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Fixed Prosthodontics - Diagnosis With Recent Aids

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Abstract
Dentistry is rapidly evolving from a surgical and reparative profession into a healing profession focused on overall patient wellness. The focus is now disease prevention, early diagnosis, and intervention to minimize treatment, thus enabling the most desirable outcomes. Advanced diagnostic technologies are increasingly playing a more vital role in this process, both in data collection and assessment capabilities, and the utilization of the information obtained. Diagnostic modalities available to clinicians today expand greatly on the foundation of a comprehensive visual assessment , which has been and will be the cornerstone of the diagnostic process. The diagnostic clinician today is able to obtain a seemingly endless amount of information to assess the patient's oral health, which in turn gives them and the patient's other healthcare providers tremendous knowledge about the patient's overall health and wellness. This article reviews various advanced diagnostic aids like CBCT, Occlusal markers, biomarkers and genotype study etc. used now these days in fixed partial denture

Key Words
Diagnostic, Occlusal, Fixed Partial Denture.

Introduction

Diagnosis is the identification of the nature and cause of a certain phenomenon.Present day diagnosis, evaluation and examination is very important in the field of dentistry and medicine & Prosthodontics is no way exception to this.

"Diagnosis" – determination of the nature of a disease[1]. (GPT-8)

To achieve predictable success, there must be meticulous attention to every detail.Making the correct diagnosis is prerequisite for formulating an appropriate treatment plan. To arrive at the correct diagnosis and for confirming the diagnosis, use of diagnostic tools plays an important role.

In fixed partial denture advances occur in every field starting from diagnosis to impression to various new materials use in fabrication of fixed partial denture. Discussing modern diagnosis in fixed partial denture following topics will be covered:

A. In radiograph
B. Diagnosing of Temporomandibular Joint
C. Shade Selection
D. Establishing Occlusion

A. In Radiograph:

Radiographs provide the information to help, correlate all the facts that have been collected in listening to the patient and examining the mouth. They should be examined carefully for any signs of caries, periapical pathology or any bone pathology. This is the reason that radiographs play an important role in fabrication of fixed partial denture.

Computed Infrared Thermographic Imaging:

Thermographic imaging (TI) is a non invasive and highly accurate methodof measuring the surface temprature of a body of teeth as an indicator of pulpal blood flow. This technique is accurate and allows comparison of different areas of the tooth. A suitable device for infrared thermographic imaging is Hughes Probeye thermal video system.

Digital Subtraction Radiography:

It has made a significant improvement in detection of dental and maxillofacial lesions. DSR is a method that can resolve deficiencies and increase the diagnostic accuracy. DSR evaluates the alveolar bone change of 1 to 5% per unit volume and significant differences in crestal bone height of 0.78 mm can be detected[2].

Three-Dimensional Imaging:

Tuned- Aperture Computed Tomography:

Tuned- aperture computed tomography (TACT) works on the basis of tomosynthesis. Claimed advantages of TACT conventional radiographic techniques is that the images produced have less superimposition of anatomical noise over the area of interest. The overall radiation dose of TACT is not greater than 1 to 2 times that of a conventional periapical X- Ray film[3].

B. Diagnosing Of Temporomandibular Joint

Fixed partial denture can transform an unhealthy, unattractive dentition with poor function into a comfortable, healthy occlusion capable of giving years of further service while greatly enhancing esthetics. Proper history taking and initial examination plays an important role in achieving success of FPD. Same like taking history for any TMJ dysfunction play a significant role in fabrication of successful fixed partial denture.

Radigraphs For TMJ[4],[5],[6],[7],[8]

Tomography provides excellent bony details but no in formation of the soft tissue component of the joint. This technique is useful in demonstrating suspected hypoplasia, hypertrophy or

malformation of the condyles, in the case of maxillofacial trauma with fracture description, infections and tumors.

Artrography is performed to determine the status of the condyle-disk-glenoid fossa and eminence relationship with regard to the closed and open mouth position.

Computerized tomography (CT) is superior to conventional radiograšhy and conventional tomography for evaluating internal derangements of temporomandibular joint, trauma, degenerative processes and tumors. CT demonstrated good evaluation of soft tissue and excellent evaluation of bony structures.

Magnetic resonance (MR) has shown exquisite soft tissue contrast and provides a view of the structures of temporomandibular joint which cannot be differentiated by conventional radiography, conventional tomography and computerized tomography. MR of temporomandibular joint can distinguish internal anatomical features of the joint to a degree that no other imaging procedure can match. An image of the articular disk without contrast media as well an image of the posterior band has made the magnetic resonance the golden standard of temporomandibular joint imaging.

TMJ views including transcranial, transorbital and transpharyngeal are also of great importance.

Biomarkers As Diagnostic Aid[9],[10],[11],[12]:

Synovial tissue from patients with TMJ disorders are also a source for evaluating potential biomarkers. Investigators using these samples have shown that there is increased expression of Interleukin-8 and microvessel density in TMD patients. Assays on urine samples have shown elevated levels of pyridinoline (Pyr) and deoxypyridinoline (Dpyr) collagen cross-links, which are known markers of bone and cartilage turnover, in patients with osteoarthritis of the TMJ.

New technologies such as microarrays on tissue, synovial fluid or serum samples are the future scope to enable the identification of specific and sensitive biomarkers of TMJ disease. Microarrays permit the analysis of the expression of thousands of genes even with extremely small quantities of sample.

Recently, significant resources have been directed towards high-throughput genome sequencing , and it seems highly likely that in the next ten to twenty years health professionals will have their patients' genomes available for analysis.

C. Shade Selection[13],[14],[15],[16]:

Shade selection and colour perception are affected by several variables, and some precautions must be met to improve consistency.The ideal daylight source is a balanced daylight with an average colour temperature of 6500ºK. The dental office and dental laboratory should have daylight colour corrected fluorescent lamps installed so that shade selection and crown fabrication are performed in the same lighting environment. Incandescent or unbalanced light should be avoided, and the lighting equipment should be regularly inspected to detect fluctuations in colour temperature. It is wise to select the shade at an early stage, since some shades are more difficult to match than others.The natural tooth must be kept wet throughout the shade determination.

Computerized Shade Matching Systems

This innovative technology improves the quality and predictability of treatment and saves time.

Newer computerized instruments include the following:

- Spectro shade
- Shade scan
- Shade eye NCC
- IKAM
- Shade - Rite

Spectro Shade

The windows-based Spectro Shade system utilizes dual digital cameras linked through optic fibers to a fully functional spectrophotometer. As the system precisely measures the color characteristics of natural tooth, it indicates the deviations of value, chroma and hue from a standard, thereby providing information to modify the restoration and accurately match the tooth. The multifocal dual lighting mechanism illuminates the tooth in such a manner that the readings of its translucency and reflectivity are also taken, thereby allowing for shade measurements regardless of environmental lighting conditions. Dental images can be magnified, highlighted, rotated and measured. The split screen feature encourages the comparison of before and after images.

Shadescan

It employs digital artificial vision technology with integrated CAD/CAM technologies. Shade is measured by a hand-held optical device from the single image of the entire tooth at the click of a button. Dentists can instantly obtain a shade map of the entire tooth with various established and popular shade systems.

ShadeEye – NCC

It consists of two components – a main unit that includes an integrated printer mobile measuring unit that is the size of a cellphone.

The mobile wireless measuring unit analyses the tooth shade digitally and instantly transmits the information to the main unit through an infrared interface. The technique involves the placing of a disposable contact tip in the gingival one-third of the tooth and then a color and shade map of the tooth is generated.

Ikam

It combines the latest digital photographic technology and an innovative color analysis software. The color reference system of IKAM is based on actual fired ceramic samples rather than traditional shade guides, eliminating subjective interpretation.Dentist selects the level of detail for each specific case - coarse (predominant shade), medium or fine (detailed analysis). Selected image level produces a shade map of the tooth.

Shade-rite

This shade measuring device is handheld and portable, analyzing the shades of the tooth to be restored and the surrounding teeth with specialized imaging software.

D. Establishing Occlusion:

Occlusal contact plays an important role in establishing an occlusal harmony. Pokorny[17] described on FPD failures, indicates that deflective occlusal contact can loosen an FPD, cause sensitivity, and be a contributing factor to an acute periodontal disturbance. So, to prevent these deflective occlusal contacts various occlusal indicators have been used in establishing the occlusion.

Occlusal Indicators

Occlusal Indicators are used to locate and define occlusal contacts. The accuracy of these indicators is essential for the establishment of occlusal harmony, "The ultimate goal of treatment"[18].Occlusal contacts occur when the maxillary and mandibular dentition touch each other.Near contacts are those areas that

range from a contact to a gap of 0.5mm between the occluding surfaces. Whereas, non-contacts are those areas wherein there is a 0.5 to 2mm separation of teeth.

Types Of Occlusion Indicators
There are two types occlusion indicators. One is Qualitative Indicators and other is Quantitative Indicators[19].

Qualitative Indicators
It determines the location and number of tooth contacts. Its cost is low and its application is easy. There are number of qualitative indicators used in fixed partial denture are:

- Articulating paper
- Articulating silk
- Articulating film
- Metallic shim stock film
- High spot indicator

Quantitative Indicators
It determines the time and force characteristics of tooth contact not localization of occlusal contact point. It is expensive and requires precision technical skill to use.

- T-Scan occlusal analysis system
- Virtual dental patient

Articulating Paper
Most frequently used qualitative indicators to locate occlusal contacts intraorally. They differ in terms of width, thickness, and the type of dye impregnated.They are hydrophobic in nature.Their basic constituents are colouring agent bonding agent. On occlusal contact, the colouring agent is expelled from the film and the bonding agent binds it onto the tooth surface.The characteristic marking is observed as a central area that is devoid of the colorant and surrounded by a peripheral rim of the dye.

This region is called 'target' or 'iris' owing to their appearance, and it denotes the exact contact point.The density of these markings does not denote the force of the contact; instead, heavier contact tends to spread the mark peripheral to the actual location of the occlusal contact.Only the central portion in heavy contact areas indicates the interference requiring correction.

Disadvantage
They are easily ruined by saliva and hence require usage in a dry field. Their thickness of 40µ is well above the thickness perception level of the patient and their relatively inflexible base material leads to the formation of a large number of pseudocontact markings.

Articulating Silk
Made of micronized colour pigment, embedded in a wax-oil emulsion. It has a soft texture; therefore pseudomarkings not produced during use.

Disadvantage
Loses marking ability when stain components are dried and can be ruined by saliva.Hence its storage in a cool, closed environment is essential.

Articulating Film
The Artifol articulating film (Bausch Inc.) has only a thickness of 8µ, which is much less than the thickness perception level of the patient.Made up of an emulsion with a thickness of 6µ, which is hydrophobic and contained inside a polyester film.Must be used with special holders in a dry environment.Universally applicable, intraorally and on lab models.

Metallic Shim Stock Film
Has a metallic surface on one side and the other side is colour coded.Mainly indicated in occlusal splint therapy to mark contacts on the soft splint in the laboratory.

High Spot Indicator
Supplied in liquid form. Used in laboratory to check the proximal contact of crowns, inlays, etc.

The liquid is applied with a brush on the proximal surface of the coping and it forms a film with a thickness of 3µ. The dye is then seated on the cast, and on removal, the proximal contact area is delineated as an area of show through in the base material of the crown.

Two - Phase Occlusion Indicator Method
Sequential use of articulating paper and articulating film highlights the actual interference areas accurately and clearly.

Disadvantages Of Qualitative Occlusal Indicators
Density of occlusal contacts cannot be determined, although the opinion can be derived from the density of the contacts according to the darkness of the marks.They lack the quantitative time and force descriptive capacity incapable of measuring tooth contact events

Quantitative indicators
T-Scan
It is a Microsoft compliant system that can record a given contact sequence in 0.01s increments.It consists of piezoelectric foil sensor, a sensor handle, both hardware and software for recording, analyzing and viewing the data.It identifies the time magnitude and the distribution of the occlusal contact.
This device is indicated in any situation where the bilateral simultaneous occlusal contact is necessary including complete dentures, fixed or removable partial dentures, complete arch reconstruction involving FPD, natural tooth occlusal equilibration.

Conclusion

- Today's clinician has a wide array of diagnostic tools at his disposal. The CT gives the best information of the available modalities. More commonly though a combination of intraoral periapical radiograph and panoramic radiograph is used.
- To date no modality has been deemed perfect. So, the clinician has to carefully weight the pros and cons of each modality. The future for further development of diagnostic techniques specific for application in implantology is bright. We can definitely expect much more accurate, faster and safer modalities at lower cost to come into the field soon. Making the correct diagnosis is a prerequisite for formulating an appropriate treatment plan. To rightly diagnose and propose a comprehensive treatment plan, various diagnostic tools are made use of. One cannot restrict to just one diagnostic tool; instead a combination of the best available tools should be made use of to arrive at the correct diagnosis.

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