

Full mouth occlusal rehabilitation- A review

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Abstract - Successful reconstruction and long term maintenance of patients with dental diseases are highly dependent upon making the correct diagnosis of the nature of the problem and developing a proper treatment plan for the implementation of solutions. Planning and executing the restorative rehabilitation of a decimated occlusion is probably one of the most intellectually and technically demanding task for a dentist. Occlusal rehabilitation is the restoration of the dental arches by the use of inlays, crowns, bridges and partial dentures. The aim of full mouth occlusal rehabilitation is to restore the dentition by establishing new occlusal forms at the correct vertical dimension in order to improve function and appearance while maintaining the health of the entire stomatognathic system where teeth and their periodontal structures, the muscles of mastication and the temporomandibular joint mechanisms function together in synchronous harmony. There are different occlusal concepts for occlusal rehabilitation which are described in this review article. This review also describes the various steps to be followed in the procedure of full mouth occlusal rehabilitation.

Key words – Occlusal rehabilitation, Occlusal concepts, Twin stage technique, Functionally guided path.

INTRODUCTION:

Successful reconstruction and long term maintenance of patients with extensive dental diseases are highly dependent upon making the correct diagnosis of the nature of the problem and developing a proper treatment plan for the implementation of solutions. Planning and executing the restorative rehabilitation of a decimated occlusion is probably one of the most intellectually and technically demanding tasks facing a restorative dentist [1,2].

The occlusal rehabilitation is the restoration of the functional integrity of the dental arches by the use of inlays, crowns, bridges and partial dentures. Occlusal rehabilitation therefore, involves restoring the dentate or a partially dentate mouth. Occlusal adjustment by grinding may be required, as a part of the rehabilitation but does not constitute rehabilitation per se [1,2]. Occlusal adjustment therapy or coronoplasty is a procedure of selective coronal tooth modification. The reshaping of the teeth is carried out on one or more teeth. The coronoplasty procedure is usually done by selective removal of enamel and usually does not produce dentinal sensitivity. The goal of the occlusal adjustment procedure is to achieve a stable, non traumatic occlusal contact relationship between the maxillary and mandibular teeth in maximum intercuspation and in all functional excursive contact positions [3].

The aim of full mouth occlusal rehabilitation to restore the dentition by establishing new occlusal forms at the correct vertical dimension in order to improve function and appearance while maintaining the health of the entire stomatognathic system where teeth and their periodontal structures, the muscles of mastication and the temporomandibular joint mechanisms function together in synchronous harmony [4,5]. Hence proper evaluation, diagnosis, careful assessment of patient's diet, eating habits and/or gastric disorders along with the present state of occlusion is essential for appropriate treatment planning [5].

The literature search was carried out using electronic database search in PubMed and Google scholar for articles from 1800-2021 with key words occlusal rehabilitation, complete mouth rehabilitation, occlusal schemes. A total of 28 articles were selected and standard textbooks of occlusion, fixed partial denture were also referred.

IDEAL OCCLUSION:

A successful physiologic occlusion may be described as one that enables the patient to function with efficiency and comfort, one that is well tolerated by the periodontium, teeth and temporomandibular joint. It acts to minimize the activity of the muscles of mastication creating neuromuscular harmony and it does not create any pathologic symptoms in these muscles. The several criteria for this occlusion, as stated by Dawson [6] are:

1. Stable, simultaneous, bilateral maximal intercuspation of the teeth with the mandible in the centric relation or terminal hinge position; no interferences to closure between maximal intercuspation and terminal hinge position of the mandible
2. Freedom of mandibular movement in lateral and protrusive movement to and from the maximal intercuspation position, without posterior or anterior interferences.
3. Occlusal forces are distributed as widely as possible, with attempts made to minimize horizontal forces on both posterior and anterior teeth.

APPROACHES FOR OCCLUSAL REHABILITATION [7]:

Conformative approach: In this approach restorations are provided with pre existing occlusal scheme.

Reorganized approach: In this approach restorations are provided with new occlusal scheme.

Table 1: EDEC principle for conformative and reorganized approaches

EDEC principle	Conformative approach	Reorganized approach
E	Examine the pre existing occlusion	Examine the characteristics of existing occlusion and jaw relationship
D	Design an operative procedure that allows the conformative approach	Design and plan the new occlusion
E	Execute that plan	Execute the new occlusal plane prior to definitive restorations
C	Check that each stage of the restoration conforms to the occlusion of the previous stage	Check that you are conforming the definitive restorations to the new occlusion

DIFFERENT OCCLUSAL CONCEPTS:

There is a search for ideal occlusal scheme to follow during full mouth rehabilitation which would provide optimal muscle and joint function besides aiming at restoring the occlusal surfaces of teeth. There are various occlusal concepts to help resolve the complexities related to treatment planning and rehabilitation of patients requiring full mouth occlusal reconstruction.

Table 2: features of different occlusal concepts

Occlusal concept	Salient features	Drawbacks
Gnathological concept given by McCollom, Stuart and Stallard [8,9]	<ul style="list-style-type: none"> It has canine guided occlusion. It shows point centric concept. There is coincidence between maximum intercuspation and centric relation. Cusp to fossa relation with tripodism. The occlusal table is narrow. 	<ul style="list-style-type: none"> The concept of point centric and cusp to fossa relation complicates the need to obtain gnathological restoration. It requires fully adjustable articulator. It has a limitation related to cost of cast transitional restorations. Inability to increase occlusal vertical dimension.
Freedom in centric concept given by Schuyler [10,11,12]	<ul style="list-style-type: none"> Balancing contacts are deleterious in natural dentition and this should be avoided. For the selection of posterior guiding tooth inclines incisal guidance is a predominating factor than the condylar guidance so it has to be recorded first. There must be freedom of movement in the antero-posterior direction. 	<ul style="list-style-type: none"> There will be lack of precision as a result of adjusting maximum intercuspation contacts in two different positions on an articulator to achieve freedom on centric Cusp to surface contact affects chewing efficiency
Simplified occlusal design given by Wiskott and Belser [13]	<ul style="list-style-type: none"> It provides cusp to fossa relation with only one contact per tooth. There will be dis-occlusion in the anterior teeth during all eccentric movements. Freedom in centric occlusion concept. It can be adapted to most anterior guidances and varying degrees of group function. 	<ul style="list-style-type: none"> Achieving freedom in centric occlusion is difficult.
Pankey, Mann and Schuyler concept [14,15,16]	<ul style="list-style-type: none"> Maxillary cuspids are in good functional contact. Group function occlusion on working side. No contacts on non working side. Necessary to provide freedom in centric occlusion. Long centric is incorporated on the lingual surfaces of maxillary incisors. 	<ul style="list-style-type: none"> Cusp to fossa marginal ridge contact. Functionally generated path technique using wax may cause some errors. It is advocated to use non arcon articulator which may not accept the interocclusal record with increased occlusal vertical dimension
Twin table technique given by Hobo [17,18,19]	<ul style="list-style-type: none"> Condylar guidance and incisal guidance both are dependent factors. Posterior teeth are restored using two customized incisal tables one without disocclusion and other with disocclusion. 	<ul style="list-style-type: none"> Cusp angles are fabricated parallel to the measured condylar path and it is too steep. The incisal path had to be set at an angle that was extremely steep to obtain a standard amount of disocclusion with such a steep cusp

		<p>angle. This makes the patient uncomfortable.</p> <ul style="list-style-type: none"> • It was technique sensitive as the customized incisal tables were fabricated using acrylic.
Twin stage procedure given by hobo and Takayama [20]	<ul style="list-style-type: none"> • The measurement of condylar path is not necessary because the cusp angle is the main determinant of occlusion. • This can be indicated in single crowns, fixed prosthodontics, implants, full mouth rehabilitation and complete dentures. • Suitable for transmandibular disorder patients. • This can be incorporated easily using common clinical techniques such as facebow transfer, various centric recording methods and cusp fossa waxing. 	<ul style="list-style-type: none"> • Contraindicated in malocclusion cases.
Youdelis scheme [21]	<ul style="list-style-type: none"> • Cuspal anatomy is so arranged that if the canine disocclusion is lost through wear or tooth movement, the posterior teeth drop into group function. 	<ul style="list-style-type: none"> • Used only in case of advanced periodontitis.
Lyman and Lindhe scheme [22]	<ul style="list-style-type: none"> • Balanced occlusion must be achieved in case of long tooth borne cantilever restorations. • Anterior disocclusion is provided when distal support is present. 	<ul style="list-style-type: none"> • Used only in extremely advanced periodontitis. • Type of contacts not specified.

INDICATIONS FOR OCCLUSAL REHABILITATION:

Restoration of teeth which are missing, worn, broken down or decayed are the reasons for occlusal rehabilitation. Replacing improper design and executed crown and bridge work also requires the occlusal rehabilitation. Sometimes treatment of temporomandibular joint disorders (TMD) may also be considered as an indication for rehabilitation, but it should be done with great caution in such cases. To achieve the goals like oral health, function, esthetics and comfort the treatment should be planned with the following considerations. [23,24,25]

1. Indications of reorganizing the occlusion.
2. Choose the appropriate scheme of occlusion.
3. The correct occlusal vertical dimension.
4. Need for replacing the missing teeth.
5. The effects of the material used for occlusal stability, control of parafunction and TMD.

DIAGNOSIS AND TREATMENT PLANNING [6,26,27,28,29]:

A thorough diagnostic planning must be done before initiating the restoration of a patient’s dentition. This includes the following

1. **PATIENT MEDICAL AND DENTAL HISTORY:** It gives the information which must be considered when formulating the treatment plan to the clinician. For example, 1. Patient with stroke will have poor oral hygiene, 2.history of any unsuccessful removable restoration so that we can avoid the repetition.
2. **CLINICAL DENTAL EXAMINATION:** This will reveal the pathologies which may influence the type of restoration. For example, 1. Some critical teeth may have unacceptable short clinical crown, 2. Some areas may have less occlusal clearance, 3. Important teeth may have inadequate zone of attached tissue.



Figure 1: Preoperative maxillary teeth



Figure 2: Preoperative mandibular teeth

3. **FULL MOUTH SERIES OF RADIOGRAPHS:** This reveals non physiologic processes which may have influence on sequence of treatment and final restoration to be placed. For example, bone loss, pathologies impacted tooth, root stumps and bone quality.
4. **DIAGNOSTIC MOUNTING:** Diagnostic mounting helps in 3D visualization of maxillary to mandibular arch relationship which includes the visualization of occlusion from the lingual aspect. This shows if any occlusal problems are there.
5. **DETERMINING THE PLANE OF OCCLUSION:** After mounting cast using facebow and centric records on the semi adjustable articulator the plane of occlusion will be determined. For this the upper model should be removed and flag is attached. Arc is drawn on the flag with a set radius from the tip of the canine assuming that the canine is not to be restored in increased vertical height. This canine arc is bisected by an arc of same radius and which uses the hinge (TMJ) of the articulator as its center. Now the divider is reversed so that the point will be on the intersection of both arcs and the graphite end is used to draw on the teeth. This will develop the occlusal plane for the future prosthesis. [7]



Figure 3: Broadrick's plane analysis

6. **DIAGNOSTIC WAXUP:** This should be done once the diagnostic tooth preparation is done on the cast [30]. The occlusal reduction should be 1.5 mm below the established plane of occlusion and then the wax up is completed. This will establish the contour and occlusion of the future prosthesis. This will become an important task if the occlusal scheme and anterior guidance are need to be modified. [7]



Figure 4: Diagnostic wax up

OUTLINE OF THE TWIN STAGE PROCEDURE: [20]:

Fabrication of the cusp angle:

1. In keeping with "condition 1" adjust an articulator to the following values: sagittal condylar path inclination = 25 degrees, Bennett angle = fifteen degrees, Sagittal inclination of the anterior guide table = twenty five degrees, and lateral wing angle = 10 degrees.
2. Create the anterior segment of the maxillary or mandibular casts removable using dowel pins. Remove the anterior segment.
3. Wax the occlusal morphology of the posterior teeth, so the maxillary and mandibular cusps contact throughout eccentric movement. Thus, a balanced articulation is obtained, and each cusp can have a standard cusp angle.

Fabrication of anterior teeth:

1. In keeping with "condition 2", adjust an articulator to the following values: Sagittal condylar path inclination = 40 degrees, Bennett angle = 15 degrees, Sagittal inclination of the anterior guide table = 45 degrees, and lateral wing angle = 20 degrees.
2. Reassemble the anterior segment of the cast such that the maxillary and mandibular casts on the articulator produce the standard amount of disocclusion.

Wax up the palatal surface of the maxillary anterior teeth such that the maxillary and mandibular incisors contact during protrusive movement, and the maxillary and mandibular canines on the working side contact during lateral movement. Thus anterior guidance is established and also the standard amount of disocclusion will be produced.

OUTLINE OF THE PANKEY MANN SCHUYLER PROCEDURE [14,15,16]:

The sequence to be followed in the PMS Philosophy:

- Examination, diagnosis, treatment planning, prognosis.
- Harmonization of the anterior guidance so that best possible esthetics, function and comfort can be achieved.
- Selection of a suitable occlusal plane, and restoration of the lower posterior occlusion harmonic with the anterior guidance in a manner that will not interfere with condylar guidance.
- Restoration of the upper posterior occlusion harmonic with the anterior guidance and condylar guidance. The functionally generated path technique is therefore closely allied with this part of the reconstruction, that it is going to be almost considered a part of the concept, although new understanding of the impact of posterior disclusion has made this unnecessary for most occlusal restorations.

STEPS TO RECORD FUNCTIONALLY GUIDED PATH (FGP):

1. Upper posterior teeth are prepared.
2. An alginate impression is made of the upper prepared arch, and while the patient waits, is poured immediately in hard stone.
3. When the model has set, extra hard base plate wax is employed to form a base for the functional wax. The wax is softened over a flame and folded into three layers. Then, the wax is adapted down around every tooth to completely cover all prepared teeth down to the gingival margins.
4. The functional wax is heated with lame to make sure it is quite soft and sticky enough to securely adhere to the base. It may be sealed to the base with a hot spatula.
5. Using the manipulative technique recording centric relation is done. The patient should be told to hold that position and slide forward until the anterior teeth are end to end.
6. The patient should close back into centric relation and the mandible is guided into lateral excursions.
7. Once all excursive movements have been recorded by manipulation of the mandible, the patient should be allowed to slide around however he wishes. This is the step that records the movements between straight lateral and straight protrusive.
8. A creamy mix of stone is jiggled into all the depressions of the functional wax.



Figure 5: FGP recording

Mounting the FGP:

1. The opposing anatomic model is removed from the articulator and also the FGP base placed on the mounted master die model. It should fit perfectly without rocking. The functional stone core should fit against the cupid's (or an unprepared tooth in front) without any crack showing
2. Stone is built up from the lower articulator ring, till it almost touches the stone core. An inverted plastic cup with the bottom cut out makes a good form for pouring the lower stone platform.

PROVISIONAL RESTORATIONS:

Provisional restorations are helpful and sometimes becomes necessary step in management of reorganized approach. Provisionary restorations are ought to be programmed using the occlusal scheme of final restorations. Some minor changes can be done in the final restoration but it should conform to the provisional. [7]

DEFINITIVE RESTORATIONS:

Once the patient and practitioner are satisfied with the provisional restoration, it can be replaced with the definitive one. Definitive restoration is now fabricated using confirmative approach. One should not proceed with the definitive restorations while the provisional restorations are causing problem or patient is not comfortable. Copying the occlusal features that have been developed in the provisional to the definitive restorations is a challenging task. Using a customized incisal guidance table is helpful in copying the guiding surfaces of the upper anterior provisional crowns so as to duplicate the same anterior guidance in the definitive restorations. [7]



Figure 6: Provisional restoration



Figure 7: Definitive restoration



Figure 8: Definitive restoration

FABRICATION OF CUSTOM GUIDE TABLE [7]:

- The models of the provisional are mounted onto the semi adjustable articulator after a facebow record.
- Lift the incisal pin 2mm above the incisal guide table.

- The self cure acrylic resin is placed on the guide table. While it is setting the incisal pin should be transcribed through it, whilst guiding the model incisors through excursive movements. This gives a template of movements of the articulator during lateral and protrusive movements. This template can be used during the fabrication of definitive prosthesis

CONCLUSION:

Planning and executing the restorative rehabilitation of the decimated occlusion is probably one of the most intellectually and technically demanding tasks facing a restorative dentist? Occlusal rehabilitation involves restoring the dentulous or partially dentulous mouth. The aim of this is to provide an orderly pattern of occlusal contact and articulation that will optimize oral function, occlusal stability, and esthetics. Some decisions must be made regarding the complex area of occlusion, before starting occlusal rehabilitation. There are many contrary writing and recommendation that have been made the subject of occlusion is still very unclear to many clinicians. General and specific recommendations, and procedural steps for full mouth occlusal rehabilitation have been discussed in this article. The practitioner must be aware of the requirements that a physiologic restoration should be made which is not only aesthetical and functional but also remain in harmony with the entire gnathostomatic system. We must also know that all patients cannot be successfully treated with a single preconceived treatment philosophy. Satisfactorily restoring patient to a state of physiologic health is a challenge that requires that the clinician not only be an accurate diagnostician but also a master of wide range of treatment modalities.

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