severe presentation has a debilitating esthetic and functional impact on the patient. The following case report highlights the management of such a case.

Case Report

A 14yrs old male patient reported to the clinic with the complaint of inability to chew his food properly and also suffered from esthetic inadequacy and sensitivity of his teeth. He expressed extreme dissatisfaction with his appearance. A detailed medical and dental examination was performed including photographs and dental radiographs. (Fig 1,2,3)

Amelogenesis Imperfecta (AI) is a heterogenous genetic disorder that disturbs the developing enamel structure.^[1] This rare ectodermal defect leads to a variety of clinical manifestations due to agenesis, hypoplasia, and/or hypomineralisation of the enamel.^[2]

In the present case tissue loss affected all the teeth. Enamel had a mottled appearance with a yellow brown discoloration. The mottled enamel had the same radiodensity as dentin. It was concluded that the patient likely suffered from a hypomaturation type of Amelogenesis Imperfecta. The family history reported no such evidence of such a condition.

Oral hygiene was not judged satisfactory at the first visit although the patient demonstrated a good knowledge of



Fig 1



Fig 2

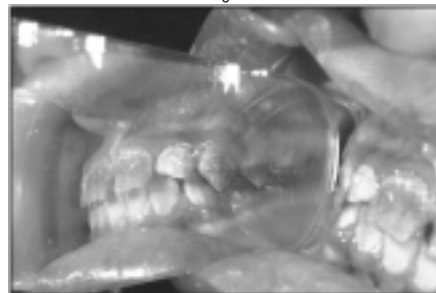


Fig 3



Fig 4

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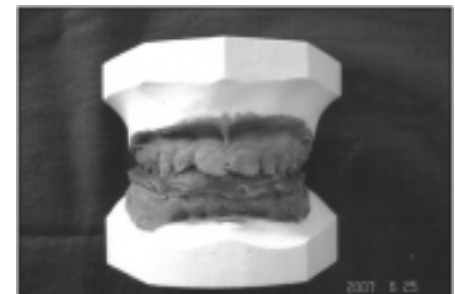


Fig 5



Fig 6

correct oral hygiene, this could be probably due to the sensitivity of teeth. A decreased occlusal vertical dimension was evident.

A treatment plan was developed with the main objectives to raise the vertical dimension of teeth, enhance the esthetics, restore masticatory function and eliminate the teeth sensitivity.^[3]

The vertical dimension of the teeth was increased by 2mm by means of an acrylic splint for 3 weeks (Fig 4,5,6). After

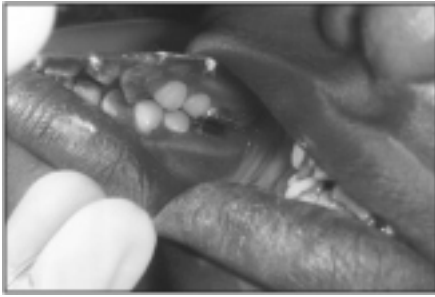


Fig 7

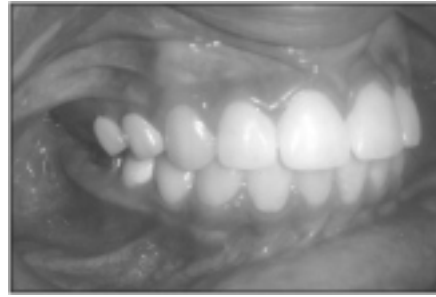


Fig 12

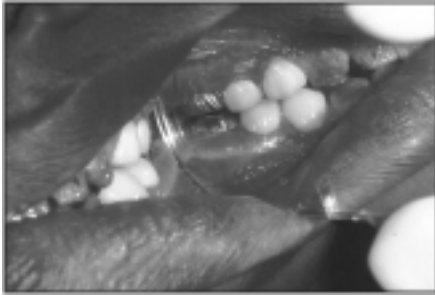


Fig 8



Fig 13



Fig 9



Fig 14

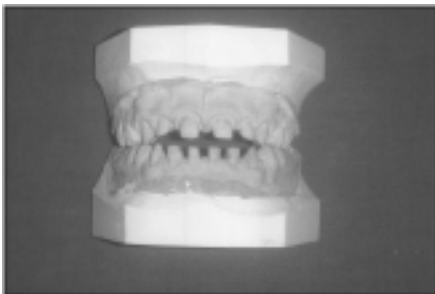


Fig 10



Fig 15



Fig 11



Fig 16

opening of bite, maxillary and mandibular first molars were prepared for full crown restorations which were then restored with glass ionomer luting cement. (Fig 7,8,9)

Keeping in mind the smile line of the patient and functional requirements, maxillary and mandibular first and second premolars were prepared for porcelain fused to metal crown with

porcelain facing.

Taking into consideration the thickness of teeth in anterior segment and the age of patient, elective root canal treatment was done for maxillary and mandibular anterior teeth followed by preparation of all ceramic crowns which were then cemented with resin cement. (Fig 10,11,12,13,14,15)

After the restorative procedures, dental hypersensitivity of the patient was reduced satisfactorily and satisfactory function and esthetics was established.

The patient was recalled after two months. The patient's oral hygiene was satisfactory. The restorations remained with no discoloration, crazing or carious lesions. The patient's esthetic and functional expectations were satisfied.^[4]

(Fig 16)

Conclusion

With the above mentioned treatment, patient was treated not only from a functional and esthetic standpoint, but also from a psychosocial standpoint by upgrading his quality of life and helped in reinforcing his self-esteem.^[5]

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Early Interception Of Anterior Crossbite In Mixed Dentition Period: Two Case Reports.

Abstract

Anterior crossbite is a major esthetic and functional concern to the parents during the developmental stage of a child. It is one of the major responsibilities of Pediatric dentist or orthodontist to guide the developing dentition to a state of normalcy in line with the stage of orofacial growth and development. This paper documents two cases in which anterior dental crossbite were successfully corrected during developing dentition using a simple fixed Catlan's appliance and tongue blade therapy.

Key Words

Anterior crossbite, Catlan's appliance, tongue blade therapy

Introduction

Well-aligned teeth not only contribute to the health of the oral cavity and the stomatognathic system but also influence the personality of the person^[1]. Within the practice environment, pedodontist are the first to examine and screen children for developing malocclusions. Among numerous dental abnormalities, anterior crossbite is a major esthetic and functional concern to the parents during the developmental stage of a child. It is one of the major responsibilities of pediatric dentist or orthodontist to guide the developing dentition to a state of normalcy in line with the stage of orofacial growth and development^[2]. Anterior dental crossbite has a reported incidence of 4- 5% and usually becomes evident during the early mixed dentition phase.^[3]

According to American Association of Orthodontists Glossary, crossbite is an abnormal relationship of a tooth or teeth to the opposing teeth, in which normal buccolingual or labiolingual relationships are reversed.

The rate of self-correction of crossbites is too low to justify without intervention. An old saying in orthodontics states "The best time to treat a cross bite is the first time it is seen".^[1] Early cross-bite corrections lead to a stable and normal occlusion pattern and contribute to symmetrical condyle growth, harmonious TMJ, and overall growth in the mandible. Few of the choices

available for crossbite corrections are Catalans appliance, tongue blade therapy, expansion appliance, cross elastics etc.^[1]

Henceforth, this paper documents two cases in which anterior dental crossbite was successfully corrected during developing dentition using a simple fixed Catlan's appliance and tongue blade therapy.

Case Report

Both the cases reported here were in the early mixed dentition period and had Class-1 molar and canine relationship. There was sufficient mesiodistal distance available in both the cases to achieve labial movement of maxillary tooth.

Case 1

An 8-year-old female patient was reported to the pediatric dental department with a chief complaint of unaesthetic appearance of the front tooth. The medical and dental histories were non-contributory. Intraoral examination showed that the lingually deflected maxillary right central incisor (**Fig 1**). The diagnosis was a single tooth dental type anterior crossbite. Initially in this case, tongue blade therapy was given. But due to poor patient compliance and unable to perform tongue blade therapy according to instructions given, the patient reported without any change after 7 days (**Fig 2a and 2b**). So to treat the dental crossbite, lower anterior inclined plane (catlan's appliance) was planed. Parents were informed about the

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Fig 1: Single Tooth Anterior Crossbite



Fig 2: Tongue Blade Therapy Explained To Patient

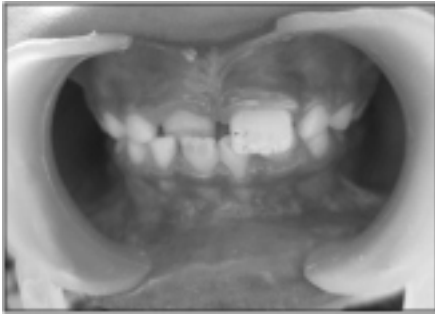


Fig 1b: Patient Returned With No Improvement After 7 Days



Fig 1la :Catlan's Appliance Constructed

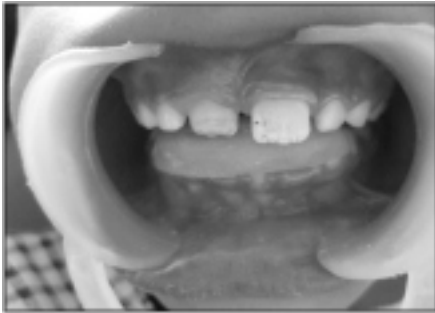


Fig 1lb: Catlan's Appliance Cemented With Zinc Oxide Eugenol



Fig 1V:Correction Of Crossbite



Fig 1V: Lingually Deflected 11 And Gingival Recession W.R.T 41

treatment, and a written consent was documented. Alginate impressions of both arches were made, and an acrylic inclined plane with a slope of 45 degree angulations to the long axis of the tooth was established. The inclined plane was cemented on to the mandibular incisors and canines with zinc oxide eugenol cement (**Fig 3a and 3b**). After the cementation of the inclined plane, the only contact point was present at the incisor region in state of occlusion. The patient was advised to maintain good oral hygiene and recalled every week to clinically evaluate the progress of the treatment. The patient was advised for a softer diet than usual for the first few days after the cementation. The inclined plane produced a forward sliding motion of the maxillary incisors on closure and an anterior crossbite correction was seen within 2 weeks itself (**Fig 4**). No post-operative sensitivity or pain was reported by the patient. Following correction, the Catlan's appliance was removed, the enamel surface was polished, and topical fluoride (APF gel) was applied.

Case 2

A 9 year old male patient reported to the pediatric dental department with the chief complaint of pain and mobility in lower front tooth. The medical and dental histories were non-contributory. Intraorally, it was observed that the maxillary right permanent central incisor(11) was lingually locked and gingival recession was seen in relation to 41(**Fig 5**). As 11 was in erupting stage tongue blade therapy was explained to the patient. The patient was instructed to insert the tongue blade at an angle between the teeth and he was asked to bite firmly for five seconds followed by rest. This is repeated for 25 times for three times a day (**Fig 6**). The patient was recalled after every one week and the crossbite was corrected within 15 days (**Fig 7**). In this particular case as the patient's compliance was good, the desired results were obtained with tongue blade only and no appliance was required further. The patient did not complain of any pain or inflammation postoperatively and was satisfied.

Discussion

Anterior crossbite is the lingual positioning of the maxillary anterior teeth in relationship to the mandibular anterior teeth. This may involve a single tooth or all four incisors. A variety of factors



Fig 1VI: Tongue Blade Therapy Demonstrated

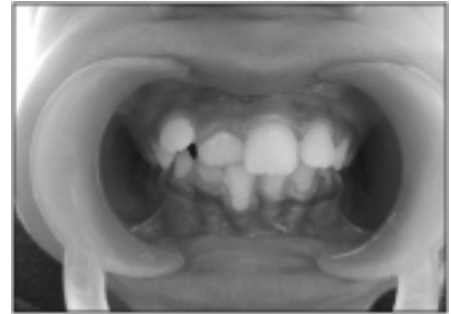


Fig 1VII: Correction Of Anterior Crossbite

reported to cause anterior dental crossbite, include a palatal eruption path of the maxillary anterior incisors; trauma to the primary incisor resulting in lingual displacement of the permanent tooth germ; supernumerary anterior teeth; an over-retained deciduous tooth; odontomas; inadequate arch length; and a habit of biting the upper lip.^[3]

There are many treatment options available for correction of crossbites according to the number and site of the teeth/tooth involved, the stage of the dentition and its etiology. The main goal of treatment is to tip the affected maxillary tooth or teeth labially to the point where a stable overbite relationship exists to prevent abnormal enamel abrasions, fractures of anterior teeth, periodontal pathosis, and to produce a more esthetic dentofacial complex and a better occlusion. Relapse is usually prevented by the normal overjet/overbite relationship that is achieved^[2].

The tongue blade is an effective method of treatment during the early phase of eruption, however, it requires total cooperation from the patient, which could not be achieved in first case. The Catlan's appliance works on the principle of Newton's third law of motion, the resin slope functions to tip an anterior tooth labially while the mandibular tooth is tipped slightly in the lingual direction. This method is a safe, cost effective, rapid

and easy alternative for the treatment of crossbite. As it is cemented on the incisors, the treatment outcome does not depend on patient cooperation, does not hamper the growth or cause any discomfort to the patient, and treatment is completed in very few visits to the dentist^[2].

Conclusion

It should be emphasized that it is very important to correct crossbites at an early age, reducing the need for long term orthodontic therapy in the future, justifying the saying “The best time to treat a cross bite is the first time it is seen”.

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Tactile Method For Estimation Of Working Length In Open Apex: A Case Report

Abstract

Accurate working length estimation in an open apex case is fraught with many difficulties. Apex locators, radiographs and paper point evaluations have all proven to be inaccurate in these challenging cases. In this clinical report a novel technique called "tactile method" for accurate assessment of working length in an open apex case has been highlighted.

Key Words

working length, tactile method, open apex

Introduction:

An 'open apex' is the presence of an exceptionally wide root canal at the apex and occurs when root development ceases as a result of pulpal necrosis in newly erupted teeth which may be due to trauma, extensive apical resorption, root-end resection or over-instrumentation.

Treatment of such teeth pose many challenges including increased risk of root fracture, difficulty in canal length determination, difficulty in instrumentation and obturation of the wide, apically divergent and thin canals^{[1],[2],[3]}. An accurate working length results in effective cleaning and shaping procedures confined within the root canal system and paves the way for a fluid tight obturation of all the portals of exit thus ensuring long term success of the treated tooth. Traditional methods of root canal length estimation like radiographs, apex locators and paper point evaluation are usually inadequate in such situations. This case report elicits the use of "Tactile Method" for accurate working length measurement in a maxillary anterior tooth as suggested in a previously published invitro study^[4].

Case Report

A 21 years old female patient reported to the author's clinic with a chief complaint of pain and discoloration with tooth no 21. Patient gave a childhood history of trauma to her front tooth and was found to be a mouth breather.

On clinical examination, the tooth in

question was mildly painful on vertical percussion and discolored with an Ellis Class II fracture mesially [Fig. 1].

An intraoral periapical (IOPA) radiograph of the tooth revealed presence of an open apex, and diffuse periapical radiolucency [Fig. 2].

The tooth was nonresponsive to heat testing. A diagnosis of pulpal necrosis associated with periapical pathology & large open apices with tooth no. 21 was made. After discussing various treatment options, the patient agreed to a treatment plan consisting of root canal treatment without rubber dam application (as the patient was a mouth breather and rejected the use of rubber dam vehemently), orthograde apical Mineral Trioxide Aggregate(MTA) plug and gutta percha obturation.

After securing local anesthesia to ease the mild painful symptoms, and access opening and pulpectomy, a size 120 H file (Dentsply Maillefer, France) was introduced till the estimated length (as measured from the preoperative IOPA) and found to be loose [Fig. 3]. Due to paucity of time an Intra Canal Medicament (ICM) of calcium hydroxide with iodine (Metapex, Meta Biomed Co, Korea) was placed in the canal, the tooth temporized with Zinc oxide eugenol (ZOE) temporary filling. The patient was prescribed Nonsteroidal Anti Inflammatory Drugs (NSAIDs) asked to report the next day for further treatment. Antibiotics were not

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Fig. 1: Pre-operative photo showing fractured and discolored 21.



Fig. 2: IOPA of the tooth showing large open apex and a diffuse periapical radiolucency.

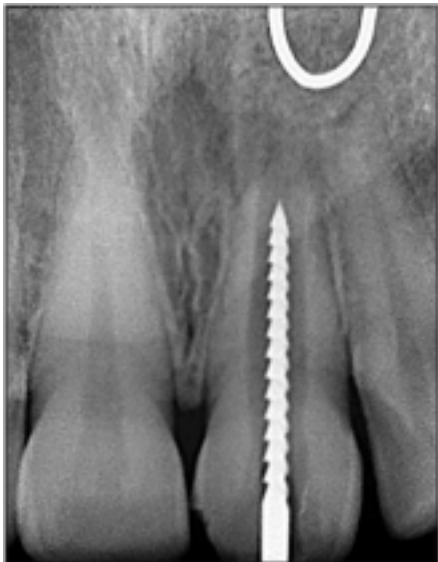


Fig. 3: IOPA showing no.120 H file loose at apex with 21.



Fig. 4: Bent no. 25 K file and schematic diagram of "The Tactile Method"



Fig. 5: IOPA showing the bent no. 25 K file engaging the mesial lip of the root apex (radiopaque ICM also visible at the apex).

prescribed as the patient was afebrile and did not show any signs of regional lymphadenopathy.

The next day the "The Tactile Method" for estimating the canal length as suggested by ElAyouti A. et al was used^[4]. After removing the temporary filling and the ICM, a size 25 (2% taper) stainless steel hand K file (Dentsply Maillefer, France) was bent at an angle of 90° at the tip (~1mm) using a universal orthodontic plier. The rubber stopper of the file was adjusted to a length as judged from the preoperative radiograph. The "Tactile Working Length" (TWL) for the root canal was determined by inserting the bent file into the canal and moving it apically along the root dentinal wall until it engaged the lip of the dentin at the apex [Fig. 4]. Care was taken not to injure the periapical tissues by over insertion. The silicon stopper was adjusted to a reference point at this length and the file disengaged from the root by turning it a full 90°, withdrawn and measured. Measurements were made with the bent portion facing mesial, distal, buccal and palatal and the length recorded as 19.6mm, 19.5mm, 19mm and 19mm respectively. The lowest figure of 19mm was taken as the TWL of the tooth.

Digital intraoral periapical xrays (Kodak RVG 5000) of mesial & distal measurements were taken for record keeping [Fig. 5, 6].

The canal was then cleaned and shaped with size 120(2% taper) K file (Dentsply Maillefer, France) using gentle circumferential filing of the dentinal walls and irrigated carefully using 3% sodium hypochlorite and 0.9% w/v saline alternatively. The canals were dried with paper points and the ICM was replaced in the canals and tooth temporized with ZOE. The patient was discharged and recalled after 10 days for evaluation.

The patient returned for recall after 3weeks, the temporary filling was removed and the canal was irrigated with copious saline to remove the ICM. The canal was dried with paper points and an apical plug of MTA (ProRoot MTA, Dentsply Tulsa, USA) was introduced in the apical 3mm following the manufacturer's instructions, a moist cotton pellet was then placed inside the canal, the tooth temporized and patient discharged.

After 24hrs the tooth was reopened and the MTA plug was probed with a smooth broach to confirm that it had set [Fig. 7]. The tooth was then obturated using chemically plasticized roll cone gutta percha using 1min chloroform (Bipin Enterprises, India) dip [Fig. 8, 9]. The patient was discharged and told to report after 2-3 weeks.

After two weeks core buildup was done using dual cure composite resin, the tooth was then restored to form, function and esthetics with a full coverage ceramic crown [Fig. 10].

The patient was recalled after one year



Fig. 6: IOPA showing the bent no. 25 K file engaging the distal lip of the root apex (radiopaque ICM also visible at the apex)



Fig. 7: IOPA showing MTA plug in apical 3mm.



Fig. 8: IOPA showing gutta percha master cone.



Fig. 9: IOPA showing obturated tooth.



Fig. 11: IOPA taken after one year showing adequate periapical healing with 21.

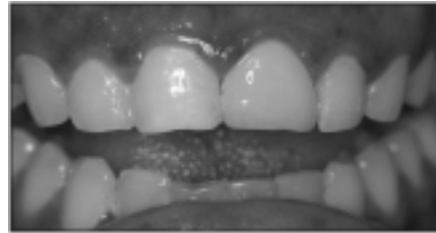


Fig. 10: Full coverage ceramic crown with 21.

and the tooth was found to be normal to percussion tests, a radiograph was also taken to ascertain adequate periapical healing [Fig. 11].

Discussion:

An accurate working length is essential for preventing overinstrumentation and overfilling and attaining optimum success during root canal treatment^{[5], [6]}.

In teeth with open apices the radiographic interpretation of canal length is even more difficult due to the altered apical anatomy and the missing periodontal ligament space at the apex^{[7], [8]}. Apex locators are of little use in such situations, as the wide root canals associated with open apices, adversely influence the function of apex locators^{[9], [10], [11], [12]}.

Paper point technique may be used in such cases. This technique requires the canal to be completely dry and the periapical tissues to be relatively moist. In open apices, the control of moisture is difficult because the contact area to the inflamed periapical tissues is large, and excess moisture is common, which may result in measurement errors.

Moreover, to obtain accurate measurements when using paper points, the periapical tissues must be located at the same level of the apical terminus, a condition that may not be fulfilled in open apices, (because of down growth of periapical tissues into the canal up to a distance of 3 mm) which may result in short measurements^[13].

The invitro accuracy of "The Tactile Method" was 97.7% within a range of ± 0.5 mm. This method is however not feasible in curved canals or in teeth with an apical size smaller than no. 100 as the gauging instrument needs to be dragged along the canal wall and twisted once beyond the apex with the bend being 1mm coronal to the tip of the instrument^[4].

The size of the file used in this case was no 25(2% taper); this provided enough instrument stiffness to probe the dentinal wall; a larger size may be used if the situation permits.

The difficulty one experiences in disengaging of the file tip from dentinal wall can be overcome by curving the file along the shaft and slightly rotating it on removal out of the canal. The operator's orientation may be further enhanced by adjusting the marker on the silicon ring to indicate the direction of the bent tip. One needs to work very cautiously while inserting and hooking the file (when at the apex); as there are chances of injuring the periapical tissues which will impede adequate healing. Practising on simulated canals is highly recommended.

Conclusion

Open Apices are difficult cases to manage. In straight canals part of the problem associated with inaccurate working lengths may be solved if one uses "The Tactile Method" presented in this clinical report. However the use of this technique is limited only to canals larger than file size 100 and should not be tried in curved canals.

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Papillon-lefevre Syndrome – A Case Report And Its Management

Abstract

Papillon-Lefevre syndrome (PLS) is an extremely rare genodermatosis inherited as an autosomal recessive trait. This disorder is characterized by palmoplantar keratoderma and precocious rapidly progressive periodontitis, leading to premature loss of deciduous and permanent teeth. Early diagnosis of the syndrome can help in preserving the teeth using multidisciplinary approach. This paper presents clinical approach in a 14 years old male diagnosed with Papillon-Lefevre syndrome.

Key Words

palmoplantar keratoderma, periodontitis, genodermatosis

Introduction

Papillon Lefèvre syndrome was first described by two French physicians Papillon and Lefèvre in 1924^[1]. It is also called as Juvenile (precocious) periodontosis with palmar plantar hyperkeratosis. Incidence of this syndrome is 1-4 persons per million and males & females are equally affected^[2]. Parental consanguinity is seen in 20%-40% cases^[3]. The common features of PLS include palmoplantar hyperkeratosis associated with severe early onset periodontitis and premature loss of primary & permanent teeth. Gorlin et al stated that calcification of dura matter is the third component of the syndrome^[4]. Additional symptoms & findings may include frequent pyogenic skin infection, nail dystrophy & hyperhidrosis. Patients with PLS are predisposed to develop pyogenic liver abscess due to impairment of the immune system.

Palmoplantar lesions usually have its onset during the time of tooth eruption between ages of six months to three years. Sharply demarcated erythematous keratotic plaques involve entire surface of palm and soles which may vary from mild psoriasiform scaly skin to hyperkeratosis. Other sites which may be affected include knees, elbows, eyelids, cheeks, labial commissures & dorsal of fingers etc. Hairs are usually normal but the nails may show transverse grooving and fissuring.

Dental involvement is typically evident

immediately after tooth eruption and is accompanied by severe gingival inflammation. Development and eruption of deciduous teeth start normally but gingiva is bright red & bleeds easily even in absence of any local etiologic factor. It leads to exfoliation of all the primary teeth by age of 4-5 years^[1]. After exfoliation, inflammation subsides and gingiva appears normal. As permanent teeth erupt, the same process of gingival inflammation and periodontitis is repeated, most of permanent teeth are lost by age of 15-17 years in the absence of dental treatment^[5]. Teeth present 'Floating in air' image on dental radiography due to severe resorption of alveolar bone.

Here we report a case of PLS in 14 years old boy with classic clinical features.

Case Report

A 14 years old male patient presented to Department of Pedodontics & Preventive Dentistry, complaining of missing teeth and difficulty in eating due to mobile permanent teeth (**Fig. 1**). Past dental history revealed that his deciduous teeth had erupted normally but were lost gradually by age of 4-5 years. Similarly some of his permanent teeth were also lost prematurely after erupting normally. There was history of recurrent swelling of gums followed by loosening of permanent teeth. Thickening and scaling of palmoplantar skin was present since childhood. The skin lesions became worse during winters. History of consanguineous marriage was positive.

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Rest of family members including parents and six siblings were apparently normal.

Clinical Examination

Cutaneous examination revealed well demarcated yellow keratotic plaques on his palms and soles (**Fig. 2 & 3**). The skin over dorsal surface of joints of hands & feet presented increased keratinization and affected skin was clearly demarcated from adjacent normal skin (**Fig. 4**). His nails and hair were normal.

Intraoral examination revealed painful, swollen and bleeding gums along with halitosis (**Fig. 5**). The teeth present in oral cavity were 11, 16, 21, 22, 23, 27, 31, 33, 36, 37, 41, 43, and 47. Root stumps of 12 & 15 were also present. 41 & 36 showed grade III mobility. Pathological migration of the teeth present was visible (**Fig. 6 & 7**). The gingiva around teeth was inflamed and tender while it appeared normal in edentulous area. The orthopantomograph revealed generalized alveolar bone loss giving the teeth "floating in air" appearance (**Fig. 9**). Class III profile was visible on lateral



Fig 1: Pre-treatment extra-oral photograph



Fig 2: Palmar surface showing hyperkeratosis



Fig 3: Plantar surface showing hyperkeratosis



Fig 4: Dorsal surface of hands and feet showing keratotic plaques

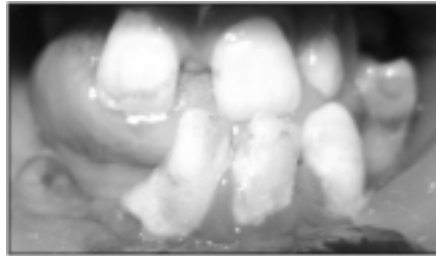


Fig 5: Intraoral photograph showing missing teeth and inflamed gingiva in relation to existing teeth

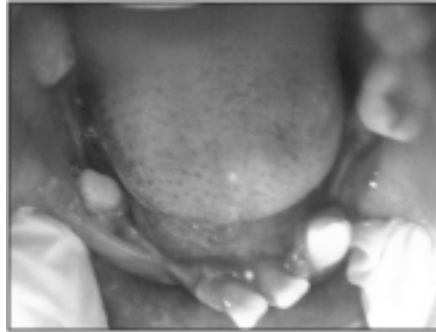


Fig 6: Intraoral photograph showing missing teeth in mandibular arch

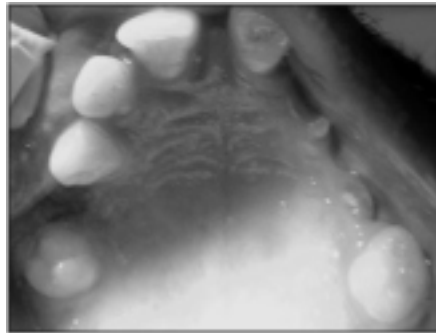


Fig 7: Intraoral photograph showing root stumps and missing teeth in maxillary arch



Fig 8: Cephalogram showing class III profile

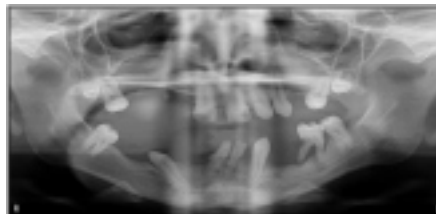


Fig 9: OPG showing "floating in air" appearance of the teeth



Fig 10: Post treatment photograph of the patient with removable partial prosthesis

cephalogram (**Fig. 8**). Skull x-ray showed thickening of dura matter. Routine laboratory investigations were within normal limits.

On basis of history and mentioned clinical findings, diagnosis of PLS was made.

Treatment

Extraction of root stump 12 and grade III mobile teeth 36 & 41 was done. Patient was put on antibiotics and mouth wash followed by complete oral prophylaxis. Oral hygiene maintenance instructions were given to patient. Distally tilted tooth 33 was up righted after completing the root canal treatment. Complete oral rehabilitation was done with transitional dentures in the maxillary & mandibular arch (**Fig. 10**). Consultation of dermatologist was taken for hyperkeratosis of palmar & plantar surfaces.

Discussion

A case of PLS is classified on basis of following three criterias – a) palmoplantar hyperkeratosis b) early loss of deciduous & permanent teeth c) autosomal recessive inheritance^[6]. With both the parents as recessive carriers, there are 25% chances of producing offsprings with PLS^[3].

Etiology of PLS is still unknown. Multiple factors are involved in causation of PLS. An impairment of neutrophil chemotaxis, phagocytosis & bactericidal activities, presence of actinomycetomycins (virulent gram negative anaerobic pathogen) in

periodontal pockets, impaired immune mediated mechanisms like depression of helper/suppressor T cells ratio & elevation of serum Ig G are some of the important factors. And recently, PLS gene locus has been localized to chromosome 11q14-21 where mutation of cathepsin C gene occurs^[2]. The cathepsin C gene encodes a cysteine-lysosomal protease also known as dipeptidyl-peptidase I. The cathepsin-C gene is expressed in epithelial regions commonly affected by PLS such as palms, soles, knees, and keratinized oral gingiva.

In our case report, the symptoms, clinical findings and past dental history resembles to the classical syndrome of PLS. Because of low socioeconomic status of the patient, genetic testing could not be performed. But the case reported was associated with consanguinity of parents. As parents were healthy and there was no family history of disease, autosomal recessive pattern of inheritance was suggested.

Although Hiam-munk syndrome and PLS share the cardinal features of palmoplantar keratoderma and pre-pubertal periodontitis as both come under the type IV palmoplantar ectodermal dysplasias. But the sufferers of HMS also exhibit arachnodactyly, acro-osteolysis and deformities of phalanges of hand^[7]. Life threatening disorders like leukemia and neutropenias should be excluded because they also present with loosening of teeth along with extensive gingivitis, haemorrhage and ulceration^[8].

Acrodynia also known as Feers' syndrome, shows premature loss of deciduous and/or permanent teeth, is caused by mercury intoxication. But in this condition erythrocytosis, muscle pain, insomnia, sweating and psychic disturbances are additional features. It presents in children between ages of six months and four years^{[9],[10]}.

In hypophosphatasia, the teeth, which are hypoplastic, are prematurely shed. There are increased amounts of phospho ethanolamine in the urine^[9].

Some other disorders in which premature loss of primary and permanent teeth occur are Langerhans cell histiocytosis, Chediak-Higashi syndrome and Takahara's syndrome^[8].

Other conditions which are associated with palmoplantar keratosis but without periodontopathy are palmoplantar hyperkeratosis of Unna Thost, mal de Meleda, Howel-Evans syndrome, keratosis punctate and Greither's syndrome^{[10],[11]}.

Recent studies have shown that PLS syndrome is manageable and permanent teeth can be saved. Various treatment modalities have been proposed for PLS like early extraction of primary teeth, construction of complete denture after removal of primary teeth, systemic and local antibiotic treatment and synthetic retinoids^[3] & then adjustment of denture base to allow emergence of permanent dentition. Oral retinoids (aciretin, etretinate & isotretinoin) are main course of treatment for both keratoderma & periodontitis associated with PLS. If oral retinoids are given before eruption of permanent teeth at age of 5 years, normal dentition can be maintained^[7]. Without treatment these patients could be rendered edentulous at very young ages which instills social phobia in these patients and they are unable to communicate with others. The use of implants could considerably improve future treatment options for oral rehabilitation^[12].

Summary

This case is presented here because of importance of its early diagnosis and intervention by Pedodontists because most of times they are the first to come in contact with such patients and can help the patients to maintain their dental health.

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One Stage Surgery Utilizing A Synchronized Combination Of Three Barrier Techniques For The Treatment Of Iatrogenic Class III Marginal Tissue Recession Extended Up To Root Apex In An Endo - Perio Treated Malpositioned Tooth: A Case Report

Abstract

Combined endodontic and periodontal lesions are the common conditions often difficult to diagnose. Inappropriate diagnosis and treatment plan for the same can result in reoccurrence and undesirable complications such as sinus formation, marginal tissue recession (MTR) etc. Predictable coverage of exposed roots and new attachment is possible in well-defined clinical situations by utilising different treatment modalities. We report a case of iatrogenic, Mahajan modification of Miller's class III marginal tissue recession extending from cemento-enamel junction to the root apex of malpositioned endo-perio treated maxillary right lateral incisor treated by a synchronized combination of chemical (tetracycline root conditioning (TRC)), biological (subepithelial connective graft (SCTG)) barrier in conjunction with physical barrier (coronally advanced pedicle flap) in one stage surgery leads to 100% root coverage with gain in clinical attachment and increase in width of attached gingiva resulting in desirable esthetic and functional outcome at 9 months interval.

Key Words

marginal tissue recession, sub epithelial connective tissue graft, root conditioning, advanced pedicle flap, new attachment.

Introduction

Marginal tissue recession (MTR) is a clinical condition in which the marginal periodontal tissue is located apical to the cemento-enamel junction (CEJ) which can lead to dentinal hypersensitivity, may compromise the width of attached gingiva, vestibular depth and desirable esthetics etc. Routinely, class III MTR is treated by two stage surgical procedure which can lead to inconvenience and certain complications^[1]. So, single stage surgical approach has been attempted for treatment of Mahajan's modification of Miller's class III MTR of maxillary right lateral incisor by utilizing a synchronized combination of three barrier technique to achieve root coverage associated new attachment.

Case Report

A 15 year old patient visited the outpatient Department of Periodontology, Surendera dental college and research institute with chief complaint of receded gum with respect to upper right second tooth since 2-3 months. Patient past

dental history reveals 6 months back he had pain and swelling w.r.t 11 and 12 for which the root canal treatment was carried out by private practitioner but lesion reoccurred after 2 months and retreatment with periapical curettage was carried out after which he experienced MTR w.r.t 12. Patient was esthetically conscious, feared of loosening the tooth. Patient was non smoker, having good health with no associated systemic problem. Upon clinical examination, mahajan modification of miller's^[2] class III MTR extending from CEJ to the root apex with lack of attached gingival, with class II and class I papillary height w.r.t 11,12 and 12,13 respectively (Norland and Tarnow 1998 classification), with compromised aesthetics on smiling w.r.t 12. MTR extended 10 mm vertically (Fig.1) and 3, 2 and 1 mm horizontally just apical to CEJ, at coronal, mid and apical 1/3rd of buccal surface of 12 respectively (Fig.2). Periodontal probing was 5mm w.r.t mesial aspect of 11,12, 13. Radiographic examination revealed radiopaque material in the root canal of

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Fig. 1 Pre operative view showing MTR of 10mm



Fig. 2 Preoperative view - horizontal MTR of 3mm at coronal 1/3rd

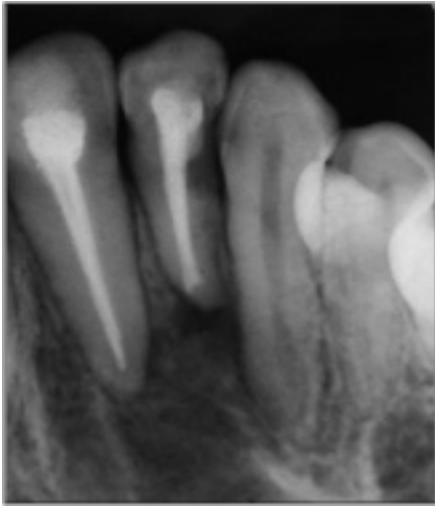


Fig. 3 Pre operative IOPA indicates resolved periapical lesion with interdenal bone loss in the coronal 1/3rd area.



Fig. 7 During tetracycline root conditioning



Fig. 8 SCTG obtained using trap door technique



Fig. 4 Internal bevel incision given

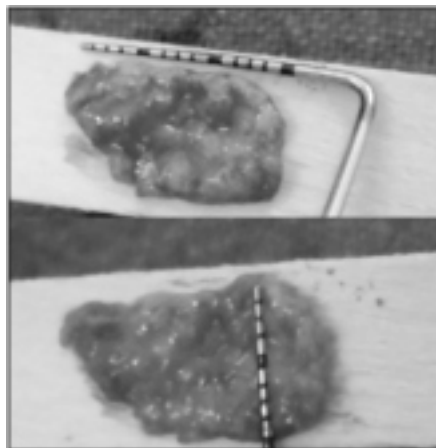


Fig. 9 SCTG obtained measuring 15mm length and 10mm wide



Fig. 5 Crevicular incision given

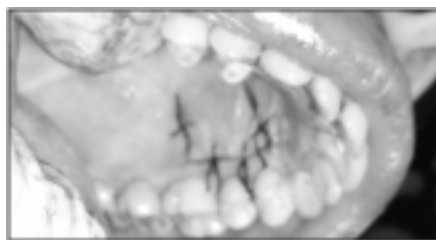


Fig. 10 Suture at donor site



Fig. 12 SCTG immediately after flap closure



Fig. 6 Full thickness flap reflection with interdenal bone loss



Fig. 11 SCTG placement at recipient site



Fig. 13 Post operative after 2 weeks

11, 12 with resolved periapical lesion and interdenal bone loss limited to the coronal 1/3rd (Fig.3).

Patient was instructed to maintain the strict oral hygiene and phase I therapy was performed. The objective of the present surgical procedure was not only to obtain aesthetically acceptable root coverage but also gain in clinical attachment and width of attached gingiva. Therefore, a synchronized combination of chemical (tetracycline root conditioning (TRC)), biological (subepithelial connective graft (SCTG)) and physical barrier (coronally advanced pedicle flap) in one stage surgery was proposed to be the best and economical option. An written informed consent was procured for the same.

Surgery was performed under strict aseptic conditions under local anesthesia, internal bevel incision (Fig.4) was given w.r.t 12 followed by crevicular incision (Fig.5) w.r.t 11,12,13. Full thickness flap was raised (Fig.6) beyond mucogingival junction and the periosteum was incised to form split thickness flap using sharp dissection with surgical blade no. 15 to facilitate the coronal advancement of pedicle flap without tension. Root planning and root prominence finishing done followed by TRC (Fig.7). After harvesting SCTG measuring approximately 15,11 and 1.5 mm in width, length, thickness using trap door technique (Fig.8,9), suturing was done (Fig.10) over the donor site. SCTG was placed (Fig.11) and after recipient vascular bed preparation by perforating



Fig. 14 Post operative at 3 months

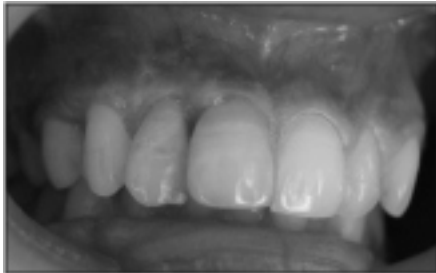


Fig. 15 Post operative view at 9 months

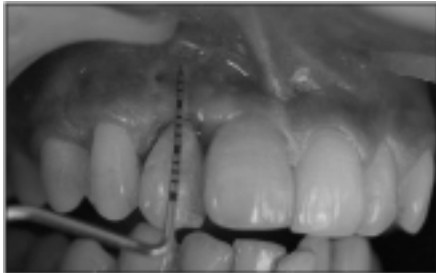


Fig. 16 Post operative view presenting width of attached gingiva

interdental bone, in the mid apical area adjacent to the recession as well as from the periosteal connective tissue bed apical to the recession and secured in the recipient site first followed by coronal advancement of pedicle flap sutured together in the apical 1/3 rd area and placed over the graft using catgut 4-0 absorbable sutures (Fig.12) Periodontal dressing was applied. The post operative instructions and medications were advised. Sutures were removed from donor site after 10 days whereas periodontal dressing was changed once at weekly intervals for the next 2 weeks (Fig.13). Maintenance therapy was performed at 15 days interval for 3 months. Post operative follow up was done at 1, 3 (Fig.14) and 9 months interval (Fig.15). 100% root coverage was obtained with gain in 9 mm clinical attachment, 6mm width of attached gingiva at the buccal aspect of 12 (Fig.16) with 1 mm probing depth w.r.t 11,12,13 without clinically visible CEJ. Patient was highly satisfied with aesthetic and functional outcome.

Discussion

MTR and its corollary, root exposure, may result in several undesirable sequelae but above all undesirable aesthetic seems to be the most common complaint which dictate the patient to seek periodontal treatment. The most commonly used classification system for MTR was proposed by Sullivan and Atkins (1968), Miller's (1985)^[3] but Miller's classification instead of being comprehensive and simple have few drawbacks one of which was it does not mention any objective criteria for assessing the severity of hard tissue or soft tissue loss in the Miller class III and IV recession which was well described by Mahajan modification of Miller classification^[2].

Various treatment modalities have been proposed for the root coverage in the literature but out of all the SCTG not only provide predictable percentage of root coverage with excellent esthetic outcome but also enhance new attachment^[5].

Multiple research on tetracycline root conditioning histologically demonstrates the exposure of dentin collagen, regulate the absorption of plasma proteins thereby enhancing the adhesion of blood clot^[6], facilitating the deposition of cementum by inducing mesenchymal cells in the adjacent tissue to differentiate into fibroblasts^[7] and also suppress the epithelial cell attachment and thereby preventing the epithelial down growth^[8]. According to the systematic reviews by Rocuzzo et al (2002) and Oates et al (2003) coronally advanced pedicle flaps with connective tissue grafts results in significantly greater root coverage compared to guided tissue regeneration^[3]. In the present case report, a synchronized combination of three barrier techniques in single stage surgery was utilized for Mahajan modification of Miller's class III MTR demonstrate excellent outcome at 9 month post operatively and result in accordance with previous literature^[9] where only partial recession coverage was achieved in Miller class III defects, regardless of the technique performed^[10]. Further randomized clinical trials with a larger population must be conducted to further evaluate the success of the technique employed for such defects.

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Management Of An Unusual Severe Multinodular Buccal Mandibular Exostosis Employing Resective Osseous Surgery - A Case Report

Abstract

Exostoses of the mandible are nodular excrescences of mature bone rarely documented in literature owing to its low prevalence rates. Multifactorial complex interplay has been implicated in the etiology though no consensus has been reached until now. Temperamentally benign, these are seldom reported in the dental office unless functional or esthetic complications set in. This case report describes a rare case of multiple mandibular exostosis in a female patient along the labial aspect of the alveolus with consequential gross deformity. Patients concern for reinstatement of her esthetics warranted a surgical intervention. Successful restitution of the physiological bony contours without any untoward complications or recurrence was accomplished thus affording as a viable therapeutic option whenever suitable indicated.

Key Words

Exostosis, Resective osseous surgery, occlusal trauma, multiple mandibular exostosis, osteoplasty

Introduction

Though routinely reported in literature since 180 years^[1], there is a continuing paucity regarding the incidence and prevalence rates of exostoses, typically torus mandibularis in the published texts. These bony hamartomas are asymptomatic, benign, exophytic nodular outgrowths of dense cortical bone^[2] that are relatively avascular. Maxilla is shown to exhibit the highest prevalence rate of 5.1:1 in comparison to mandible with male population afflicted more than females 1.66:1, in all intraoral locations^[3]. Usually the bicuspid and molar areas are the affected sites yet occasionally they may occur in other parts of the jaw, either as a smooth bulging of the bone surface continuous with the adjacent area or as discrete, multilobular spherical projections with a broad base that forms a nodular cluster^[4,15]. Buccal surface involvement however, typically in the mandible has been an unusual occurrence.

Commonly presenting as solitary discreet masses of varying proportions, in the rare instances of untoward sporadic exacerbations, they may present as colossal unaesthetic masses, creating speech issues due to limited tongue space. Additionally, they may contribute significantly towards the inception of

periodontal disease by promoting food lodgement^[6]. Histologically, the soft tissue overlying the exostosis has been found to be thinner than the gingiva thus predisposing it to trauma or ulceration when masticating hard or sharp food^[7]. Successful recording of dental impressions and seating of complete as well as partial dentures have posed a constant therapeutic challenge in such patients. No malignant potential has been reported till date.

With the growing emphasis on cosmetic dentistry and esthetics especially among the youngsters, surgical removal is routinely warranted for such lesions. This article will report a rare case of multiple mandibular exostosis along the anterior labial region along with its surgical management.

Case Description

A 33 year old female patient reported to our dental office with the chief complaint of unaesthetic facial appearance owing to the increased lower jaw size. On clinical examination, multiple bony projections along the buccal surface of the jaw in the anterior region, at a level below the mucobuccal fold could be visualized. Overlying mucosa appeared to be stretched thus blanched with focal areas of inflammation and traumatic

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ulcerations. Keeping in mind the predicament of the patient and a desire for an esthetic form, surgical intervention for complete excision was planned. Routine blood and urine investigations were found to be non-contributory. After explaining the patient the potential risks and benefits, an informed consent was obtained. Once adequate anesthesia was achieved, a full thickness mucoperiosteal flap was elevated to gain complete access to the exostosis. Following exposure of the lesion, a molt periosteal elevator was placed at the apical end to prevent inadvertent injury during excision. The bony growth was sequentially reduced from the superior border employing a micromotor diamond bur under copious saline irrigation. Final step involved the complete alveolar gradualization to mimic the physiological bone contour. Mucoperiosteal flap was trimmed to fit the re-established bony outline and secured with black silk sutures. Postoperatively patient was appropriately prescribed medication and chlorhexidine mouth wash. No obvious post-operative complications were observed. The patient was scheduled to report back in a week's time for post-operative follow-up and suture removal.



Fig.1. Multiple buccal exostoses in mandibular anterior region: Pre-operative View



Fig.2. Intra sulcular incision to gain access to the surgical site



Fig.3. Full thickness mucoperiosteal flap raised to expose the exostoses



Fig.4. Scoring of the bony exostosis being done with a micromotor diamond bur



Fig.5. Surgical site following restitution of anatomical contours



Fig.6. Surgical site after placement of sutures

Uneventful healing at the surgical site with no untoward discomfort was reported by the patient.

Discussion

Meager representation of 0.09% among the contemporary constitutional bony disorders merits exostosis as an uncommon benign tumor of the oral cavity. The novelty of this article lies with the fact that the bony outgrowth in question was found along the buccal aspect of the mandible in a female patient; all factors emphatically documented in literature of least predilection.

Several authors have attempted to investigate the etiology of this bony hamartoma though no consensus has been reached. A multifactorial etiology encompassing a complex interplay of genetic and environmental factors has been strongly implicated in the advent of the lesion^{[8], [9]}. Giving credence to the quasi-continuous genetic or threshold theory, Gould AW(1964)^[10] identified exostosis as an autosomal dominant lesion expressed in the event when the environmental factors reach their threshold levels. Variation in frequency and morphology among various racial and ethnic groups also strongly suggest a genetic basis of the lesion attributable presumably to the variation among groups in diet and food preparation habits^{[11], [12]}. Curiously, literature documents cases of spontaneous sequestration of bone occurring with an almost certainty in patients genetically predisposed to develop exostosis.

A cumulative functional influence on the alveolar bone particularly in the elderly patients has been positively correlated to an increased prevalence of exostosis^[13] in this strata of patients as identified by Nery et al^[14]. The bony outgrowths are thought to represent a reaction to increased or abnormal occlusal stress to the teeth in the involved areas^[15]. Clinical research has extensively supported this hypothesis based on significant co-occurrence of exostosis in patients with para-functional habits viz. bruxism, clenching and grinding^{[16], [17]}. Jaws deformed due to bony buttress formation in an attempt to ward off excessive occlusal forces in these patients provide the clinical evidence for the same. Severe occlusal wear alters the masticatory plane and changes the distribution of strain and pressure forces along the alveolar bone and this redistribution exerted

particularly by molars has been experimentally shown to induce bone remodeling in rat maxillas^[18]. Sonnier et al^[19] in contrast however reported a decreasing prevalence beyond 50 years of age correlating it with edentulism resulting in gradual remodeling and its subsequent obliteration^[20]. A diminished masticatory demand after the third and fourth decades of life appears to be underlying mechanism.

A remarkably strong pattern of concurrence of exostosis, torus palatinus and torus mandibularis has been recognized^[3] in literature which persuasively suggests general multiple exostosis syndrome.

Interestingly, van den Broek (1941)^[21] incriminated chemical irritation of the alveolar bone as witnessed in periodontal disease with subsequent mineralisation of the inflamed fibrous tissue, as a possible etiological factor for exostosis. Buccal exostoses have also exhibited a significant correlation with caries and calculus occurrence, calculus severity and a particularly strong association with periodontal disease as demonstrated by Pechenkina and Benfer^[22].

Ossenberg^[23] proposed the etiologic role of root apex pressure on the periodontal ligament chiefly in the incidence of mandibular exostosis. Lingually tilted roots of upper molar and buccally tilted lower molar roots is known to exert pressure on the periodontal ligament in opposite directions resulting in micro ruptures in the ligament thereby initiating periodontal infection triggering exostosis formation.

Schriener^[24] postulated vitamin deficiencies leading to damaging of connective tissue and frequent haemorrhages as yet another possible causative factor for exostosis in genetically susceptible individuals.

For successful therapeutic intervention, it is therefore imperative to correctly diagnose the contributing factors to allow complete resolution of the lesion.

Conclusion

Although a multifactorial etiology has been established, yet cosmetic and functional demands of the patients necessitates the surgical excision of such bony excrescences with a concomitant attempt to limit the underlying etiological factors as much as possible.

Conflict Of Interest

There was no financial support in the

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Complete Oral Rehabilitation - Aesthetics, Phonetics & Function Of Severely Carious Dentition In A Blind Elderly Patient

Abstract

Complete oral rehabilitation is a challenging treatment modality that enhances the appearance of the patient and corrects imperfections in the occlusion. It is a combination of the science of neuromuscular dentistry with the display of artistic dentistry. Vertical dimension, centric relation, speech and muscle tone are its essential elements. Full mouth rehabilitation tends to create smile that is not only esthetic but also functionally comfortable. It requires a careful evaluation of the subject as a whole & an understanding of the causes behind the loss of vertical dimension. The practitioner needs to assess each aspect carefully with regards to existing natural dentition and its relationship with the stomatognathic system. This insight will determine whether it is necessary to restore one or both the arches or sometimes only a few teeth in an arch. At times it is observed that only one of the two arches is so destroyed that the entire loss of vertical facial height is only because of its breakdown & can be corrected by the restoration of this arch alone. Therefore an astute diagnosis is paramount in planning any cosmetic or functional changes in a mutilated dentition. A case has to be considered not only in terms of correcting worn out, broken or discolored teeth but also requires treating the oral cavity holistically.

Key Words

Oral Rehabilitation, vertical dimension, zirconia crowns, mutually protected occlusion.

Introduction

Restoration of the severely broken down dentition is one of the most demanding procedures in dentistry. The steps involved in treatment of these patients include a comprehensive examination, diagnostic mounting and diagnostic wax-up, careful planning and sequencing of various steps, discussion with the patient of the different treatment alternatives and careful execution of the treatment plan^{[1],[2],[3]}.

In order to successfully restore and maintain the teeth, one must gain insight into how the teeth arrived at this state of destruction. Tooth wear can result from caries, abrasion, attrition, and erosion. While all occlusions wear to some degree over the lifetime of the patient, normal physiological wear usually does not require correction. Severe or excessive wear due to any of the reasons results into tooth destruction that requires restorative intervention^{[4],[5]}. Once a complete recognition of the etiology of present state of dentition is made, a treatment plan can be formulated, based on the number of teeth to be treated, condylar position, space availability, the occlusal

vertical dimension of occlusion (OVD), and the choice of restorative material.

The etiology of loss of vertical dimension for this patient was primarily dental decay in the upper arch, because of lack of oral hygiene maintenance due to blindness; however, it can be hypothesized that the blind patient also had a history of stress which may have led to parafunctional occlusal habit and started grinding her anterior teeth. Once the anterior teeth got shorter, the patient lost anterior guidance and further developed posterior interferences^[6]. The posterior interferences in lateral excursions activated the masseter and temporalis muscles, generating more forces on the teeth. Therefore it was paramount to adopt an occlusal scheme that prevented the future destruction of the new restorations at the increased vertical dimension - a mutually protected occlusal plan was implemented^[7].

The present case demonstrates the restoration of masticatory efficiency & aesthetics of a blind elderly patient with endodontics & metal free restorations of the maxillary arch alone while also raising the collapsed occlusal vertical

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dimension(OVD) of the patient along with. As anatomy & physiology of the mandibular teeth, mandibular plane of occlusion & the cervicoincisal length of the lower anteriors appeared satisfactory it wasn't deemed necessary to fiddle with the lower arch as well. Therefore, a minimally invasive treatment plan was formulated & executed through a combination of dental occlusion, dental balance, and functionality with dental esthetics while, keeping in mind the patients needs & also preserving the sanctity of the entire stomatognathic system^{[8],[9]}.

Clinical Report

A 64 yr old blind female patient reported with the chief complaint of inability in mastication & her relatives complained of foul smelling & an unaesthetic mouth. Clinical examination revealed severely carious & broken down anterior and posterior maxillary teeth (**Fig. 1, 2**). Intraoral examination revealed over closure due to generalized caries & subsequent breakdown of maxillary teeth, however mandibular teeth appeared normal (**Fig. 3**). Extraoral examination revealed no facial asymmetry or muscle tenderness. The

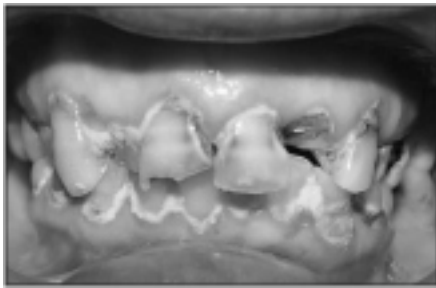


Fig. 1 Preoperative extra oral view



Fig. 2 Preoperative extra oral view

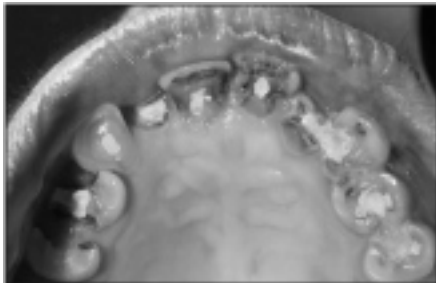


Fig. 3 Preoperative intraoral view



Fig. 4 Facebow recording



Fig. 5 Diagnostic wax up

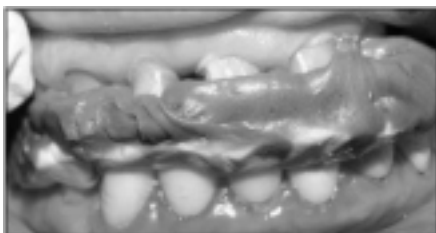


Fig. 6 Bite-registration at increased vertical dimension

mandibular movements were normal, TMJ evaluation was unremarkable with normal jaw opening and range of motion, no joint sounds, signs or symptoms of instability. Facial appearance showed wrinkles, and drooping commissures at the corner of the mouth indicating loss of vertical dimension. Facial measurements showed increased interocclusal distance far beyond the normal (2–4 mm) due to carious breakdown of upper dentition. Phonetic examination revealed—the S sound altered to F due to increased interocclusal space.

Impressions for study casts were made with irreversible hydrocolloid material along with a centric relation occlusal record. The patient's casts were mounted on a fully adjustable articulator (Stratos300-Ivoclar Vivadent) using face bow (Fig. 4) and the centric relation record. After studying & mounting the diagnostic casts, it was observed that because of the destruction of upper teeth, maxillary occlusal plane was nonexistent; however the lower teeth were normal without any significant signs of wear or decay & exhibited a regular harmonious occlusal plane.

From all the aforesaid assessments, it was decided that apart from restoration of maxillary teeth to normal health & function, the vertical dimension of the patient had to be increased to a proper comfortable position which is called the physiological neuromuscular rest position. The findings were explained to the patient & her relatives, and treatment options were presented. The treatment goals were to restore function, lost occlusal vertical dimension (OVD), to correct the maxillary occlusal plane, and to restore the esthetics of the patient's dentition.

The first step in this case was to determine how much to increase the patients vertical dimension. Although there is more than one way to find this physiologic position, in this case we used the esthetic & phonetic method to determine the correct resting position of mandible where the muscles are at rest. The facial measurements showed an increase by 4mm of the existing OVD in order to have a comfortable phonetics & pleasing esthetics. The new OVD was set by 4mm increase in incisal guidance pin of the articulator. Diagnostic wax up (Fig. 5) of the upper arch was performed

at the new VD & a putty index in poly vinyl siloxane was made from it

Following this endodontic treatment was performed on all the remaining maxillary teeth & composite build up done in order to lengthen & reinforce them to receive & retain the crowns. Thereafter crown preparations for all ceramic crowns was performed on all the upper teeth A full-arch polyether impression (3M ESPE, Impregum) of the prepared upper arch was then taken, & along with the registered bite (Fig. 6), sent to the laboratory for the fabrication of temporaries. Then using the indirect technique, the putty index made from the diagnostic wax up was used to fabricate provisionals on this cast with the with Temp Bond auto polymerizing resin (3M ESPE, Germany). The temporaries were then tried in the mouth for fit, esthetics & comfort. Necessary adjustments were made in the centric & eccentric movements. After the required reshaping in the mouth to achieve ideal contour, temporaries were cemented using eugenol free temporary luting cement (Rely X Temp NE, 3M ESPE, Germany). Once the provisional restorations were equilibrated and the aesthetics and phonetics were deemed satisfactory, the adaptation of the patient to increased VD was evaluated during 6-week period. No muscle tenderness or discomfort in TMJ was noted during this period. Once the occlusal adjustments, speech and esthetics appeared satisfactory, an occlusal bite record was taken with the provisionals against the mandibular naturals. Casts were mounted on the articulator with facebow transfer and the occlusal bite record taken in centric and eccentric relations. These records along with digital photographs of the preparations and provisional restorations were sent to the ceramist so that he had all the information necessary to fabricate the definitive restorations. The provisional restorations were removed & an impression of the maxillary preparations made in putty wash technique using 3M ESPE rubber base Express XT Putty soft & Express XT light body (Germany) & model poured in TypeIV die stone (Kalabhai). The mandibular model was next mounted against the maxillary preparation model with the first set of bite records (Fig. 7). Definitive Zirconia based restorations in the form of individual crowns were fabricated for each crown preparation (Fig. 8). The



Fig. 7 Mounting the maxillary preparation model on the articulator with bite at raised vertical dimension

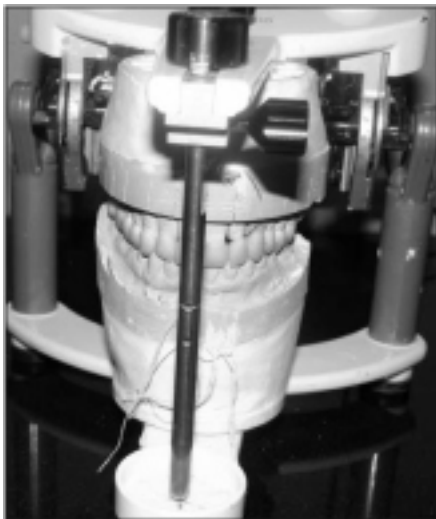


Fig. 8 Definitive zirconia restorations on the articulator



Fig. 9 Tryin of Zirconia copings



Fig. 10 Postoperative intra oral view



Fig. 11 Postoperative extra oral view

Zirconia copings were first tried in the oral cavity for fit & clearance (Fig. 9). The definitive restorations were then tried in the oral cavity in both centric & eccentric contacts. The scheme of occlusion given to the patient was mutually protected occlusion & was checked for canine disclusion on both sides in laterotrusion & disclusion of posteriors during protrusion. Then arch was evaluated for aesthetics, occlusion, and phonetics (Fig. 10, 11). Since the ceramist followed the guidelines of the provisional restorations, minimal adjustments were necessary at this stage. Final equilibration of the case was accomplished with a leaf gauge.

Thereafter, the definitive crowns were temporarily cemented & patient was evaluated for next 48 hrs for any signs of discomfort. Following this period the required minor occlusal corrections were made & after making the needed adjustments, the crowns were glazed and bonded individually to their respective preparations. Bonding involved etching the undersurface of the crowns with hydrofluoric acid for 30 seconds, followed by complete rinsing off the acid with water. 3M silane coupling agent was then applied to the undersurface for 10 seconds & dried off. Then resin bonding was carried out using Relyx U200 (3M Germany). The patient was instructed oral hygiene maintenance and was advised six monthly check-up. A protective splint was fabricated to prevent further damage to the restoration.

Discussion

Complete oral rehabilitation is the combination of dental occlusion, dental balance, and functionality, with dental esthetics. The goal for a clinician is to find a position in which the masticatory function, facial & dental esthetics must be enhanced. Immediate value for the patient is determined by the esthetics of the case, the comfort of the reconstruction and the care in which the dentistry was delivered. Long-term value

will be determined by longevity and continuing patient satisfaction^[10].

Understanding what determines the VDO and what the effects of altering it have on the temporomandibular joint (TMJ), muscle comfort, bite force, speech, and long term occlusal stability are prerequisites to restoring the worn dentition^[11]. Spear clearly outlines the principles of VDO and concludes that patients can function at many acceptable vertical dimensions, provided the condyles are functioning from centric relation and the joint complex is healthy. He states that "vertical is a highly adaptable position, and there is no single correct vertical dimension." He further concludes that the best vertical dimension is the one that satisfies the patient's aesthetic desires and the practitioner's functional goals with the most conservative approach^{[12],[13]}.

While increasing the vertical dimension of a dentate patient, a mutually protected occlusal scheme is considered most protective to the long term health of the restorations & stomatognathic system as opposed to group function. Studies have shown that in lateral excursive movements, the anterior teeth can best receive and dissipate the forces and posterior contacts in excursions appear to provide unfavorable forces to the masticatory system because of the amount and direction of the applied forces^[14]. Posterior simultaneous contacts and canine guidance with posterior disclusion and no anterior posterior discrepancy (centric relation=centric occlusion, CR=CO) should be considered the gold standard for any reorganized approach to the occlusion be it aesthetically or functionally driven.

Anterior guidance plays a very important role in full mouth rehabilitation following centric relation. The anterior guidance forms the anterior control to provide posterior disclusion^[6]. The job of anterior guidance is to protect the posterior teeth from lateral or protrusive stresses. The facebow transfer is a must to relate the anterior guidance with the opening and closing axis. It is required to reproduce the arc of closure from the patient to the articulator^[15]. The three main things to be taken care of while replacing posterior teeth, are achieving posterior disclusion, establishing the plane of occlusion and deciding the type

of occlusal scheme^[16]. Disclusion refers to separation of opposing teeth during eccentric movements of mandible, as reported by D'Amico^[17]. Posterior occlusion should have equal simultaneous contacts so that it does not interfere with either the TMJs in the back or the anterior guidance in the front. Occlusal interference can be detrimental to the health of the patient. A proper plane of occlusion must permit disclusion of all the teeth on the balancing side when the mandible is moved laterally. The reconstruction of vertical dimension of occlusion should be done at the centric relation and it should be acceptable for the patient at the neuromuscular level^[10].

One of the most difficult decisions facing clinicians is related to metal ceramic crowns versus all-ceramic alternatives^[18]. Metal-ceramic crowns continue to be the most frequently used full-coverage restoration, and when coupled with the use of porcelain facial margins, proper tooth preparation, and soft tissue management, provides the best combination of decent esthetics and clinical longevity. Although many advances have been made with high-strength all-ceramic crowns, they should continue to be used with caution and only in those patients who demand the ultimate in esthetics or who have a demonstrated allergy to specific metal elements. In this case even though the patient was blind & esthetics wasn't a major concern, still zirconia restorations were chosen as the material of choice because of reported allergy to some metals^{[19],[20]}.

Also, whenever there is a wear & breakdown in only one arch & no wearing in the other, then the preparation & rebuilding can be restricted to the same arch to achieve the desired result^[10]. This case demonstrates that spectacular functional & cosmetic results can be provided if appropriate diagnosis & treatment planning are done. We should weigh & consider the different treatment modalities available for complete oral rehabilitation & apply the one that is in

the best interest of our patient.

Conclusion

Ultimately, complete oral rehabilitation should be a treatment modality that not only focuses on the esthetics and functional aspect of the dentition but at the same time be minimally invasive in nature. The goal for a clinician is to find a position in which the masticatory function, facial & dental esthetics must be enhanced with least amount of intervention. The aim of oral rehabilitation should be make the teeth fit the jaw-to jaw relationship, not vice versa. In fact care should be taken with occlusal philosophies that strictly believe in preparations of all the 28 teeth for full mouth rehabilitation. In the end all treatments should be designed keeping in mind improvement in the health of the entire stomatognathic system.

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Lasers In Endodontics - A Review

Abstract

Dentistry has entered an exciting era of technology. Today the dental lasers offer the dentist not only with a window, but a door into this high-tech; rewarding and potentially profitable arena. Laser is an acronym for light amplification by stimulated emission of radiation. The common principle on which all lasers work is the generation of a monochromatic, coherent and collimated radiation by a suitable laser medium in an optical resonator. This Review Article is a humble effort to provide an overview of Applications of lasers in Endodontics, As technology advances and our understanding of laser light expands its necessary to revise and update from time to time.

Key Words

Laser, Dental Hard Tissue, Adhesive Dentistry

Introduction

Dentistry has changed tremendously over the past decade to the benefit of both the clinician and the patient. New materials and technologies have improved the efficiency of restorative dentistry for clinicians. One technology that has become increasingly popular in clinical dentistry is that of the laser. Initially introduced as an alternative to the traditional halogen curing light, the laser now has become the instrument of choice in many applications for both periodontal and restorative care. Although the laser offers many advantages over other modalities of treatment, probably the greatest impact it has made is in its ability to be used for both hard and soft tissues often without the need of anaesthesia^[9]. The field of lasers in general practice essentially began with the introduction of the Nd: YAG laser in 1990^[3]. With dentistry in the high tech era of 1990s, we are fortunate to have, at our disposal many technologic innovations to enhance treatment, including intraoral camera, computer imaging, CAD-CAM and air abrasive units^[12]. Today more experience and knowledge in applying lasers in conservative dentistry and Endodontics is available^[10]. Lasers now a days are widely used in conservative dentistry and endodontics for Cavity preparation, Tooth Etching, Disinfection of the root canal, Sealing of the root canal, Removal of the Gutta-Percha in Re-Treatment, Bleaching, Crown lengthening and for treating Dentin hypersensitivity.^[10] Lasers are employed in the restorative dentistry

for the removal of incipient caries, for curing composite resins, enamel etching.^[3] When lasers are properly used within the ethical envelope of dentistry, they offer present day dentists a superb treatment modality for various common clinical conditions.^[12] The promise that laser offers to both dentists and the patients of simple, painless, dental treatments has stimulated continuing research into their use for the removal of dental hard tissue.^[13] The aim of this review is to describe the application of lasers in dental hard tissue procedures.

Review

The first experiment with lasers in dentistry was reported in a study about the effects of a pulsed ruby laser on human caries^[7]. The results of that study showed that the effects varied from small 2-mm deep holes to complete disappearance of the carious tissue, with some whitening of the surrounding rim of enamel, indicating extensive destruction of carious areas along with crater formation and melting of dentine. Further work in the 1970's focused on the effects of neodymium (Nd) and carbon dioxide (CO₂) lasers on dental hard tissues. Early researches found that CO₂ lasers produced cracking and disruption of enamel rods, incineration of dentinal tubule contents, excessive loss of tooth structure, carbonisation and fissuring and increased mineralization caused by the removal of organic contents^[6]. It was also reported that the use of the CO₂ laser was unfavourable because of the loss of the odontoblastic layer^[16].

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Therefore, it was concluded that, unless heat-related structural changes and damage to dentinal tissues could be reduced, laser technology could not replace the conventional dental drill. Further advances in laser technology however, have identified acceptable biologic interactions. For example, the Er: YAG laser was tested for its ability to ablate (or vapourise) dental hard tissues^[6]. Enamel and dentine cavities were successfully prepared using the Er: YAG laser. Since then, this laser has been used for caries removal and cavity preparation, soft tissue minor surgery and scaling^[11]

How Laser Works^{[8][12]}

Lasers consist of the following components

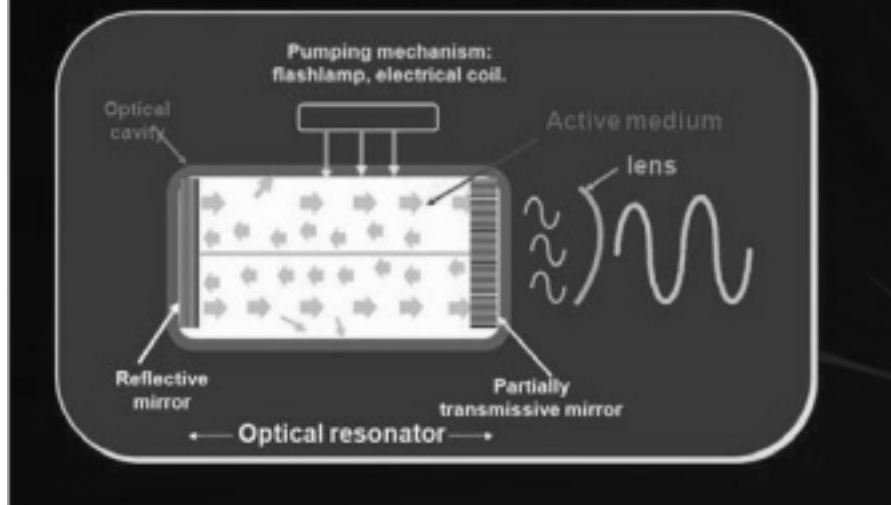
1. Optical cavity:
 - Lasing medium
 - Parallel mirrors
2. Pump energy source
3. Cooling system

Optical Cavity

An Optical cavity is at the center of the device.

The core of the cavity is comprised of

Gas or Solid Laser Components



Gas Or Solid Laser Components

chemical elements, molecules, or compounds and is called the Active medium.

Lasers are generically named for the material of the Active medium, which can be a container of gas, a crystal or a solid state semiconductor (e.g, a crystal)

Lasing Medium

There are two Active medium gaseous lasers used in dentistry:

Argon and CO_2

The remainder that are available are solid state semiconductor wafers made with multiple layers of metals such as gallium, aluminum, indium, and arsenic or solid rods of garnet crystal grown with various combinations of yttrium, aluminum, scandium and gallium and then doped with the elements of chromium, neodymium, or erbium.;

Mirrors: On either side of the lasing medium there are placed 2 parallel mirrors. In this configuration, photons bounce off the mirrors and re-enters the medium to stimulate the release of more photons. The mirrors collimate the light that is photons exactly perpendicular to the mirrors re-enter the active medium, while those off axis leave the lasing process. If one mirror is totally reflective and other mirror partially transmissive, the light that escapes through first mirror

becomes the laser beam.

Pump energy source: The Pump Source is the Energy provided by the Flash lamp or electrical coil. High energy radiation is pumped into active medium by medium of the pump source. (flash lamp or electrical coil)

Cooling System:

Because the process is not 100 % efficient and the remaining energy is converted into heat, it is necessary to provide some form of cooling. Cooling is provided by water. Thus, stimulated emission within an optical cavity generates a collimated, coherent, and monochromatic beam of light

Clinical Applications Of Lasers in Endodontics^{[2][3]}

Pulpal Diagnosis

Laser Doppler flowmetry, which was developed to assess blood flow in microvascular systems, also can be used for diagnosis of blood flow in the dental pulp. This technique uses helium-neon and diode lasers at a low power of 1 or 2 mW. The laser beam is directed through the crown of the tooth to the blood vessels within the pulp. Moving red blood cells causes the frequency of the laser beam to be Doppler shifted and some of the light to be backscattered out of the tooth. The reflected light is detected by a photocell on the tooth surface

The main advantage of this technique, in comparison with electric pulp testing or other vitality tests, is that it does not rely on the occurrence of a painful sensation to determine the vitality of a tooth. Laser Doppler flowmetry has some limitations. It may be difficult to obtain laser reflection from certain teeth. Generally, the anterior teeth, in which the enamel and dentin are thin, do not present a problem. Molars, with their thicker enamel and dentin and the variability in the position of the pulp within the tooth, may cause variations in pulpal blood flow.

Cleaning and Shaping of Root Canal System

Successful endodontic therapy, which mainly depends on the elimination of microorganisms from the root canal system, is accomplished by means of biomechanical instrumentation of the root canal system. In various laser systems used in dentistry, the emitted energy can be delivered into the root canal system by a thin optical fiber (Nd:YAG), erbium, chromium:yttrium-scandium-gallium-garnet [Er,Cr:YSGG], argon, and diode) or by a hollow tube (CO_2 and Er:YAG). Thus, the potential bactericidal effect of laser irradiation can be used effectively for additional cleansing of the root canal system following biomechanical instrumentation. This effect was studied extensively using lasers such as CO_2 , Nd:YAG, excimer, diode, and Er:YAG

Endodontic Surgery

Surgical endodontic therapy is the treatment of choice when teeth have responded poorly to conventional treatment or when they cannot be treated appropriately by nonsurgical means. The goal of endodontic surgery is to eliminate the disease and to prevent it from recurring. The surgical option should be considered only when a better result cannot be achieved by nonsurgical treatment. Nd:YAG lasers have shown a reduction in the penetration of dye or bacteria through resected roots..

Root Canal Irrigation in Combination with laser

Some laser devices produce cavitation effects in root canals in a manner similar to that of the ultrasonic irrigation. At present, the effect is weaker than that of ultrasonic irrigation. This laser technique is likely to be improved in the future.

Straight and slightly curved root canals as well as wide root canals are indications for this treatment. The pulsed Nd:YAG laser, Er:YAG laser, and Er,Cr:YSGG laser are recommended. The laser irradiation is not carried out by the laser alone; a solution such as 5.25% sodium hypochloride or 14% ethylenediaminetetra-acetic acid (EDTA) also must be used. A power of 2 to 5 W usually is used for approximately 2 minutes.

Sterilization or disinfection of Infected Root Canals

The laser is an effective tool for killing microorganisms because of the laser energy and wavelength characteristics. Infected root canals are an indication for this laser treatment, but application to extremely curved and narrow infected root canals appears difficult. Pulsed Nd:YAG, argon, semiconductor diode, CO₂, Er:YAG, have been considered for use in this treatment.

Root Canal Obturation using Gutta percha and Laser:

Gutta-percha is thought to be melted by laser heat energy. Anic and Matsumoto, attempted to investigate whether it is possible to perform the root canal filling using sectioned gutta-percha segments and a pulsed Nd:YAG laser. This was shown to be possible by the vertical condensation method, but the technique required too much time. At present, this technique is not practical. Although a method combining an argon laser and light-curable resin is in the literature, proper application of this method requires further research.

Treatment by Laser in Case of Indirect Pulp Capping

As lasers were introduced to dentistry, nobody thought that laser could perform the treatment of indirect pulp capping. The discovery of closure of dentinal tubules by laser energy and the sedative effects on pulpitis has led to the development of several new treatments that are soon to be put into practice. Deep cavities, hypersensitive cavities, and cavities that require sedative treatment are some of the indications for this treatment.

Treatment by laser in Case of Direct Pulp Capping

Because laser treatment has advantages with respect to control of hemorrhage and sterilization, laser use for direct pulp capping has attracted dentists' attention. Various studies have examined this treatment, and some researchers have recommended the laser as a treatment method for direct pulp capping. Laser irradiation should be performed at 1 or 2W irrigating alternatively with 5.25% sodium hypochlorite and 3% hydrogen peroxide for more than 5 minutes.

Conclusion

Scientific research and papers describing the dental applications of lasers have appeared in dental literature for more than 30 years. However due to vast and contradictory nature of this subject very few comprehensive compilations are available on their use in dentistry.

Dentistry like other health care profession is in midst of major transitions. In the fast changing arena of dentistry the laser can be very useful tool for dental practitioners. The high quality state of art has been employed in various procedures such as in diagnostics, the laser is used for examining the caries, Pulpal blood flow using laser Doppler flowmetry.^[11] From the vast literature on lasers it is understood that it is not only important to realize the various potential uses but also the necessity to select proper wavelength, understand laser tissue interactions and not over enthusiastically jump into laser dentistry before science properly supports it.

This review is a very humble effort to provide an overview of applications of lasers in endodontics as technology advances and our understanding of laser light expands its necessary to revise and update from time to time.

Researchers and clinicians must continue to explore before the investigational uses of lasers are brought from the researchers lab to the clinicians doorstep.

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The Management Of Worn Dentition- A Systematic Approach

Abstract

The etiology and treatment of occlusal tooth wear remain controversial. Longer tooth retention by the aging population increases the likelihood of treating the treatment of worn dentition. A careful systematic approach should be advocated for the definitive management of worn teeth. This article reviews the etiology of worn dentition and presents a conservative approach to its management.

Key Words

attrition, abrasion, erosion, tooth wear, Dahl concept, vertical dimension

Introduction

The gradual wear of the occlusal surfaces of the teeth is a normal process during the lifetime of a patient. However, excessive occlusal wear can result in pulpal pathology, occlusal disharmony, impaired function, and esthetic disfigurement.^[1] It has been recognized that tooth wear is becoming increasingly important in the aging population.^[2] This may be due to increasing dental awareness, with increased interest in retaining teeth as opposed to having them extracted.^[3] Data from prevalence studies have demonstrated high level of tooth wear in adults^[4], adolescents^[5] and children^[6], indicating that tooth wear is a clinical finding in all age groups.

Smith and Robb, in a cross sectional study observed that tooth wear is common in adults, with upto 97% of the study cohort experiencing some tooth wear.^[4] However, only 5-7% of the 1007 adults in the study exhibited severe tooth wear, for which interventive restorative treatment was justified.

In a study from United Kingdom, the prevalence of tooth wear was high (57%) in adolescents aged between 11 and 14 years, but dentin involvement was rare.^[5] A recent systemic review on the prevalence of in children and adolescents has indicated that the prevalence of tooth wear leading to dentin exposure in deciduous teeth increases with age, while wear of permanent teeth in adolescents does not correlate with age. It was emphasized that

tooth wear is a lifelong cumulative process and should be recorded in both primary and permanent dentitions. The aim of this review is to provide an insight to etiology and management of worn dentition.

Etiology

Four types of surface loss have been identified, distinguished by the differing causes of loss.^[7] Attrition describes mechanical wear resulting from mastication or parafunction, and is limited to the contacting surfaces of teeth.^[8] Abrasion denotes the wearing away of structure through some unusual or abnormal mechanical process other than tooth-to-tooth contact.^[8] Erosion indicates the progressive loss of tooth structure through chemical processes that do not involve bacterial action producing defects that are sharply defined, wedge-shaped depressions often in facial and cervical areas.^[8] Abfraction connotes the pathologic loss of tooth structure attributed to biomechanical loading and

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resulting in wedge-shaped defects in the cervical areas.^{[9],[10]} These terms describe clinical outcomes of a number of underlying events.^{[11],[12]} (Table 1)

Simply the surface loss can be mechanical (attrition & abrasion), chemical (erosion) or biomechanical (abfraction by Grippo)^[9] The etiology of pathologic wear resulting from mechanical or chemical causes can be determined by co-relating the location of wear, other signs and symptoms, and information obtained during the patient

TABLE 1. Characteristics of Different Wear Mechanisms

	Attrition	Erosion	Abrasion
Location	Incisal/occlusal surfaces; mainly anteriorly	Upper palatal surfaces; mainly anteriorly	Buccal surfaces; mainly at cemento-enamel junction
Severity	Normally moderate; can be severe	Potentially very severe	Normally mild; sometimes moderate and seldom severe
Topography	Well defined facets; sharp edges and angles; flat surface	Occlusal contacts lost; the pulp may be visible; "saucer"- shaped defects buccally and sometimes palatally	V- shaped defects; more severe in premolar and canine regions and less in the incisors or molar segments
Enamel/ dentin texture	Normal; shining facets	Matte, silky enamel; sometimes very thin enamel edges; large areas of exposed dentin	Well- defined defects; often involving both enamel and dentin
Subjective complaints	Seldom; sometimes esthetics	Sensitivity	Seldom; sensitivity, if extensive

TABLE 2. Etiology of pathologic wear

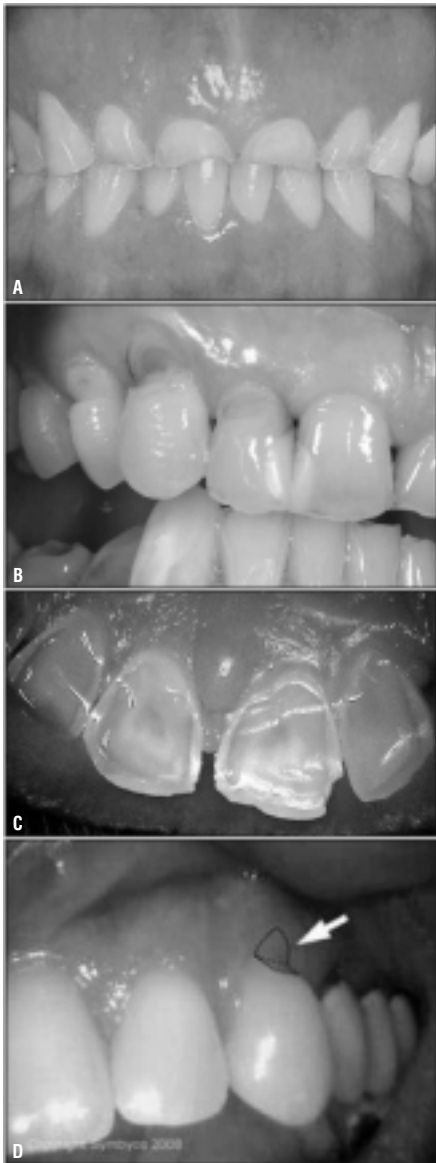
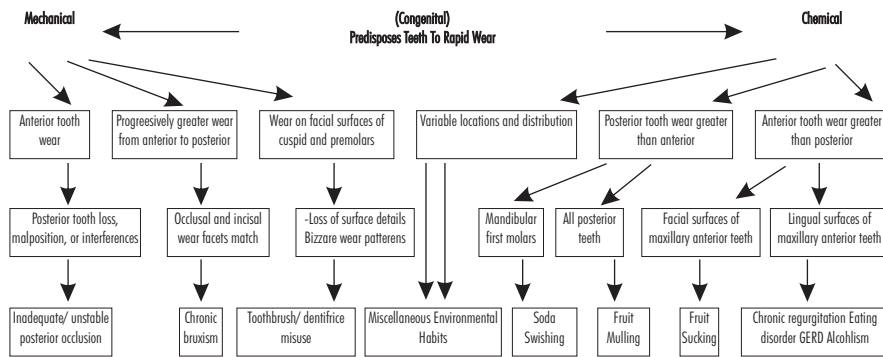


Figure 1. A. Attrition, B. Abrasion, C. Erosion, D. Abfraction ; Lesions Of Teeth

interview.^[7] (Table 2) (Figure 1)

Most of the times the tooth wear progress with multifactorial etiology.^[13] It is generally found that in both arches anterior teeth (and anterior tooth wear indices) exhibit significantly greater

wear than posterior teeth.^[12] The precise cause of the higher frequency of worn anterior teeth remains unclear. It is generally held that in earlier populations, the excessive wear of molars resulted mainly from a coarser diet and from the more vigorous masticatory activity required. Wear of anterior teeth also results from nondietary functions such as holding and manipulating.^[14] It can be speculated that in contemporary humans, wear-inducing factors are likely to affect the anterior teeth more than the posterior. For example, intrinsic acid and bruxism (which are common in modern humans) primarily affect the anterior teeth, while the absence of a coarse diet is less likely to cause wear of the posterior teeth.^[13]

Classification By Turner And Missirlain (1984):^[1]

The patients were classified into three categories

- Category 1 Excessive wear with loss of vertical dimension.
- Category 2 Excessive wear without loss of vertical dimension of occlusion but with space available.
- Category 3 Excessive wear without loss of vertical dimension of occlusion but with limited space available

In a typical Category-1 patient there are few posterior teeth and unstable posterior occlusion. There is excessive wear of anterior teeth. The closest speaking space is more than 1mm and interocclusal distance is more than 4mm. There is some loss of facial contour that results in drooping of the corners of mouth.^[15] Patients with dentinogenesis imperfecta in centric occlusion also belongs to this category. There is loss of occlusal vertical dimension with concomitant occlusal

wear. The loss of vertical dimension can be carefully evaluated using several techniques.^{[16],[17],[18],[19],[20],[21],[22]} At first, a removable splint or partial denture is placed and observed periodically for 6-8 weeks. This is followed by fixed provisional restorations for another 2-3 months before final cementation.

Patient in category- 2 have adequate posterior support and history of gradual wear.1 Closest speaking space of 1mm and interocclusal distance of 2-3mm. Continuous eruption has maintained occlusal vertical dimension leaving insufficient interocclusal space for restorative material. Manipulation of mandible into centric relation will often reveal significant anterior slide from centric relation to maximum intercuspation. Gingivoplasty may be needed to gain clinical crown length. Enameloplasty of the opposing posterior teeth may provide some space for the restorative material.^[23]

In patients of category-3, the posterior teeth exhibit minimal wear but anterior teeth show excessive gradual wear over a period of 20-25 years. Centric relation and centric occlusion are coincidental with closest speaking space 1mm and interocclusal distance 2-3mm.^[1] It is most difficult to treat because vertical space must be obtained for restorative material.this can be accomplished by fixed or removable anterior bite planes (Dahl appliance)^{[24],[25],[26]}, orthodontic movement, tooth preparation and surgical repositioning of the segments.

The Dahl Concept refers to the relative axial tooth movement that is observed when a localized appliance or localized restorations are placed in supra-occlusion and the occlusion re-establishes full arch contacts over a period of time. The combination of intrusion of the anterior teeth in contact with the appliance and eruption of the separated posterior teeth creates the interocclusal space.^{[24],[25],[26]} (Figure 2) Orthodontic movement usually involves anterior- posterior repositioning of the teeth combined with intrusion, although intrusion is considerably more complex. Tooth preparation creates the space by reducing the articulating surfaces of the teeth requiring restoration. Surgical repositioning of a segment of teeth and supporting alveolus may be indicated if a dentofacial deformity exists in

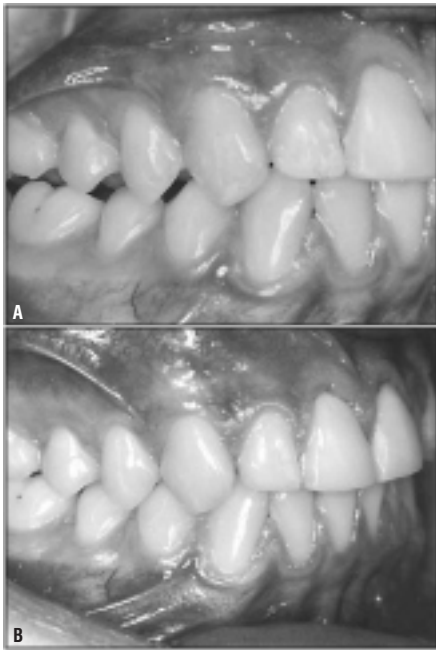


Figure 2: A. Posterior Teeth Disclusion Immediately After Restoration Of Anterior Teeth With Composite B. Reestablishment Of Posterior Occlusion After Short Period Of Time

conjunction with extreme wear.^[11]

Increasing the OVD to achieve space for restorative materials is seldom advisable; but if deemed necessary, the increase should be minimal and used for restorative needs only.¹ Hinge axis location by a kinematic facebow provides greater accuracy in increasing the VDO on the articulator.^[27]

Approach Of Restoring Worn Dentition:

A severely worn dentition in the presence of sound periodontium presents unique challenges in patient management, diagnosis, treatment planning, and restorative methodology.

However, a systematic and integrated approach leads to favorable and predictable prognosis. It facilitates development of optimum oral function, comfort, and esthetics, resulting in a satisfied patient.^[27] It consists of four logical phases: (1) patient evaluation, (2) comprehensive treatment planning, (3) integrated and systematic reconstruction and (4) postoperative maintenance.

The presenting technique is for restoring the worn dentition at existing vertical dimension of occlusion. But this systematic approach can also be followed for the management of other situations of worn dentition.

TABLE 3: Elements of history to be taken for the individuals with tooth wear

Element	Question
General data	Age and sex
	Subjective symptom (s)
	Duration of wear
	Lifestyle and behavioral factors
	Occupational environment
Diet and beverages	Type (e.g. citrus fruits, coarse food, cola, fruit juices, etc.)
	Frequency of daily intake
	Period of consumption
	Method of drinking or eating
TMJ	Orofacial pain/ masticatory function
	Onset and Duration
Parafunctional habits	Type(e.g. bruxism, pen biting etc.)
	Frequency and duration
Oral hygiene	Type of toothbrush
	Intensity, frequency and time of tooth brushing
	Abrasivity of tooth paste
Others	Systemic diseases: diagnosis and duration
	Medication
	Mouth

TABLE 4: Elements of clinical examination for the individuals with tooth wear

Element	Procedure
Study casts	Poured in vacuum-mixed stone
Intra-oral radiographs	Anterior, posterior L/R, occlusal U/L views
Examination of wear features	Wear facets: location, extension, matching of opposing facets, diffuse/demarcated Enamel/ dentin texture, dentinal exposure
Grading of the severity of wear	Clinical, study casts and intraoral photographs
Salivary analysis	Unstimulated and stimulated secretion rate, buffering capacity
Assessment for TMD	Examination of muscles, TMJ, occlusion and mandibular movements
Oral hygiene	Type of toothbrush
	Intensity, frequency and time of tooth brushing
	Abrasivity of tooth paste
Others	Systemic diseases: diagnosis and duration
	Medication
	Mouth

TMJ, temporomandibular joint; TMD, temporomandibular disorder; L/R, left/right; U/L, upper/ lower

Patient Evaluation:

Patient evaluation is subdivided into a preclinical interview and clinical examination. The preclinical interview is conducted during the first appointment. In addition to developing rapport, a thorough general and oral health history is taken. Also the patient's emotional well-being and expectations are noted.^[27] For an assessment of possible causative factors, a systematic history should be taken.^{[11],[13]} (Table 3)

A methodical approach to clinical examination should be followed. Some of the aspects are^{[11],[13]}: (Table 4) Along with this, a thorough examination of the soft tissues and underlying bony contours should be carried out for apparent pathology.

Impressions are taken for two complete sets of diagnostic casts, as well as complete jaw relationship records including a facebow transfer and protrusive and centric relation records are made. Casts are mounted on the semi adjustable articulator of choice. One set of casts is maintained as an unaltered pretreatment record, while the other set is modified during diagnostic treatment planning. The jaw relationship records may not be precise if the patient is suffering from temporomandibular joint dysfunction and/or myofascial pain dysfunction. In those instances,

reconstruction should be deferred until these problems are resolved through appropriate therapy. A patient with prolonged occlusal disharmony will often be unable to provide an accurate recording at centric relation as a result of muscle splinting. Effective treatment planning requires the need for comfortable and asymptomatic temporomandibular joints and stomatognathic musculature.^[27]

Comprehensive Treatment Planning:

Comprehensive treatment planning is a method of setting goals and then actuating these goals by exercising specific treatment-planning options.^[27]

Initially, the progression of wear should be carefully monitored. As the wear normally progresses slowly, the patients seldom have either functional or esthetic complaints. So the need for major restorative work to be routinely carried out is substantially reduced.

Serial investigations should be performed using diagnostic casts at 6 to

TABLE 5. Scale used for scoring the progression of occlusal/ incisal wear

Grade	Criteria
0	No visible change
1	Visible change, such as increase of facet areas, without measurable reduction of tooth length; occlusal / incisal morphology changed in shape compared to the first examination
2	Measurable reduction of tooth length, < 1mm
3	Marked reduction of tooth length, > 1mm

12 month intervals (depending on the perceived rate of progression) and recordings compared. Based on an assessment of the rate of wear, (Table 5) it is possible to decide whether intervention is necessary. Usually an interim occlusal splint, especially if bruxism is confirmed, can be provided. This affords some protection while monitoring the progression of wear.^[13]

When a dominant and active erosive influence has been implicated, rapid deterioration of tooth structures may be expected and serial monitoring is contraindicated. In these cases, reconstructive procedures should be carried out without delay.^{[11],[13]} An integrated treatment plan is first developed on one set of diagnostic casts, properly mounted on a semiajustable articulator using jaw relationship records. This is accomplished by using wax or composite to make reconstructive modifications to the casts. These modified casts become the blueprint for planned occlusal changes and the fabrication of provisional restorations. This blueprint allows for the development of an integrated treatment plan that is properly sequenced and facilitates fabrication of optimal provisional restorations constructed to a new planned functional occlusion.^[27]

The treatment goals are^[27]: (1) comfortably functioning temporomandibular joints and stomatognathic musculature; (2) adherence to the basic principles of occlusion advocated by Schuyler;^{[28],[29]} (3) anterior guidance that is in harmony with the envelope of function; and (4) restorations that will not violate the patient's neutral zone.

Treatment planning options that may be used to actuate treatment goals are summed up in the "six R's": (1) reshape, (2) restore, (3) remove, (4) reposition, (5) refer in part or totality to another practitioner, and (6) relinquish any action by leaving a tooth alone. These options may be used individually or in any combination to achieve treatment goals^[27].

Preoperative treatment planning reconstruction is performed on casts by modification of teeth and the use of diagnostic waxups in the following sequence^[27]:

1. Teeth are equilibrated on mounted casts so that centric occlusion and centric relation occlusion are in harmony.
2. Mandibular anterior teeth are modified on diagnostic casts to restore their optimum morphology function, and esthetics.
3. Maxillary anterior teeth are then altered for esthetics and to allow for the function of mandibular anterior teeth at the patient's current vertical dimension of occlusion. Efforts are made to keep the anterior guidance no steeper, and generally shallower, than that with which the patient originally presented. When dealing with severely worn anterior teeth and very limited interalveolar ridge space, consideration is frequently given to crown lengthening procedures, endodontics, orthodontics, and sometimes extraction and orthognathic surgery.^{[23],[27],[30]}
4. Mandibular posterior teeth are modified to establish the plane of occlusion with the optimum curves of Spee and Wilson using a Broadrick Occlusal Plane Analyzer or "Broadrick Flag".^[31] If necessary, subtle modifications of this optimum plane of occlusion may be made to avoid mutilation of maxillary posterior teeth that might result from strictly following a predetermined occlusal curve.
5. Maxillary posterior teeth are next modified on mounted diagnostic casts so that there is a harmonious cuspal relationship with mandibular dental fossa-receiving areas, free of eccentric interferences and with stable centric stops.

Reconstruction

Integrated and systematic reconstruction of the severely worn dentition is only pursued after a complete and proper comprehensive treatment planning diagnostic waxup has been accomplished on mounted diagnostic casts. Reconstruction is considered to be a four-step process consisting of: (1) fabrication of preparation guides; (2) tooth preparation and provisionalization; (3) fabrication of the final restorations and provisionalization; and (4) final cementation of restorations^[27].

Preparation guide, Preparation guides are fabricated from a preoperative treatment

planning diagnostic waxup. These generally consist of preparation plane guides made of wax or silicone putty or clear plastic vacuum forms of the newly developed occlusal design. These guides show the amount of occlusal tooth reduction necessary to accommodate planned relationships developed from the treatment planning diagnostic waxup.^[27]

Tooth preparation and provisionalization, Tooth preparation and provisionalization are generally carried out in two stages, with the maxillary and mandibular arches prepared separately on successive days. Tooth preparation should be done meticulously to protect the health and integrity of the periodontium.^[32] Acrylic provisional restorations are cemented with temporary cement. A patient is allowed to wear these provisional restorations for an appropriate amount of time to refine and confirm functionality of the occlusal design developed.^[27] T-scan technology is a recent advancement which can detect any interference in occlusion. It allows to functionally balance the teeth with high degree of precision.^[33] This time period also allows for any additional modifications necessary to enhance esthetics and patient comfort.^[27]

Fabrication of final restorations, All final impressions are made with provisional restorations in place, except for those teeth that are the focus of a specific step. In case of an opposing occlusion of tooth enamel, most of the studies prefer metal occlusal surface and preferably one of the high noble content is preferred to minimize the wear of the natural dentition.^[27]

1. Mandibular anterior teeth receive provisionally cemented final restorations first.
2. Maxillary anterior teeth are restored next. After the provisional cementation of mandibular anterior final restoration, anterior guidance is reproduced with a customized anterior guide table on a semiajustable articulator. Optimal anterior guidance should demonstrate: (1) sound centric stops that fall on flat receiving areas in both centric relation closure and postural closure; (2) immediate protrusive disclusion usually by the central incisors; (3) working disclusion caused by contact of the mesial lingual surface of the maxillary

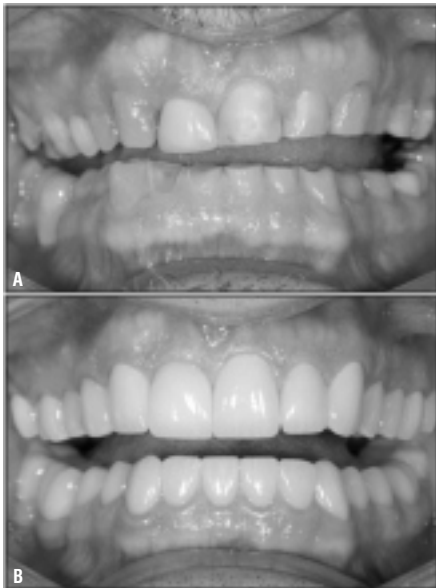


Figure 3. A. Before Treatment B. After Treatment Of A Patient With Generalized Worn Dentition

canine against the distal incisal bevel of the mandibular canine; and (4) a smooth parafunctional crossover position that preferably has no eccentric contact on the lateral incisors.

3. When the anterior guidance is found to be satisfactory, mandibular posterior teeth are restored with final restorations cemented provisionally.
4. Finally the maxillary final restorations are provisionally cemented.

Final cementation, Provisionally cemented final restorations are monitored for comfort, stability and optimum function for several weeks and in certain special cases for months or a year or two before final cementation. Many cement bond failures result from cross-arch torque" as well as from harmful parafunctional and horizontal occlusal forces. These factors are minimized by using the systematized approach and meticulous occlusal adjustment.^[27]

Occasionally a provisionally cemented restoration loosens. Upon close examination, a slight dislodging eccentric interference that breaks the temporary cement seal is frequently found. Occlusal adjustment resolves such a situation and further refines final treatment outcomes.

When the reconstructed dentition has been found to fulfill the basic objectives of oral rehabilitation, such as optimum function and stability,

easy maintenance and improved esthetics and comfort, the restorations are cemented with a final luting agent.^[27] (Figure 3)

Postoperative Maintenance:

Postoperative maintenance may need to include management of parafunctional activity such as bruxism, which is often associated with a severely worn dentition. In addition to making the patient aware of the need to control such a habit during waking hours, the patient should wear an occlusal guard at night. With optimum occlusion the tendency to clench and grind teeth is reduced. Patient behavior modification may also be a necessary adjunctive therapy to control the stress-habit patterns often associated with long-term parafunctional activity.^[27]

Patients presenting with combination of short clinical crowns, differential wear and bruxism, etc., increase the risks of cementation failure. Similarly, erosion-induced wear may continue even in the presence of teeth with full coverage crowns and can progress cervical to the crowned tooth if causative factors have not been eliminated. In addition, occlusal splint treatment in combined attrition (bruxism) and erosion cases may not be successful^{[11],[13]}

Patients should be reviewed at least annually; at this time, new study casts, and photographs should be made. A careful clinical and radiographic examination of abutments should be performed: caries, failed retention, wear facets, porcelain integrity, etc., must be checked, recorded, and treated as necessary.^{[11],[13]}

Conclusion:

Tooth wear is a multifactorial process. Its progress is usually slow and generally accompanied by dentoalveolar compensation. In the absence of overwhelming pathology, this process keeps the facial height constant. Continuous apposition of alveolar bone as a tooth erupts to compensate for wear can seriously reduce interalveolar space.

The reconstructive problem of limited interalveolar ridge space can be managed by developing a systematic treatment plan on diagnostic casts. The modified treatment planning diagnostic casts can then be used as guide to dental preparation, provisionalization to an

optimum occlusion and final restoration for successful clinical outcome.

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Cumulative Traumatic Disorders In Dentistry

Abstract

Serious neck, shoulder, and upper back pain, fatigue, and injury problems, as well as posture so poor that it affects general physical performance, are disturbingly common throughout the dental profession. Forced early retirement due to neck, shoulder, and back problems is a frequent occurrence in dentistry. Cumulative traumatic disorders (CTD) are affecting more dentists today. This article focuses on the CTDs commonly affecting dentists.

Key Words

Back pain, Cumulative traumatic disorders, Ergonomics, Posture, Repetitive movements.

Introduction

Dentists experience more lower back pain than do practitioners in other occupational groups^[2]. A study of back pain in dentistry (2005) concluded that 86 % of dentists in Glasgow reported back pain at some point in their career thus indicating the severity of the problem. 83% of these dentists believe this pain was due to posture at work.

Dentist could be at ergonomic risk, depending on the number and type of procedure they perform, the position that they occupy during a procedure and the extensiveness of the procedure itself^[1].

Cumulative trauma disorders (CTD) is defined as musculoskeletal disorders that can result from the body's inability to heal itself from the long-term effects of repetitive motion, exposure to vibration, and/or mechanical stress. It is a syndrome that affects muscles, tendons, nerves and blood vessels. It commonly involves the hands, arms and upper back. Lower limbs may also be affected^[5].

Dental health-care personnel (DHCP) are most prone to CTD's as they commonly assume awkward work postures to obtain better intraoral view, provide a more comfortable position for the patient. Dentists, moreover, coordinate their position relative to the patient or assistant and inadvertently achieve uncomfortable postures while reaching for instruments and supplies.

Contributing factors

Routine exposure to:

- Forceful hand exertions
- Grasping small instruments for prolonged periods
- Forceful squeezing/release of instruments

- Repetitive movements
- Fixed or awkward postures
- Vibrating tools
- Unassisted frequent or heavy lifting

Risk factors

Associated with dentistry:

- Prolonged static neck flexion
- Shoulder abduction or flexion
- Lack of upper-extremity support
- Inadequate work breaks

Signs and symptoms of most commonly seen CTDs

1. Myofascial Pain Disorder^[8]

- Pain and tenderness in the neck, shoulder, arm muscles
- Painful trigger points - may twitch upon touch or massage
- Restricted range of motion
- Possible causes: overloaded neck/shoulder muscles

2. Cervical Spondylosis^[11]

- Intermittent/chronic neck and shoulder pain or stiffness
- Headache
- Hand and arm pain, numbness, tingling, clumsiness may occur
- Possible causes: age-related spinal disc degeneration leading to nerve

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compression and spinal cord damage; arthritis

3. Herniated Spinal Disc

- Back and leg numbness, tingling, pain, weakness
- Worsens with coughing, sneezing, sitting, driving, bending forward
- Possible causes: bulging or fragmenting of intervertebral discs into spinal canal compressing and irritating spinal nerves; excessive heavy lifting without adequate rest

4. Lower Back Pain^[9]

- Low back pain was found to be the most prevalent musculoskeletal complaint, reported by 46% of the dentists^[3]. Pain
- Stiffness in lower spine and surrounding tissues
- Possible causes: heavy lifting and forceful movements; whole body vibration; bending/twisting; awkward static postures

5. Sciatica^[10]

- Pain from lower back or hip radiating to the buttocks and legs

Cumulative traumatic disorders (CTD) affecting dentists can be broadly classified into:

Hand And Wrist Disorders	Neck And Shoulder Disorders	Back Disorders
Dequervain's Disease	Myofascial Pain Disorder	Herniated Spinal Disc
Trigger Finger	Cervical Spondylolysis	Lower Back Pain
Carpal Tunnel Syndrome	Thoracic Outlet Syndrome	Sciatica
Guyon's Syndrome	Rotator Cuff Tendinitis/Tears	
Cubital Tunnel Syndrome		
Hand-arm Vibration Syndrome		
Raynaud's Phenomenon		

- Leg weakness, numbness, or tingling
- Possible causes: prolapsed intervertebral disc pressuring the sciatic nerve; worsened with prolonged sitting or excessive bending/lifting

6. Carpal Tunnel Syndrome^{[6],[7]}

- Pain or tingling that awakens the patient at night with relief via shaking/massaging the hand is considered a hallmark symptom for diagnosis
- Eventual muscle weakness and atrophy
- Symptoms often worse with increased activity

Ergonomics

Ergonomics is the science of fitting workplace conditions and job demands to the capabilities of employees. A practical approach to Ergonomics considers the match between the person, the equipment they use, the work processes and the work environment. A person's capabilities, physical attributes and work habits must be recognized to improve ergonomic factors in the workplace^[12].

Applying Ergonomics to Dentistry

While setting up the dental practice, following suggestions should be kept in mind:

1. Provide sufficient space

Permanently place equipment used in every clinical procedure within comfortable reach (within 20 inches of the front of the body). Use mobile carts for less commonly used equipment to allow convenient positioning when required.

2. Accommodate individual needs and preferences

Individuals vary in size, shape, training, and experience. Ensure that equipment and work areas allow flexibility for examples

- Allow right- or left-handed use
- Allow different working postures
- Provide a choice in methods used

3. Reduce physical effort

All effort should be made to avoid bent or unnatural postures. Ideally, equipment should allow work in a relaxed and well-balanced position

4. Instrument selection

The goal of proper instrument selection should be to reduce force exertion and

maintain hand/wrist in neutral position with no wrist bend. Always consider the overall shape/size, handle shape/size, weight, balance, maneuverability and ease of operation and maintenance of the instrument.

5. Magnification

Latest advancements in dentistry like operating microscopes and loupes if used correctly can be a boon to the dentist. The aim should be to improve neck posture and provide clearer vision. Loupes used by dentists help to magnify objects allowing easier detection of things that are difficult to see e.g. root canals and cavity margins. They also act to enhance posture as the dentist can sit more upright and not have to be as close to the patient as possible to accurately view the treatment they are carrying out^[4]. While selecting the magnification systems consider

- Working distance
- Depth of field
- Declination angle
- Convergence angle
- Magnification factor
- Lighting needs

6. Operator Chair

A good seating position and correct posture is vital for the efficient practice of dentistry and to avoid chronic back pain^[2]. An ideal operator stool should promote mobility and patient access as well as accommodate different body sizes. While selecting the dentist should look for:

- Stability
- Lumbar support
- Hands-free seat
- height adjustment

7. Scheduling

The dental surgeon should be careful to schedule appointments to provide sufficient recovery time and avoid muscular fatigue. Some suggestions in this regard are:

- Increase treatment time for more difficult patients
- Alternate heavy and light calculus patients within a schedule
- Vary procedures within the same appointment
- Shorten patient's recall interval

Conclusion

Dentist should maintain the shape of the spine in a natural 'S-shape' rather than strained seating position therefore

creating an upright posture. The pelvis should be correctly positioned during work so that less stress is placed on the spine i.e. its curvature is controlled. All the years of training, skill acquisition, and capital investment are worth nothing if you can't hold up to the physical demands of dental practice and then retire healthfully.

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Stem Cells - Great Adjunct In Regeneration

Abstract

Cell is the structural and functional unit of life. A living cell is a true representative of life with its own organisation and specialised functions. Stem cells are defined as clonogenic, unspecialised cells capable of both self renewal for long periods and multilineage differentiation contributing to regenerate specific tissues. Stem cells are dormant until called into action by proper set of chemical signals, where upon they differentiate to form required tissues. The cells are research tools and they open many doors of opportunity for biomedical & transplantation research, & restoring vital body functions. Stem cells may hold the key to replacing cells lost in many devastating diseases. There is little doubt that this potential benefit underpins the vast interest about stem cell research. What is clear about stem cells is that a tremendous amount of work is still required to identify and maintain multipotential mesenchymal stem cells in vitro, in order to complement the recent advances in tissue engineering and gene manipulation technology.

Key Words

stem cells, pulp, cementum, bone, oral mucosa, craniofacial.

Introduction

Cut a stem of a plant and stick it on ground. Chances are it will grow into a new plant. The cells in the plant stem have ability to do so. Do we humans have this same ability to do so? Research findings during the last two decades suggest that we might, depending on which of our cells we start from. Scientists have been interested in cell biology since the advent of microscopes in 18th century. Cell propagation and differentiation were witnessed for the first time and cells were recognized as the building blocks of life capable of giving rise to other cells and key to understanding human development in 19th century.^{[1],[2],[3]}

Cell is the structural and functional unit of life. A living cell is a true representative of life with its own organisation and specialised functions.^{[4],[5]} The human body has a remarkable capacity for regeneration. Cells in tissues such as blood and epithelia divide rapidly and are regenerated continually throughout life, whereas cells in most other tissues turn over more slowly and respond only to specific biological signals. The unique cells that give rise to specialised cells are called stem cells.^{[6],[7]}

Stem cells are defined as clonogenic, unspecialised cells capable of both self

renewal for long periods and multilineage differentiation contributing to regenerate specific tissues. They can theoretically divide without limit to replenish other cells as long as the person is still alive. Stem cells could be of embryonic, or adult type. Recently stem cells are also obtained from umbilical cord blood. Adult tissues reported to contain stem cells include brain, bone marrow, peripheral blood, blood vessels, skeletal muscle, skin, periodontal ligament and more recently, in the pulp. In tooth and its supporting structures, stem cells are identified in adult human dental pulp, human primary teeth (stem cells from primary exfoliated deciduous teeth) and periodontal ligament.^{[8],[9]}

Dead cells of any kind, no matter the type of injury or disease, can be replaced with new healthy cells due to the amazing flexibility of stem cells. Thus any disease in which there is tissue degeneration, could be a potential source for stem cell therapies including skin diseases, anaemias, bone diseases, cancers, cartilaginous diseases, liver diseases, myocardial diseases, immuno deficiencies, stroke, eye diseases, gastrointestinal disorders, neural disorders and the list goes on.^{[10],[11]}

Stem cells are dormant until called into action by proper set of chemical signals, where upon they differentiate to form required tissues. They are known to play

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a role in dentinogenesis and amelogenesis. Various bone regenerative procedures and pulpal regeneration is thought to be induced by stem cells. More recently tooth and periodontal tissue regeneration has been done by taking stem cells from third molar tooth in California.^{[12],[13],[14]}

Research on stem cells and their application to treat various diseases is still at a preliminary stage. However, results from animal models are very promising and many researchers believe that it is only a matter of time before the same results can be achieved with human stem cell. But stem cells are very complex in themselves. A great amount of work is still required to identify and maintain multipotential mesenchymal stem cells in vitro, in order to complement the recent advances in tissue engineering and gene manipulation

technology.^{[1],[15],[16]}

Regenerative Potential

The craniofacial region mainly consists of bone, cartilage, adipose tissue, muscle, nerve, and dental tissue. Many of these tissues have originated from either mesoderm- derived cells or ectoderm-derived neural crest cells during development. Bone marrow derived mesenchymal stem cells have been reported to differentiate, at least into mesoderm derived tissues including bone, cartilage, adipose tissue and muscle. Therefore, bone marrow derived mesenchymal stem cells may be the ideal candidates for the regeneration of multiple tissue types in different craniofacial region.^{[5],[6]}

A multinational team headed by University of California school of Dentistry researcher Dr Songtao Shi, has successfully regenerated tooth root and supporting periodontal ligament to restore human tooth in animal model utilising stem cells harvested from the extracted wisdom teeth of 18-20 year old. The technique relies on stem cells harvested from the root apical papilla, which is responsible for the development of tooth's root and periodontal ligament. So for the tooth regeneration, there should be availability of stem cell for every structure present in the teeth like cementum, dentin, enamel, pulp, and so on with supporting bone.^[2]

Bone

Tremendous amount of work has been done on the ability of bone marrow derived stem cells to differentiate into the bone. When cultured in the presence of dexamethasone, inorganic phosphate and ascorbic acid, bone marrow derived stem cells can differentiate into osteoblast-like cells with capacity to synthesize mineralised nodules (Gronthos et al. 1994, Pittenger et al. 1999).^{[1],[8],[17]} Under these conditions uncommitted Bone marrow derived stem cells begin to express many osteogenic markers such as CBFA/Runx2, Osterix, Osteopontin, Parathyroid hormone receptor and Osteocalcin. In addition, optimal outcomes have been achieved in studies by using autologous Bone marrow derived stem cells to treat human patients with different bone defects (Quarto et al. 2001, Warnke et al. 2004). For example the study by Warnke et al. 2004 designed a custom made biomaterial scaffold that

contained BMP-7 and autologous bone marrow in order to generate a functional mandible. Although the origin of cells (presumed to be bone marrow derived stem cells) responsible for the regeneration of the mandible was not defined, the patient developed an improved masticatory function and was reported to be satisfied with the esthetic outcome.

Another important feature of in vivo osteogenesis of Bone marrow derived stem cells is the capacity of these cells to facilitate formation of organised haematopoietic marrow elements, which originate from recipient cells, when transplanted into immunocompromised mice with hydroxyapatite tricalcium phosphate ceramic powder as a carrier (Ashton et al. 1980, Friedenstein et al. 1982, Bab et al. 1988, Goshima et al. 1991).^{[18],[19]}

So after successful Bone marrow derived stem cells transplantation, donor cells actively form Bone on the surface of the carrier vehicle and the recipient cells are induced to form haematopoietic marrow elements, leading to a bone marrow organ like structure. However the mechanism by which osteogenic differentiation of Bone marrow derived stem cells influences the organisation of recipient marrow components, is yet to be elucidated.^{[14],[20]}

Cementum

Although there are differences in the organisation of Bone and Cementum, it is not clear if they are formed by distinct cell types or by bone forming cells that have different environment clues. Distinguishing between two possibilities has been difficult, because to date, there is no specific marker for Cementum and Cementocytes. Cultures of murine or Primary Human Derived stem cells have been established from healthy teeth using a Collagenase pre-treatment as had been established previously for the culture of trabecular bone cells. With primary human cementum-derived cells, discrete colonies that contained cells exhibiting fibroblast-like morphology formed, and when the colonies became sufficiently large, cells from individual colonies were isolated and sub cultured. Cementum-derived cells exhibit low alkaline phosphatase activity and mineralize in vitro to a lesser degree than Bone marrow derived stem cell cultures.^[17]

To study the differentiation capacities, Human Cementum derived cells were attached to the hydroxyapatite/tricalcium phosphate ceramic and transplanted subcutaneously into immunocompromised mice. Like individual colonies of Human Bone marrow derived stem cells approximately 50 percent of the clonal human cementum derived cells tested, formed a bone like tissue that featured osteocyte/cementocyte-like cells embedded with in a mineralised matrix. However mineralised tissue was lined with a layer of cells that were somewhat more elongated than osteoblasts and the human derived cementum cell matrix was somewhat less cellular than that produced by Bone marrow derived stem cells. Unlike Bone marrow derived skeletal cell transplants which developed lamellar bone, the Human cementum derived cell matrix was found to contain unorganised collagen bundles, as seen in cementum.^[18]

Cells in the Human cementum derived cell matrix were positive for Fibromodulin and Lumican. While Osteocytes in Bone marrow derived skeletal cell matrix were negative. The Human cementum derived cells were devoid of haematopoietic marrow. These results show that cells from normal Human cementum can be isolated and expanded in vitro. Furthermore, these cells are capable of differentiating and forming a cementum-like tissue when transplanted into immunocompromised mice.^{[2],[3]}

Dentin-Pulp Complex

The Dentin-pulp complex displays an exquisite regenerative potential in response to injury. The post-natal dental pulp contains a variety of potential progenitor/stem cells (Gronthos 2002). Potential derivatives suggested for these stem/progenitor cells include the cell-rich layer of Hohl adjacent to odontoblasts (Cotton 1968), perivascular cells, undifferentiated mesenchymal cells, and fibroblasts (Ruch 1998).

In dental tissues it has been suggested that the newly generated odontoblast-like cells are the pulp cells and undifferentiated mesenchymal cells, which had de-differentiated from pulp-cells and Pericytes (Yamamura 1985). Recently, Gronthos (2000-2002) have attempted to characterize a unique population of post-natal human dental

pulp-stem cells. These cells have shown the capacity for self-renewal and differentiation into odontoblast-like cells, which formed the dentin matrix with some tubular features in vivo.^[6]

The same group has also identified a potential mesenchymal stem cell population derived from Exfoliated deciduous human teeth (SHED), capable of extensive proliferation and multipotential differentiation (Miura et al.2003).The possible role for post-natal human dental pulp stem cells in vitro differentiation into odontoblast-like cells and deposition of mineraliseddeposits after treatment with dentin matrix extracts in association with a mineralization supplement of B-Glycerophosphate and ascorbic acid (Liu et al. 2005).^[7]

Further studies to identify a stem cell niche in the dental pulp suggested that the putative stem cell marker, STRO-1 is expressed by dental derived stem cells using immunomagnetic activated cell selection(Shi and Gronthos 2003, Shi et al 2005).It has also been reported that postnatal human dental pulp stem cells express the perivascular cell marker CD146 and a proportion of these cells also positively co-express alpha smooth muscle actin and the pericyte associated antigen 3G5(Gronthos et al.2003, Muira et al. 2004).These findings concur with co-localisation studies of these markers to perivascular cells in situ, and it is possible that post natal human dental pulp stem cells may reside in this perivascular niche with in the adult pulp derived from outside the tooth.

It is interesting to note that expansion cultures of rodent mature dental pulp cells give rise to cells of myofibroblast appearance and strong expression of smooth muscle alpha actin(Smith et al 2005).This may be simply due to a stronger competitive growth by myofibroblast progenitors in the cell population being cultured, however it has been speculated that myofibroblast are form of 'default' differentiation as the neural crest phenotype has been suggested to be unstable with schwann cells able to trans-differentiate into this cell type(Real et al 2005, Smith et al 2005).This also raises interesting questions regarding the 'site' specificity of any primary explant of dental pulp which may contain more or less vascular-

derived progenitors or myofibroblast progenitors. Should we really be isolating and culturing a mixed population of primary cells or is it better to select cells, early, on the basis of surface antigens prior to culturing on?

The use of the cell surface marker low-affinity nerve growth factor receptor to identify possible postnatal stem progenitor cells from mature rodent dental pulp using flow cytometry has yielded a small population of cells whose potentiality is now being examined(Smith 2005).

It has been shown that post natal human dental pulp stem cells and stem cell population derived from Exfoliated deciduous human teeth express Dentin Sialophosphoproteins in xenogenic transplants and that this expression is not present in bone formed by bone marrow stromal cells in similar transplants suggesting that the clonogenic dental pulp derived cells represent an undifferentiated pre-odontogenic phenotype in vitro.

Despite a gene expression, profile of post natal human dental pulp stem cells have been compared with bone marrow stromal cells, only relatively few differentially expressed genes(including collagen 18 and 1,IGF-2 cyclin -dependent kinase6) were highly expressed in post natal human dental pulp stem cells and there are still no specific markers for post natal human dental pulp stem cells(Shi and Gronthos 2003).Thus it appears that there are potentially several niches of stem/ progenitors cell with in the dental pulp, more information is required to further understand whether all clonogenic cells are derived from a single highly proliferative pluripotent stem cell population or from committed progenitors belonging to distinct lineages. Post natal human pulp stem cells like osteoblasts express markers such as bone sialoprotein, alkaline phosphatase, type 1 collagen, and osteocalcin (Kuo et al. 1992, Tsukamoto et al. 1992, Buurma et al. 1999, Buchuille et al.2000).

Dentin matrix can be considered a reservoir of growth factors since growth factors such as transforming growth factor-beta, Bone morphogenic protein, Fibroblast growth factor and Insulin like growth factor are secreted by functional

Odontoblasts and pulp fibroblasts (Frinkelman et al.1990, Ruch et al. 1995). These factors are released after Dentin demineralisation by caries process and seem to be involved in the proliferation and differentiation of pulp cells, providing chemotactic signals to recruit progenitor pulp cells at injury site and to initiate tissue repair (Martin et al.19997, D'Souza et al. 1998).

The dental pulp is a naturally highly vascularised tissue and conservative pulp procedures like pulp capping and pulpotomy result in the injury of blood vessels. The injured endothelial cells release chemotactic factors, signaling molecules necessary for the recruitment of inflammatory and progenitors for initiating the healing process (Martin 1997, Tedder et al 1995). It is suggested that endothelial injury is involved in the recruitment of odontoblast-like cells at the site of injury (Matheinet al.2005).This information raises the speculations about the use of stem cells and signal molecules in conservative pulp therapies and in trauma to teeth, with incomplete root formation, leading to more biological approach.

The odontogenic potential of individual single-colony derived human dental pulp stem cells was determined. In this, two-third of single colony derived human dental pulp stem cell strains generated abundant ectopic dentin in vivo, while only a limited amount of dentin was detected in the remaining one-third. These results indicate that single-colony derived human dental pulp stem cells differ from each other with respect to their rate of odontogenesis.

Further studies must be focused on the molecular and cellular events that play an important role in tooth regeneration, physiology, embryology, treatment related events and therapies related with stem cells, contributing to a better clinical dental practice. Taken together these results indicate that human dental pulp stem cells possess stem cell like qualities including self-renewal capability and multilineage differentiation.^{[9],[10]}

Periodontal Ligament Attachment Apparatus

The functional periodontal ligament apparatus anchors the tooth and consists of periodontal fibres that run between alveolar bone and cementum lining the

root surface. Following conventional periodontal therapy involving debridement of root surface, the periodontal tissues heal by repair and migration of the epithelium along the previously contaminated root surface.

Periodontal regeneration requires new connective tissue attachment to the root surface, a process that involves the regeneration of periodontal fibres and the insertion of these fibres into newly formed cementum. Unfortunately currently available regeneration techniques are clinically unpredictable, resulting in only partial regeneration at best (Bartoldet al.2000, Wang et al.2005).^[11]

From a biological perspective, current and future prospects for improved regeneration of periodontal tissues are dependent on our ability to facilitate the repopulation of the periodontal wound by cells capable of promoting regeneration. It has been demonstrated that only the periodontal ligament, but not gingival connective tissue or bone, contains cells capable of establishing new attachment fibres between cementum and bone. The ability of Periodontal ligament cell populations to achieve regeneration has implied that progenitor cells, and possibly stem cells reside in Periodontal ligament.^[12]

Although it is clear that cells residing in the periodontal ligament can achieve regeneration and this population is heterogenous (Limebacket al.1983), it is not known that which subpopulations are capable of achieving regeneration. Indeed, cells derived from regenerating defects are found to have specific properties such as increased proliferation rates, representative of a 'regenerative phenotype and distinct from PDL cells(Ivanovski et al.2001).Therefore in order to identify progenitor and stem cells from the periodontium, identifying markers should be there to distinguish these types of cells.

In order to understand the cellular origin of developing PDL apparatus, transplanted tooth buds were used to show that the mesenchymal-derived dental follicle surrounding the developing tooth root is the source of progenitor cells for Cementum,Alveolar bone and PDL(Tencate et al 1971, Tencate and Mills 1972, Palmer and

Lumsden 1987).

More recently, the dental follicle associated with third molars has been shown to contain precursor cells which are clonogenic and have the ability to differentiate under in vitro conditions to a membrane-like structure containing calcified nodules (Marsezecket al.2005).

The source of post-natal progenitor cells which may be capable of regenerating the periodontium has been investigated for a number of years. Cell kinetic experiments in mice and rats (McCulloch and Melcher 1983, McCulloch et al.1989) have shown that PDL fibroblast populations represent a steady-state renewal system with number of new cells generated by mitosis equal to the number of cells lost through apoptosis and migration. This capacity of self-renewal, which is further evidenced by the rapid turn over of the PDL, supports the notion of progenitor/stem cell populations. Furthermore, a significant number of periodontal cells do not enter the cell cycle (McCulloch and Melcher 1983) suggesting that cells may act in a similar manner to quiescent, self-renewal and multipotent stem cells.^[13]

The relationship between progenitor cells in regenerating tissues and normally functioning (steady-state) tissues has been investigated in studies performed in normal mouse PDL(McCulloch 1985), rounded mouse PDL(Gould et al.1980), normal rat gingiva(Nemeth et al. 1993).These studies have identified a common paravascular location for fibroblast progenitors. These cells exhibit some of the classical cytological features of stem cells, including small size, responsiveness to stimulating factors and slow cycle (Gould et al 1980, McCulloch and Melcher 1983, McCulloch 1985).

Furthermore, these paravascular cells exhibit spatial clustering which suggests a possible clonal distribution of progenitors and their progeny (McCulloch 1985).Other possible sources of osteoblast and cementoblast precursors are the endosteal spaces of alveolar bone from which cells have been observed to adopt a paravascular location in the PDL of mice (McCulloch et al 1987).

However, based on these studies,

paravascular cells in PDL cannot be designated as stem cells because the clonogenic capacity of these cells and their ability to differentiate into multiple cell types were not demonstrated. Additional identification and isolation of these cells using membrane surface for stem cells and demonstration of their clonogenic as well as multilineage properties, has subsequently been sought in order to consolidate the hypothesis that stem cells reside in PDL.

Additional challenges have been encountered when trying to extract mesenchymal stem cells from connective tissue composed largely of fibroblastic cells, such as PDL. As stated earlier, a single specific antigenic marker for mesenchymal stem cells is not available, and hence a combination of markers must be used in order to achieve their isolation. Thus it appeared or demonstrated that PDL stem cells can be isolated using STRO-1 and CD146 markers. The presence of mesenchymal stem cells in the PDL is also supported by the findings of Trubian et al 2005, who isolated and characterised a population of mesenchymal stem cells from PDL which expressed a variety of stromal cell markers CD90, CD29, CD44, CD166, CD105, and Cd13.

The clinical potential for the use of PDL derived stem cells has been further enhanced by the demonstration that these cells can be isolated from cryopreserved PDL's thus providing a ready source of mesenchymal stem cells (Sec et al 2005).

From a biological perspective, in order for periodontal regeneration to occur, the availability of appropriate cell types, together with favourable local environment promoting cell migration, adhesion, proliferation and differentiation, all need to be precisely coordinated both temporarily and spatially. Thus a tissue engineering strategy for periodontal regeneration that exploits the regenerative capacity of stem cells residing in the periodontium, grown in three-dimensional construction and subsequently implanted into the defect may help to overcome many limitations with current regenerative modalities (Bartold et al.2000).In doing so, the need for recruitment of various different cells to site is negated and the predictability of outcome may be enhanced.^[15]

Cartilage

Craniofacial tissue contains several areas which consist of Cartilage, such as nose, ear, and temporomandibular ligament. Surgery, Congenital deformity, trauma or some types of temporomandibular ligament disorders may lead to a loss or destruction of the cartilage matrix. It is anticipated that cartilage regeneration may offer an alternative approach to the treatment of these disorders.

Bone marrow derived mesenchymal stem cells can differentiate into chondrocytes when cultured under a three dimensional serum-free setting in the presence of transforming growth factor-beta (Pittenger et al 1999), which was confirmed by the expression of type 2 collagen and Aggrecan (Pittenger et al 1999, Gronthos et al 2003).

When bovine bone marrow derived mesenchymal stem cells were receded into biodegradable scaffolds and subsequently implanted into fetal tracheas, they showed a significant chondrogenic differentiation (Fuchs et al 2003)

Moreover, improved cartilage repair in patellar groove defects was observed following implantation of rabbit bone marrow derived mesenchymal stem cells (Wakitani et al 1994, Im et al 2001). At the molecular and cellular levels, recent studies have demonstrated that Wnt beta-catenin may play a crucial role in regulating chondrogenesis of Bone marrow derived mesenchymal stem cells (Day et al 2003, Hill et al 2005).

Ectopic canonical Wnt signalling leads to enhanced ossification and suppression of chondrocyte formation, while genetic inactivation of beta-catenin causes ectopic formation of chondrocytes while the requirement of high-quality cell preparations, growth factors and ideal scaffolds possess many challenges for cell-based therapies. Bone marrow derived mesenchymal stem cells have shown a great therapeutic potential to repair cartilage defect (Magne et al 2005, Raghunath et al 2005).^[17]

Adipose Tissue

Adipose tissue in different craniofacial regions may have a considerable impact on the appearance of facial structures. Bone marrow derived mesenchymal stem cells can differentiate into

adipocytes when cultured with the inductive medium, which contains hydrocortisone, indomethacin, insulin and isobutyl methyl xanthenes (Pittenger et al 1999, Gimble and Guilak 2003). The adipocytes derived from bone marrow derived mesenchymal stem cells show cytoplasmic lipid vacuoles positively stained with Oil red O. The differentiation can be genetically confirmed by the expression of the fat-associated markers, Peroxisome proliferators activated receptor (PPAR) gamma 2 and leptin (Gronthos et al 2003). On the other hand, adipose-derived adult mesenchymal cells have also been demonstrated as a population of multipotent stem cells, which can differentiate into adipogenic, osteogenic, chondrogenic, myogenic and neuronal strains to regenerate adipose tissue for cosmetic purpose and tissue repair in craniofacial reconstructive surgery.^[18]

Muscular Tissue

It has been shown that demethylation compounds such as 5-azacytidine or amphotericin B can induce myogenic differentiation of bone marrow derived mesenchymal stem cells in vitro (Wakitani et al 1995, Makino et al 1999, Phinney et al 1999). Many reports have demonstrated that implantation of cultured bone marrow mononuclear cells by intracoronary injection improves left ventricular function (Assmus et al 2002, Strauer et al 2002, Wollest et al 2004) although the question of transdifferentiation of bone-marrow derived cells into cardiomyocytes has been raised (Balson et al 2004).

Recently, several clinical trials have reported an improvement of myocardial function by an autologous bone marrow derived mesenchymal stem cells transplantation after acute myocardial infarction (Chin et al 2004, Price et al 2006). Collectively, these studies demonstrate a potential therapeutic use of Bone marrow derived mesenchymal stem cells for regeneration of cardiac and perhaps skeletal muscles, particularly for patients who have undergone a radical surgery or trauma, including patients having problems in mastication.^{[17],[18]}

Oral Mucosa

Trans et al (2003) reported an example of transdifferentiation of human bone marrow derived stem cells into buccal epithelial cells. Using fluorescence in

situ hybridisation and immuno histochemistry, they identified Y-chromosome-positive buccal cells in five female patients who had received either a bone marrow transplant or an allogenic mobilized peripheral blood stem cell transplant from male donors. Y-chromosome-positive cells in these female patients were morphologically distinguishable as buccal epithelial cells and they also expressed cytokeratin 13, a recognized epithelial marker located in the superficial layer of the cheek. The donor-derived buccal epithelial cells were identified by morphologic characteristics, cytokeratin expression, positive Y-chromosome and negative CD45.

The plasticity of adult bone marrow-derived cells has been questioned by studies suggesting that fusion between donor and host cells gave an appearance of transdifferentiation (Terada et al. 2002, Ying et al. 2002). However in vivo they did not observe cell fusion. Trans et al examined more than 9700 buccal cells and reported no evidence of fusion. These findings were also confirmed by Metaxas et al 2005 who reported that none of the buccal cells examined had more than one chromosome, which excludes fusion as the answer to cell plasticity.^{[16],[20]}

Conclusion

There has been much written about the new discoveries of various stem cell types and their properties. Importantly, these cells are research tools and they open many doors of opportunity for biomedical & transplantation research, & restoring vital body functions. Stem cells may hold the key to replacing cells lost in many devastating diseases. There is little doubt that this potential benefit underpins the vast interest about stem cell research.

What is clear about stem cells is that a tremendous amount of work is still required to identify and maintain multipotential mesenchymal stem cells in vitro, in order to complement the recent advances in tissue engineering and gene manipulation technology.

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Rugoscopy – An Emerging Aid For Personal Identification - A Review

Abstract

Palatal rugoscopy, or palatoscopy, is the process by which human identification can be obtained by inspecting the transverse palatal rugae inside the mouth. The palatal rugae are unique, unchanging, perennial and subject to classification. It appears in the third month of the embryonic period, remaining for the entire life of the individual and for several days after his/her death. When identification cannot be established by fingerprinting or by analysis of dental arches (dental records data), the palatal rugae can be considered as a source of comparative material. This paper reviews the development of rugae, the different classifications and significance of palatoscopy.

Key Words

Forensic Odontology, Palatoscopy, Rugoscopy Calcorrugoscopy

Introduction

Forensic odontology can be defined as a branch of dentistry which deals with the appropriate handling and examination of dental evidence and with the proper evaluation and presentation of dental findings in the interest of justice.^[1] In forensic identification, the mouth allows for a myriad of possibilities. Due to the distinctive features of teeth, dental identification is one of the most popular ways to positively identify somebody. In fact, teeth are known to have singular features and possess extraordinary resistance to extreme conditions. These properties enable fast and secure identification processes.^[2] However at times identification using dental records may prove to be inconclusive, since many antemortem dental records may be inaccurate or incomplete.^[3] Also, additional dental treatment might have been performed in the time interval between the creation of a dental record and death of the individual.^[4] In such cases data collected from lips & palate can help in person's identification. The study of lip prints is known as cheiloscopy; and the study of hard palate anatomy to establish someone's identity is called palatoscopy.^[2] Palatal rugae (PR) also called plicae palatinae transversae and rugae palatine are asymmetrical and irregular elevations of the mucosa located in the anterior third of the palate, made from the lateral membrane of the incisive papilla, arranged in transverse direction from palatine raphe located in

the mid sagittal plane.^{[5],[6]}

Historical Overview

The earliest reference to rugae was in an anatomy text by Winslow in 1732 and was first illustrated by Santorini in 1775.^[7] The use of human palatal rugae was suggested as an alternate method of identification in 1889 by Harrison Allen.^[8] Many researchers have studied the morphology and the racial differences of palatal rugae.^[7] Kuppler, in 1897, was the first person to study palatal anatomy to identify racial anatomic features. In 1932, a Spanish investigator called Trobo Hermosa first proposed palatal rugoscopy.^[2]

Anatomy & Development of Rugae

Palatal rugae in mammals are transversally running crests, which are exclusively formed by the mucosa of the hard palate except where an ossified base can be distinguished. The occurrence, number and arrangement of palatal rugae in mammals are species-specific.^[9] Studies conducted on mice has shown that they develop as localized regions of epithelial proliferation and thickening even before the elevation of the palatal shelves. Later fibroblasts and collagen fibres accumulate in the connective tissue below the thickened epithelium and then assume a distinctive orientation. The collagen fibres determine the orientation of the rugae Individual variations in the number and morphology of palatal rugae in man were described in detail by C a r u

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s o (1969). In human embryos, rugae are relatively prominent and occupy most of the length of the palatal shelves at the time of their elevation.^[10] At the 550 mm stage of embryonic development, there are five to seven rather symmetrically disposed ridges, with the anterior ones beginning at the raphe, the others more laterally. Towards the end of intra-uterine life, the pattern of rugae becomes less regular, posterior ones disappearing and those anterior become considerably more pronounced and compressed. Several studies conducted on children & adults have shown a reduction in mean palatal ridge number with age.^[11]

Peterková et al. (1987) also defined six stages of individual development of palatal rugae as follows: 1) thickening of epithelium, dipping into mesenchyme – the rugal anlage; 2) levelling of basement membrane and protrusion of epithelium above the surface – the primitive ruga; 3) condensation of mesenchymal cells beneath the top of rugae; 4) formation of bulged fibrous stroma beneath the rugae – the rugal core - covered by thinning epithelium; 5) epithelium of uniform

thickness similar to that covering the interrugal areas – definitive ruga, initial keratinization; 6) the ruga as in adults.^[9] Controversy still exists about the stability of quantitative and qualitative characteristics of rugae during growth, and the extent of differences between ethnic groups and sexes.^[10] Hauser et al. have suggested that mean ruga count changes moderately in adolescence, then increases markedly from the age of 35 to 40 years.^[11] In contrast, Lysell considered that the number of rugae decreased from 23 years of age onwards.^[12] English et al. noted that the characteristic pattern of the palatal rugae did not change as a result of growth, remaining stable from time of development until the oral mucosa degenerated at death.^[13] However, some events can contribute to changes in rugae pattern, including trauma, extreme finger sucking in infancy, and persistent pressure with orthodontic treatment and dentures.^[10]

Palatal Rugae Classifications

Researchers have found the task of classification a difficult aspect of rugae studies. The subjective nature of observation and interpretation within and between observers poses a problem. Nowadays, there are several known palatal rugae classifications.^[2] The first system of classification was developed by Gorla in 1911 and was rudimentary. The rugae pattern was categorized in two ways: specifying the number of rugae and specifying the extent of the rugal zone relative to the teeth. In this system, compound rugae of two or more branches were counted as one, whether they were V- or Y-shaped. Gorla further distinguished two types: simple or primitive and more developed.^[14] However, according to several authors Lysell, in 1955, developed the first classification system for palatal rugae pairs.^[2] His classification is the most important, and it has been used widely in research involving rugae. In this classification rugae are measured in a straight line between the origin and termination and are grouped into three categories:

Primary: 5 millimeters or more;

Secondary: 3 to 5 mm;

Fragmentary: 2 to 3 mm;

Rugae smaller than 2 mm are

disregarded. This is rather simplified picture of the intricate form that rugae usually present.^[2]

Several other classifications have been proposed but none have been able to fill all the criteria. The various classifications are those given by Thomas and Kotze. They classified rugae as branched, unified, crosslinked, annular, and papillary, among others. Carrea classified them based on directions.^[14] Martins dos Santos based it on the form and position of each palatal rugae. Lo'pez de Le'on proposed the existence of a link between a person's personality and palatal rugae morphology. In this manner, there were four known types of palatal rugae: B—bilious personality rugae; N—nervous personality rugae; S—sanguinary personality rugae; L—lymphatic personality rugae. The letters B, N, L, and S, stand for the different personalities. The letters l and r stand for the left and right side of the palate, and are followed by a number, which specifies the palatal rugae number on each side. For instances, a possible rugogram would be Br6; Bl8. It has only historic relevance.^[2]

Basauri proposed a very easy classification. It distinguishes between the principal rugae, which is the more anterior one (labelled with letters) and the accessory rugae, which concerns all the remaining rugae (labelled with numbers).^[15] Cormoy classifies palatal rugae according to their size. The form (line, curve, and angle), origin (medial extremity) and direction of each rugae are also described. Possible ramifications are also pointed out. It is a very complete system. However, its use does not lead to rugogram elaboration, which makes the managing and processing of data difficult.^[15]

Analysing and recording palatal rugae

There are several ways to analyse palatal rugae. Intraoral inspection is probably the most used and also the easiest and the cheapest. However, it can create difficulties if a future comparative exam is required.^[15] A more detailed and exact study, as well as the need to preserve evidence may justify oral photography or oral impressions.^[16] Calcorrugoscopy, or the overlay print of palatal rugae in a maxillary cast, can be used in order to perform comparative analysis.^[2] Other more complex techniques are also available. By using stereoscopy, for

example, one can obtain a three dimensional image of palatal rugae anatomy. It is based on the analysis of two pictures taken with the same camera, from two different points, using special equipment. Another technique is the stereophotogrammetry which, by using a special device called Traster Marker, allows for an accurate determination of the length and position of every single palatal ruga.^[15] However, due to its simplicity, price and reliability, the study of maxillary dental casts is the most used technique.^[2]

Forensic identification:

Human identification has become fundamental in all aspects of human relationships, at both social and legal levels. Establishment of person's identity can be a difficult task in cases of traffic accidents or acts of terrorism or in mass disaster situations.^[2] According to Arbenz (1988), the identification requires demonstrating that a person or one of his or her characteristics being examined is the same as observed in a previous situation. An important aspect refers to the distinction between recognition and identification. In Forensic Medicine or Dentistry, it is usually visually conducted by relatives and friends of the victim, thus making this practice highly susceptible to mistakes and failures. The identification is characterized by the utilization of proper techniques and means to find the identity. It may be performed by experienced technicians (law professionals or policemen) or by professionals with differentiated and specific knowledge in biology (forensic medical or forensic dental), with utilization of a nearly unlimited series of techniques and means to determine the human identity. Five elementary technical requirements should be met to assure the applicability of an identification process: unicity, individuality or variability, immutability, perennity (persistence), practicability and possibility of classification. In some patients, a prominent exostosis, the torus palatinus, is found in the palatal midline. Its presence is sometimes recorded in dental notes and, therefore, it can be used as an identification mark. According to Arbenz (1988), dactyloscopy is the only method currently available that meets all these requirements; however, it lacks the quality of perennity, since it disappears after skeletization.^[17] In forensic identification, use of dental records,

visual identification and fingerprints and DNA comparisons probably are the most common techniques used allowing fast and secure reliable identification. When identification cannot be established by fingerprinting or by analysis of dental arches (dental records data), the palatal rugae can be considered as a source of comparative material^[18] because they are able to individualize a person, legitimizing an identification process,^[6] even in extreme circumstances.^[19] Illnesses, chemical injury or trauma do not seem to modify the palatal rugae structure.^[18]

Significance Of Palatal Rugae

Uniqueness of Rugoscopy for personal identification

It is a well-established fact that the rugae pattern is as unique to a human as are his or her fingerprints and it retains its shape throughout life. The anatomical position of the rugae inside the mouth - surrounded by cheeks, lips, tongue, buccal pad of fat, teeth and bone - keeps them well-protected from trauma and high temperatures. Thus, they can be used reliably as a reference landmark during forensic identification.^[14] Sassouni stated that no two palates are alike in their configuration and that the palatoprint did not change during growth.^[20] Ritter studied the rugae of twins and found that the pattern was similar but not identical. Hausser studied children from birth to nine years old and found that the characteristic picture of the palate does not change as a result of growth. Leontsinis ascertained that rugae do not change from the time they develop until the oral mucosa degenerates at death.^[6] Peavy et al. have shown that slight morphologic alterations occur in the relationship of rugae to teeth during orthodontic tooth movement, but no major alteration in the rugae shape occurs.^[21]

Variation of rugae pattern in different ethnic groups:

There seems to be a significant association between rugae forms and ethnicity. Kapali and colleagues studied the palatal rugae pattern in Australian Aborigines and whites. They observed the number, length, shape, direction and unification of rugae. The authors concluded that the mean number of primary rugae in Australian Aborigines was higher than that in whites, although whites had more primary rugae that

exceeded 10 mm in length. The most common shapes in both ethnic groups were wavy and curved forms, while straight and circular forms were least common.^[10] Shetty and colleagues compared the palatine rugae patterns in Indians with those in a Tibetan population. The results of their study showed that males had more rugae on the right side than on the left side in both populations, Indian males had more primary rugae on the left side than did females and vice versa for the Tibetan population, and Indian males had more curved rugae than did Tibetan males.^[22]

Rugae patterns as an adjunct to sex differentiation in forensic identification

Palatal rugae pattern of an individual may be considered as a useful adjunct for sex determination for identification purposes. Many studies have been carried out on the rugae patterns in the populations of Australia, South Africa and Japan.^[4] Kapali et al in their study did not reveal any significant differences in the number of primary rugae between Australian Aboriginal males and females.^[10] Saraf A et al in their study found that in terms of the different types of rugae shape, the converging type of rugae were statistically greater in number in females whilst the circular type of rugae were statistically greater in number in males, which contrasts with earlier studies. The use of logistic regression analysis (LRA) enabled highly accurate sex prediction (>99%) when all the rugae shapes were analyzed. It may be concluded that rugae pattern through the use of LRA can be an additional method of differentiation between the Indian male and female and assist with the identification process in conjunction with other methods such as visual, fingerprints and dental characteristics in forensic sciences.^[4]

Rugae patterns as identification tool in burn cases

Muthusubramanian et al. did a study to examine the extent of palatine rugae preservation for use as an identification tool in burn victims and cadavers, thus simulating forensic cases of incineration and decomposition. The study results showed that among the subjects with third-degree panfacial burns, 93 percent of the palatine rugae were normal. They concluded that the palatine rugae could be used as a reference landmark during

forensic identification of individual.^[23] Many victims of natural disasters such as fires and floods, have also been identified by dental means. Many criminal investigations have included the use of dental evidence. Unfortunately, the dentition is not always available for identification. Teeth may be lost due to trauma, heat fracture, or may not be present if the victim was edentulous at the time of the accident.^[7]

Problems With Palatoscopy

Palatoscopy is a technique that can be of great interest in human identification. In fact, contrary to lip prints, it is possible to have antemortem data established such as records found in dental practice in different forms (dental casts, old prosthetic maxillary devices and intraoral photographs). However, palatoscopy might not be so useful in crime scene investigations in the linking of suspects to crime scenes. In fact, this kind of evidence is not expected to be found in such circumstances. Another aspect of palatoscopy that one must consider is the possibility of rugae pattern forgery.^[2]

Conclusion

Nowadays, palatal rugae patterns are considered a viable alternative for identification purposes. Some investigators aim to assess its feasibility with the aid of a computer and a software program. The results so far are good, but expected to be better. Few studies using palatal rugae as a means of forensic identification are found in literature. However, the idea of rugae being unique to an individual is promising and deserves further investigation.

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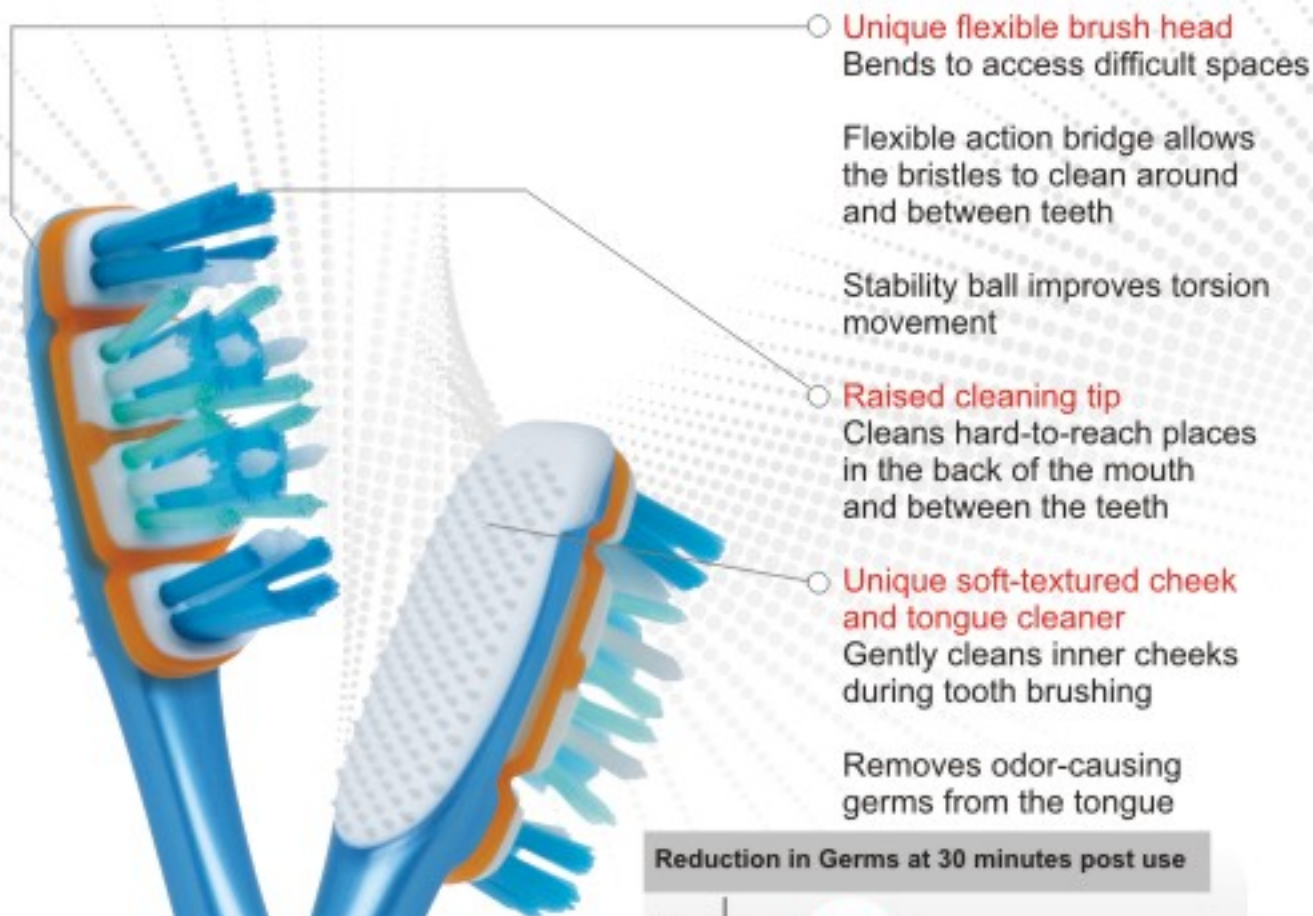
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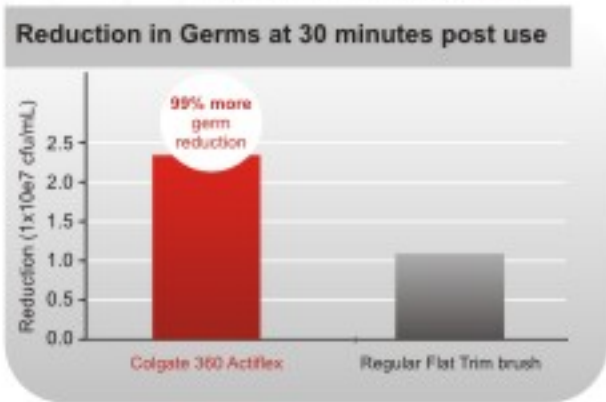
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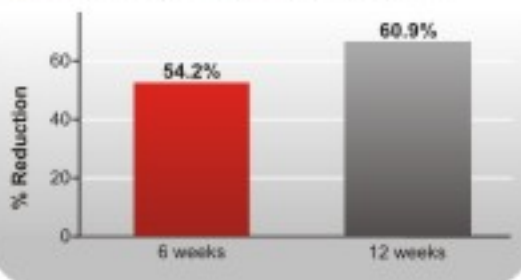
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