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Comparative Evaluation Of Accuracy Of Matrix Impression System With Multiple Mix Technique - An In Vitro Study

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Abstract

Background & Objective

The success of prosthesis in terms of fit, accuracy and longevity are dependent on the impression materials and their techniques utilized. The addition type silicone impression materials, polyvinylsiloxanes have been reported to be the most accurate and dimensionally stable material. The present study is to compare the accuracy of impressions made with matrix impression system and multiple mix impression technique using poly vinyl siloxane impression material.

Material & methods

The typhodont teeth were mounted in the maxillary frasaco model base. The left canine and second premolar were prepared conservatively to receive a ceramo-metal fixed partial denture. The first premolar was removed and the socket was obliterated with wax to simulate a clinical case of 3-unit fixed partial denture requirement. Fifteen impressions were made for each technique and impressions were poured using die stone. The mesio-distal, labio-palatal and cervico-incisal dimensions of canine and second premolar, and inter abutment distance of the master model and the casts obtained were measured using Profile projector and they were compared statistically to each other by using t-test.

Results

The results showed that the matrix impression system showed more accuracy of reproduction for individual dies and for inter-abutment distance when compared to multiple mix technique.

Conclusion

Hence it was concluded that matrix impression system has better accuracy than multiple mix technique.

Key Words

Matrix impression system, multiple mix impression technique, Accuracy

Introduction

Making an accurate impression of dental and dentoalveolar structures is important and is an essential requirement for the precise fit of the prosthesis. This is one of the important factors in determining the longevity of the restoration. The addition type silicon impression materials, polyvinyl siloxanes(PVS) have been reported to be most accurate and dimensionally stable.[1] Some authors claim that the extent of accuracy of dies is determined more with the technique than by the material itself,[2] and others reporting that the impression accuracy is governed more with material employed.[3] However with the proven accuracy of the material, the technique also has to be considered, especially in cases of fixed partial denture. Here inter-abutment relation is also equally important along with accuracy of the individual tooth/die.

Matrix impression system (MIS) developed by Gus J. Livaditis(1998) uses a precisely designed matrix which can provide a mean to better control the unpredictable dentogingival environment when making impressions which significantly improves the gingival displacement and sulcular cleansing phases.[4] The technique has shown to be beneficial in single crowns and its feasibility to use in FPD cases is still questioned.

Hence the present study was conducted to compare the accuracy of the matrix impression system with conventional technique for individual dies and also to compare the inter- abutment distance in master model using both impression methods.

Material & Methods

The materials used were polyvinyl siloxane putty material (3M ESPE, express STD, Germany) and Kalrock (class IV) die stone. All the measurements were made using profile projector. The samples were divided into two groups:

Group I-Impressions were made using Matrix impression system (MIS).

Group II-Impressions were made using multiple mix technique (MMT).

The typhodont teeth were embedded in the maxillary frasaco model base. The left canine and second premolar were prepared conservatively to receive a ceramometal fixed partial denture. The first premolar was removed and the socket was obliterated with wax to simulate a clinical case of 3-unit fixed partial denture **(Fig 1)**. Four sharp hatch marks were made with a round bur on the finish lines of each prepare tooth. The hatch marks were placed diagonally

Fig 1: Master Model With Typhodont Teeth

opposite i.e., one each on labial, buccal, palatal, mesial and distal of each prepared tooth. Two more hatch marks were placed on incisal surface of canine and occlusal surface of premolar **(Fig 2)**.The measurements of master model were made using profile projector.[5]

For Group-I, A matrix of the prepared teeth was made with polyvinyl siloxane putty material, which was extended to one tooth on either side. The matrix was relieved internally except for the incisal and occlusal portion which served as vertical stops. A definitive impression was made using the matrix of the preparations with a high viscosity elastomeric impression material (3M ESPE, Imprint II Garant), was seated over the remaining teeth to make an impression of the entire arch. Simultaneously, a stock tray filled with medium viscosity elastomeric impression material (3M ESPE, Germany) was seated over the remaining teeth to make an impression of the entire arch**(Fig 3)**.[6]

For Group II, A mix of light body(3M ESPE, express, Germany) was injected over the prepared teeth on the master model and simultaneously a mix of heavy body was injected in to the custom tray which was seated on the master model to make an impression of the entire arch. The impressions for this group were made using custom trays for the prepared master casts**(Fig 4)**.[7]

Fifteen impressions were made for each technique and the impressions were poured using die stone using standard W/P (water : powder) ratio and allowed to set completely to get the working casts. The master casts were recovered and the bases were formed by dental plaster. The working casts were checked carefully for any defects especially over the hatch marks. The mesiodistal, buccolingual, inciso-cervical dimensions of the canine and the second premolar and interabutment distance of the obtained casts (Group I and Group II) were measured using Profile projector and tabulated **(Fig 5)**. Each measurement was repeated three times and the mean was recorded for a particular dimension. Thus obtained readings were then compared with master model and analysed.

Fig 2: Hatch Marks Placed On The Finish Lines Of The Prepared Teeth (23 And 24)

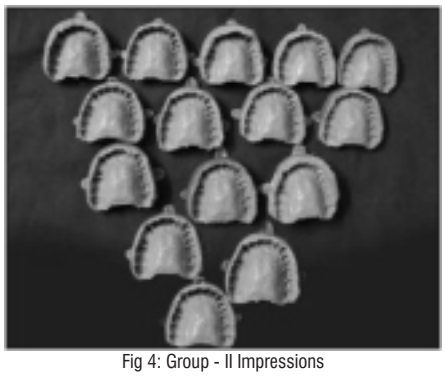

Fig 4: Group - II Impressions

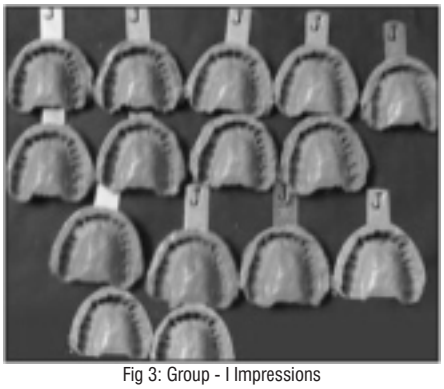

Fig 3: Group - I Impressions

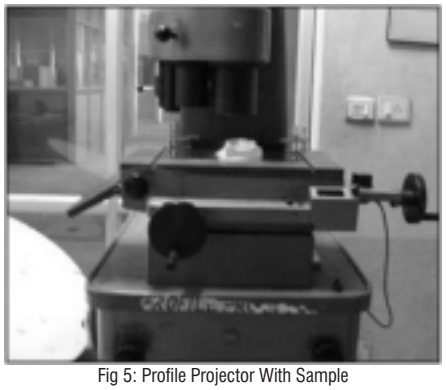

Fig 5: Profile Projector With Sample

Results

Matrix Impression System: **(Table 1 & 2)**

Mesio –distal width of canine and second premolar showed significant contraction from the master model i.e., -0.27mm and

Table I: Shows The Mean Differences Of Measurements Of Abutment A, Abutment B, Inter-abutment Distance Between The Master Model (Mm), Group I, Ii Working Casts

Teeth	Measurement (Mm)	Master Model (Mm)	MIS			MMT		
			Mean	Sd	Diff Frommm	Mean	Sd	Diff From Mm
Abutment A	Mesio-distal	6.61	6.3367	.61501	-0.27	5.6953	.7186	-0.92
(Canine)	Labio-palatal	6.42	6.040	.57867	-0.38	6.3471	.29234	-0.08
	Cervico-incisal	8.19	8.40	.22626	0.21	8.0040	.32809	-0.186
Abutment B	Mesio-distal	6.40	6.2180	.86947	-0.18	5.1347	.55973	-0.266
(Premolar)	Labio-palatal	5.12	4.9060	.25737	-0.22	4.7233	.30170	-0.40
	Cervico-incisal	5.53	5.6653	.32963	0.13	5.540	.45142	0.01
Inter Abutment Distance		14.63	14.69	.17866	0.03	14.15	.10117	-0.48

-ve sign indicates lower measurement compared to MM (master model)

Table-II: Results Obtained From T Test Showing Difference Between The Groups I And II

Abutment A And Abutment B	Groups	N	Mean	Std. Deviation	Std.Error Mean	T-test (P< .001), Mis Vs Mmt	
						T	Sig.(2-tailed)
Mesio-distalwidth	Mis	15	6.3367	.61501	.15880	2.626	.014(S)*
Of Canine	Mmt	15	5.6953	.71861	.18554	2.626	
Labiopalatal	Mis	15	6.0400	.57867	.14941	-1.835	.077(Ns)
Width Of Canine	Mmt	15	6.3471	.29234	.07548	-1.835	
Cervicoincisal	Mis	15	8.4071	.22626	.05842	3.918	.001(S)*
Length Of Canine	Mmt	15	8.0040	.32809	.08471	3.918	
Mesio Distal	Mis	15	6.2180	.86947	.22450	4.058	.000(S)*
Width Of Premolar	Mmt	15	5.1347	.55973	.14452	4.058	
Labiopalatal Width	Mis	15	4.9060	.25737	.06645	1.784	.085(Ns)
Of Premolar	Mmt	15	4.7233	.30170	.07790	1.784	
Cervicoincisal Length	Mis	15	5.6653	.32963	.08511	.839	.409(Ns)
Of Premolar	Mmt	15	5.5443	.45142	.11656	.839	
Inter-abutment	Mis	15	14.690	.17866	.04613	9.834	.000(S)*
Distance	Mmt	15	14.159	.10117	.02612	9.834	

Sig-Significance, S*- Significant, NS-Not significant

-0.18mm (p < 001). No significant differences were found in other dimensions.

Multiple Mix Technique: (Table 1 & 2)
Mesio – distal width of canine and second premolar showed significant contraction from the master model i.e., -0.92mm and -0.266mm(p< .001). Cervico – incisal width of canine showed significant contraction from the master model i.e., -0.816 mm (p< .001). Inter abutment distance showed significant contraction from the master model i.e., -0.48mm (p< .001).

Discussion
Fabrication of fixed prosthesis is an indirect technique, in which the prosthesis is to be fabricated in the laboratory and then it is placed in the oral cavity. For this purpose accurate replica of the dental and dentoalveolar structures are required. Making an accurate impression of individual tooth in their position is very vital in obtaining accurate working casts for the fabrication of FPD. Controlling the tissue fluids like gingival sulcular fluids, saliva and displacement of the gingival tissues around the abutments during impression procedure is a challenging task. The matrix impression system developed by Gus J. Livaditis (1998) requires a series of three impression procedures, using three types and /or viscosities of impression materials. This system effectively controls the four forces (relapsing, retraction, displacement, and collapsing) which impact over the gingiva during the critical phase of making an impression when attempting to register the subgingival margins.[6] The matrix impression system incorporates the attributes of traditional methods and overcomes important deficiencies in;

- Registration of subgingival margins
- Gingival retraction and relapse
- Hemostasis and sulcular cleansing
- Delivery of impression material subgingivally
- Strengthening the sulcular flange of the impression
- Simplification for making complex impression.[4]

The measurements of mesio-distal dimensions of canine and second premolar were 6.336 mm and 5.67 mm in group I, 5.693 mm and 5.13 mm in group II against the master model which was 6.61 mm and 6.42 mm. The contraction observed was more in group II when compared with group I. The results found in this study were similar to those found by Bomberg et al.,[8] which revealed the thickness of impression materials in custom and stock trays have reported a difference of less than 1.5mm and described that eccentric orientation of the tray on the arch was found in almost half of the impressions in both categories, and neither tray system confronted the non uniformity in thickness between prepared and prepared teeth. This may result in dies which are short mesio-distally.

The measurements of cervico-incisal dimensions of canine and second premolar were 8.40 mm and 5.66 mm in group I and 8.04 mm and 5.540 mm in group II against the master model which was 8.19 mm and 5.53 mm respectively. Group I showed a considerable amount of expansion in cervico-incisal dimensions of canine and second premolar. The results found in this study were similar to those found by Gordon et al.,[9] which revealed a slight increase in the vertical dimension of the dies when PVS impression material was used with stock trays. This may result in an elongated die in cervico-incisal direction.

The inter-abutment dimension of dies obtained from group I (14.69 mm) and group II (14.15 mm contraction) against the master model 14.63 mm. The contraction in the group II (14.15 mm) may be because of the uncontrolled wash bulk, which allows for differential contraction and results in uneven dimensional change. This may result in dies which are short mesio-distally, with decreased inter abutment distance. Increasing the thickness of the wash material increases the distortion of the impression because of greater polymerization shrinkage.

From the above mentioned results and discussion it can be concluded that group I impression (matrix impression system) produced less dimensional changes when compared to the dimensional changes shown in group II impression (multiple mix technique).The matrix impression system is more acceptable to obtain accurate dies with polyvinyl siloxane impressions.

Conclusion
Thus the present study concluded that the matrix impression system showed more accuracy of reproduction for individual dies and inter abutment distance when compared with multiple mix impression technique.

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