History of Medicine, 2022, 8(2): 127–137
DOI: 10.17720/2409-5834.v8.2.2022.015

FULL MOUTH OCCLUSAL REHABILITATION USING FIXED PARTIAL DENTURE

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Abstract: Restoration of occlusion in patients with severely worn dentition is a challenging situation as every case is unique in itself. There is great apprehension involved in reconstructing debilitated dentition due to widely divergent views concerning the choice of an appropriate occlusal scheme for successful full mouth rehabilitation. This article is an overview of the various occlusal concepts/philosophies in full mouth rehabilitation which will help the clinician select an appropriate occlusal scheme for an individual case.[1]

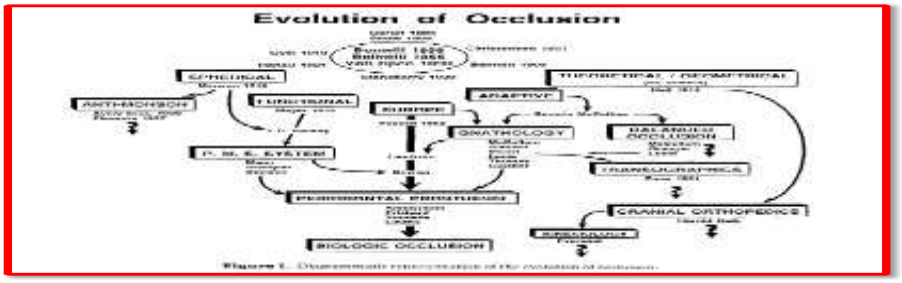
Introduction:

Oral rehabilitation is the practice of dentistry that includes the execution of any phase of our profession. A single amalgam restoration or a successful periodontal treatment rehabilitates the mouth in one instance while extensive crowns & bridges do so in another. When the restorations and treatment include the entire occlusion, the procedure is referred as occlusal rehabilitation. Full mouth rehabilitation entails the performance of all the procedures necessary to produce a healthy, aesthetic, well-functioning, self-maintaining masticatory mechanism.[2]

EVOLUTION OF OCCLUSION:

For nearly a century, the diversity of concepts about „normal" and „ideal" dental occlusal relationships have led to confusion in trying to describe the occlusion of any individual

patient8. In addition, a similar controversy arises when trying to formulate treatment plans for



patients who need extensive dental restorations. And finally, the application of occlusal concepts to patients with temporomandibular pain and dysfunction has created a third area of debate. The need to perform complex restorative dentistry requires some organizing concepts for delivery of optimal results –yet, dentists cannot seem to agree on what those concepts should be, nor even on what constitutes a good outcome. The past, present and future of these occlusal concepts and their clinical implications are reviewed.

Various classifications have been proposed to classify patients requiring full mouth rehabilitation, however, the classification most widely adopted is the one given by Turner and Missirlian.

According to them, patients with occlusal wear can be broadly classified as follows:

Category-1: Excessive wear with loss of vertical dimension of occlusion (VDO)

The patient closest speaking space is more than 1 mm and the interocclusal space is more than 4 mm and has some loss of facial contour and drooping of the corners of the mouth. All teeth of one arch must be prepared in a single sitting once the final decision is made. This makes the increase in VDO less abrupt and allows better control of aesthetics.

Category-2: Excessive wear without loss of VDO but with space available

Patients typically have a long history of gradual wear caused by bruxism, oral habits, or environmental factors but the occlusal vertical dimension (OVD) is maintained by continuous eruption. It might be difficult to achieve retention and resistance form because of shorter crown length and gingivoplasty may be needed. Enameloplasty of opposing posterior teeth may provide some space for the restorative material.

Category-3: Excessive wear without loss of VDO but with limited space

There is excessive wear of anterior teeth over a long period, and there is minimal wear of the posterior teeth. Centric relation and centric occlusion are coincidental with a closest speaking space of 1 mm and an interocclusal distance of 2–3 mm. In such cases vertical space must be obtained for restorative materials. This can be accomplished by orthodontic movement, restorative repositioning, surgical repositioning of segments, and programmed OVD modification.

After evaluating and classifying the patient's existing clinical situation but before beginning the reconstruction procedure, the clinician must decide upon the occlusal approach and choose an appropriate occlusal scheme. Occlusal Approach

Occlusal approach for restorative therapy can be either conformative approach (often advisable) or a reorganised approach.

In confirmative approach, occlusion is reconstructed according to the patient's existing intercuspal position. It is adopted when small amount of restorative treatment is undertaken.

It includes two situations:

Occlusion is untouched prior to tooth preparation although small changes can be made on restorations such as elimination of the non-working contacts.

Occlusion is modified by localized occlusal adjustments before tooth preparation that is shortening of an opposing cusp, elimination of non-working side interferences and removal of a deflective contact on tooth to be restored.[7]

In reorganised approach, new occlusal scheme is established around a suitable condylar position which is the centric relation position. The patient's occlusion may be reorganised if the existing intercuspal position is unacceptable and needs to be changed or when extensive treatment is to be undertaken to optimize patient's occlusion.

Indications for reorganised approach are loss of vertical dimension, repeated fracture/failure of teeth or restorations, severe bruxism, lack of interocclusal space for restorations, trauma from occlusion, unacceptable function and aesthetics, presence of temporomandibular disorders or developmental anomalies.

Occlusal Schemes

The ideal occlusion for eccentric movements can be classified by three schemes according to the tooth contact condition; mutually protected articulation, group function, and balanced articulation. The balanced occlusion concept is applied to complete denture patients while mutually protected occlusion and group function are applied for natural dentition.

Choice of Occlusal Concepts and Philosophies. There has been a search for the ideal occlusal scheme to be followed during full mouth rehabilitation that would provide optimal muscle and joint function besides aiming at restoring the occlusal surfaces of teeth. Many concepts

and techniques have been discussed till now in order to rehabilitate dentition with fixed prosthodontic.

The article overviews the various occlusal concepts to help absolve the complexities related to treatment planning and rehabilitation of patients requiring full mouth reconstruction. An early concept of comprehensive dentistry originated from the gnathological society founded by McCollum in. McCollum together with Stuart published their classic ‘‘Research Report’’ in 1955 and gave the Gnathological Concept. Their observations led to the development of mandibular movements, transverse hinge axis, maxillomandibular relationships, and an arcon fully adjustable articulator. They believed that anterior guidance was independent of the

condylar path and described condylar path as a fixed entity in adults. The concept of balanced occlusion which included the idea that the most posterior position of the condyles was the optimal functional position for restoring denture occlusion was applied to restoration of the natural dentition by McCollum, Schuyler and others. Schuyler supported balanced occlusion during his early clinical years but later began to observe clinical failures. Similar failures were observed by Stuart due to unequal wear of the buccal and lingual cusps causing deflective occlusal contacts with a loss of centric-related closure, causing patients to bite their cheeks and tongue. Stuart and Stallard observed that the upper lingual cusps stamp into lower fossae and lower incisors, canines and buccal cusps stamp into the upper fossae. They observed that canines discluded all other teeth in laterotrusive (working) excursion which was similar to the observation of D’Amico. In their report in 1960 they adopted the concept of mutually protected occlusion (canine-protected /organic occlusion which replaced the concept of balanced occlusion. In mutually protected articulation, the anterior teeth protect the posterior teeth in eccentric movements and conversely have the posterior teeth protect the anterior teeth in maximal intercuspation without any deflective occlusal contacts or interferences in speech.

Requirements for a mutually protected occlusion included that the cusps of posterior teeth should close in centric occlusion with the mandible in centric jaw relation, while, in lateral excursions only opposing canines should contact and in protrusion only the anterior teeth should contact.[4]

Spee in 1890 had referred to the vertical overlap “overbite” of the cuspids which was overlooked entirely. In 1915, Gysi described the masticating functions of the teeth and he was

the first to describe the scheme of canine-protected occlusion. D'Amico in 1958 studied the significance of cuspid teeth and presented the Concept of Canine Guidance (Canine disclusion) in which the maxillary canine teeth serve to guide the mandible during eccentric movements and when in functional contact with the lower canines and first premolars, determine both lateral and protrusive movements of the mandible. Thus, preventing any force other than along the long axis to be applied to the opposing incisors, premolars and molars.

Schuyler first introduced the Concept Of 'Freedom in Centric" and supported the theory that centric relation was rather a biological area of the TMJ than a point.

In this concept, "there is a flat area in the central fossae upon which opposing cusps contact which permits a degree of freedom (0.5–1 mm) in eccentric movements uninfluenced by tooth inclines". It relies on cusp-to-surface mechanics. Schuyler suggested that incisal guidance without freedom of movement from a centric relation occlusion to a more anterior tooth intercuspation will "lock-in" the posterior occlusion. Dawson used the term 'long centric' for freedom in centric. Long centric accommodated changes in head position and postural closure. The measurable amount of long centric needed is the difference between centric-related closure and postural closure which is rarely more than 0.5 mm.

Ash and Ramfjord also advocated the horizontal "long centric". Pullinger et al. suggested that an intercuspal position anterior to the retruded contact position in association with bilateral occlusal stability may be protective.

According to Wiskott and Belser, in natural dentition, occlusal contacts are few and not ideally placed. Also, functional and parafunctional forces are not directed along the long axis of the tooth. Based on this, they proposed a simplified occlusal scheme in which; one occlusal contact per tooth usually a cusp-fossa relation is sufficient instead of a tripod contact, all interproximal contacts should be proper and tight as they stabilize the tooth mesio-distally, anterior disclusion mechanics should be applied so that posteriors do not experience any interference on lateral excursive movements, antero-posterior freedom of movement should be provided which is achieved by having concave internal slopes on the cusps of posterior teeth.

This technique helps maintain vertical dimension and allows chewing due to cusp-fossa relation. The overall numbers of occlusal contacts are reduced and it can be used for small as well as extensive restorations. This design ensures occlusal stability and satisfies aesthetic

demands. The system can be adapted to most anterior guidance's and varying degrees of group function. Occlusal adjustment is simple.

An organized approach to oral rehabilitation was introduced by Pankey utilizing the principles of occlusion advocated by Schuyler, known as the Pankey–Mann–Schuyler (PMS) Philosophy of Oral Rehabilitation. Their philosophy was pertinently based on the spherical theory of occlusion, the "wax chew-in" technique described by Meyer and Brenner, and on the importance of cuspid teeth as discussed by D'Amico. As a modification of canine disclusion, the PMS philosophy was to have simultaneous contacts of the canine and posterior teeth in the working excursion (group function), and only anterior teeth contact in the protrusive excursive movement.

The PM instrument was based on Monson's spherical theory of occlusion and Monson articulator. It was used to establish functional occlusal plane on the mandibular teeth. The "wax chew-in" technique was modified, and the occlusal scheme was developed by intraoral recording of the functional occlusal path. In this, both maxillary cuspids had to be in good functional contact in centric and eccentric positions before beginning the reconstruction of the posterior teeth. If not, it must be obtained by reconstruction of the cuspids even if there is no caries.

In PMS technique, the incisal guidance was the developed intraorally with acrylic resin to satisfy aesthetic and functional requirements. Optimal occlusal plane is selected as dictated by the curve of Monson and mandibular posterior teeth are restored in harmony with the anterior guidance such that they will not interfere with the condylar guidance. Maxillary posterior occlusal surfaces are developed after the completion of mandibular restorations by the functionally generated path technique (FGP). The definitive restorations are equilibrated into a centric relation position with mandibular buccal cusps onto a flattened fossa–marginal ridge contact, with "long centric" incisal guidance and group function in working excursion. Use of FGP records allows eliminating all occlusal interferences and establishing functional form of the occlusal surfaces of the restoration. The PM philosophy was developed and its use advocated on a non-arcon articulator, which may not accept interocclusal records made at increased OVD.

Early gnathologic concepts focussed primarily on the condylar path and it was believed that anterior guidance was independent of the condylar path. However, Hobo and Takayama [36]

in their study revealed that anterior guidance influenced the working condylar path and concluded that they were dependent factors. Hobo adopted the concept of posterior disocclusion and gave the Twin-tables Technique. According to him, posterior disocclusion is dependent on; the angle of hinge rotation created by the angular difference between anterior guidance and condylar path, and on inclination and shape of posterior cusps which helps in controlling harmful lateral forces. In this technique, molar disocclusion is achieved by the use of two incisal tables. The first incisal guide table termed as the incisal table without disocclusion is used to fabricate restorations for posterior teeth. The second incisal table termed as the incisal table with disocclusion is used to achieve incisal guidance with posterior disclusion.[5]

The Twin-Stage Procedure was developed as the advanced version of the Twin-Table technique. Hobo and Takayama in their research concluded that cusp angle be considered as the most reliable determinant of occlusion as cusp angle does not deviate and is 4 times more reliable than the condylar and incisal path which show deviation. Though independent of condylar path as well as incisal path, a standard value for cusp angle was determined such that it may compensate for wear of natural dentition due to caries, abrasion and restorative works. By using the standard cusp angle, it was possible to establish the standard amount of disclusion (see Table 1). Different adjustment values of an articulator were determined for each occlusal scheme to reproduce the standard amount of disclusion.[6]

Table 1: Amount of disclusion of molars for each occlusal scheme length of condylar path = 3 mm

	Mutually protracted articulation	**Group function**	**Balanced articulation**
Protrusion	**1.0**	**1.0**	**0.0**
Non-working side	**1.0**	**0.5**	**0.0**
Working side	**0.5**	**0.0**	**0.0**

Table 2. Articulator adjustment values for mutually protected articulation (degree)

Condition	**Condylar path**		**Anterior guide table**	
Protrusion	**Sagittal condylar path**	**Bennett Angle**	**Sagittal inclination**	**Lateral wing angle**
Condition 1	**25**	**15**	**25**	**10**

Without anterior teeth				
Condition 2 With anterior teeth	**40**	**15**	**45**	**20**

Table 3. Articulator adjustment values for group function (degree)

Condition	**Condylar path**		**Anterior guide table**	
Protrusion	**Sagittal condylar path**	**Bennett Angle**	**Sagittal inclination**	**Lateral wing angle**
Condition 1 Without anterior teeth	**25**	**15**	**25**	**10**
Condition 2 With anterior teeth	**40**	**15**	**45**	**00**

Table 4. Articulator adjustment values for balanced articulation (degree)

Condition	**Condylar path**		**Anterior guide table**	
Protrusion	**Sagittal condylar path**	**Bennett Angle**	**Sagittal inclination**	**Lateral wing angle**
Condition 1 Without anterior teeth	**25**	**15**	**25**	**10**
Condition 2 With anterior teeth	**40**	**15**	**25**	**10**

Table 5 Summarizes various occlusal concepts in full mouth rehabilitation

S. No.	Occlusal concept/ philosophy	Salient features	Limitations
1.	Gnathological concept (McCollum, Stuart, Stallard)	• Mutually protected occlusion • Point centric concept • Maximum intercuspation coincides with centric relation (RUM position) • Cusp to fossa relationship with tripodism • Narrow occlusal table	• Point centric and cusp-to-fossa tripodization complicate the need to obtain precise gnathologic restorations • Need for a fully adjustable articulator • Cast metal transitional restorations had limitations related to cost, inability to increase occlusal vertical dimension, and changes in mandibular position that cannot be equilibrated easily to a new maximum intercuspal relation
2.	Freedom in centric concept (Schuyler)	• Balancing contacts are deleterious and must be avoided in natural dentition • Incisal guidance is a predominating factor for selection of posterior guiding tooth inclines than condylar guidance so it should be the first step of occlusal rehabilitation • Antero-posterior freedom of movement must be incorporated in the restoration	• According to gnathologists, the task of adjusting maximum intercuspation contacts in two different positions on an articulator to achieve freedom in centric may result in a lack of precision in both positions • Cusp-to-surface rather than cusp-to-fossa relation affects chewing efficiency
3.	Simplified occlusal design (Wiskott and Belser)	• Cusp-fossa relation with only one occlusal contact per tooth • Anterior disclusion during all eccentric movements • Freedom in centric occlusion • Can be adapted to most anterior guidances and varying degrees of group function	•
4.	Pankey, Mann and Schuyler Philosophy (1960)	• Maxillary cuspids in good functional contact • Group function on working side • Absence of nonworking side contacts. • Freedom of movement in centric occlusion is necessary • Long centric is incorporated in the lingual surfaces of maxillary incisors	• Cusp to fossae marginal ridge contact • Use of wax functionally generated path techniques can cause errors • The PM philosophy was developed and its use advocated on a non-arcon articulator, which may not accept interocclusal records made at increased occlusal vertical dimension
5.	Twin Table technique-Hobo (1991)	• Incisal guidance and condylar path are dependant factors • Posterior teeth are restored using two customised incisal tables: without disclusion; and with disclusion	• The cusp angle was fabricated parallel to the measured condylar path, and the cusp angle became too steep • To obtain a standard amount of disclusion with such a steep cusp angle, the incisal path had to be set at an angle that was extremely steep. This made the patient uncomfortable • The customised guide tables were fabricated by means of resin molding. It was technique sensitive
6.	Twin Stage Procedure-Hobo and Takayama	• Since cusp angle is the main determinant of occlusion, the measurement of the condylar path is not necessary • The procedure can be indicated for single crowns, fixed prosthodontics, implants, complete-mouth reconstructions, and complete dentures • Suitable for transmandibular disorder patients • It can be incorporated easily with commonly used clinical techniques such as facebow transfer, various centric recording methods, and cusp-fossa waxing	• Contraindicated for malocclusion cases
7.	Youdelis Scheme	• Cuspal anatomy is so arranged that if the canine disclusion is lost through wear or tooth movement, the posterior teeth drop into group function	• Used in advanced periodontitis cases
8.	Nyman and Lindhe Scheme	• When there are long tooth-borne cantilevered restorations, balanced occlusion must be achieved • When distal support is present, anterior disclusion is provided	• For extremely advanced periodontitis cases • Type of contacts not specified

Conclusion

The principles of treatment are universal, all the functional factors are interrelated, and all efforts should be made to construct an occlusal interface such that the periodontium of teeth, muscles of mastication, and TMJ's function in harmony with each other. This requires accurate diagnosis regarding the aetiology of the deranged condition, intra-oral changes and other adverse effects on jaw relations. Optimal occlusion according to the needs of the patient should be attained in rehabilitation procedures. Chewing efficiency can exist over a wide range of occlusal forms and types of occlusal schemes, so no set rule can be applied to all the patients.

Occlusal rehabilitation is a radical procedure and should be carried out in accordance with the dentist's choice of treatment based on his knowledge of various philosophies followed and clinical skills. A comprehensive study and practical approach must be directed towards reconstruction, restoration and maintenance of the health of the entire oral mechanism.

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