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Various concepts of occlusion in full mouth rehabilitation: A review

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Abstract

Full mouth reformation is an effective useful attempt and it personify the interrelationship and assimilation of all constituent parts in to one working unit. As with time emerges different approaches as well as theories to obtain restoration and rehabilitation of the full dentition, pleasing all the pertinent component.

Restoration of occlusion in patients with severely worn dentition is a challenging situation as every case is unique in itself. There is immense fear involved in rebuilding incapacitated dentition due to extensively diverse perspective regarding the choice of a relevant occlusal scheme for successful full mouth rehabilitation.

This review article reviews different occlusal philosophies which can be applied in full mouth rehabilitation, help the dentist to select relevant occlusal scheme for an individual patient.

Keywords: full mouth rehabilitation, restoration, rehabilitation

Introduction

The primary concern of a full mouth rehabilitation is not only reformation and reclamation of the deteriorated dentition, however likewise maintenance of the well being of the full stomatognathic structure. Full mouth rehabilitation should restore a state of serviceable as well as biological productivity, where teeth, periodontal structures, muscles of mastication and temporomandibular joint all function together in consistency^[1, 2].

Careful assessment of the patient's diet, eating habits and/or gastric disorders, along with the present state of occlusion is essential for appropriate treatment planning^[2, 3]. Various classifications^[4, 5] have been proposed to classify patients requiring full mouth rehabilitation, however, the classification most widely adopted is the one given by Turner and Missirlian^[6].

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 visit, so that there should be less increase in vertical dimension of occlusion that provides better control of esthetics.

Category-2: There should be excessive wear without much loss of vertical dimension of occlusion however patient with space available. Patient usually had a history of bruxism, paraoral habits, however vertical dimension of occlusion is maintained by continuous eruption. There might be hardship in upheaving retention as well as resistance form because of shorter crown height, in that case gingivoplasty is needed. Slight reshaping of superior surface of tooth i.e. enamel of teeth from posterior segment from opposing arch might be helpful in gaining some interocclusal space for restorative material.

Category-3: Excessive wear without loss of vertical dimension of occlusion but with limited space available.

In this category there is extensive wear down of teeth which are present in anterior region that too over a long period of time and simultaneously there is less wear down of teeth present in posterior region. Centric relation and centric occlusion are coincidental with a closest speaking space of 1 mm and an interocclusal distance of 2–3 mm.

In these cases vertical dimension must be obtained for restorative materials. This can be accomplished by orthodontic movement, restorative repositioning, surgical repositioning of segments, and programmed OVD modification [2].

The focus is to reinstate the tooth to its instinctive form, function and esthetics while preserving the physiologic principle in melodious correlation with the adjoining hard and soft tissues, all of them intensify the oral health and well being of patient.

The goals to be attained for full mouth rehabilitation are as follows [7]:-

1. Liberation from disease in all the masticatory and associated structures
2. Maintainable healthy periodontium
3. Stable TMJs
4. Stable occlusion
5. Maintainable healthy teeth
6. Comfortable function
7. Optimum esthetics

Earliest manifestations for restoration of the complete dentition are:

1. Restoration of teeth that were worn out [7].
2. To replace improperly designed and executed crown and bridge framework [7].
3. Therapy of TMD disorganization is also advised [7].

Functional Aspects of Full Mouth Rehabilitation [8]

Full mouth rehabilitation is a zestful effective attempt and it incorporates the association and combination of all the constituent parts into one functioning component. The aim, should be reconstruction and rehabilitation of the complete dentition, fulfilling all the associated elements. The discipline of complete mouth rehabilitation rests upon three demonstrated and accepted fundamentals:

1. The already existing physiologic rest position of the mandible, which is constant [8].
2. The recognition of a vertical dimension [8].
3. The acceptance of a dynamic, functional centric occlusion [8].

Occlusal approach

For restorative therapy can be either confirmative approach (often advisable) or a reorganized approach².

In confirmative approach⁹, occlusion is reconstructed according to the patient's existing intercuspal position. It is acquired when there is little amount of rehabilitative therapy is accepted.

It includes two situations:

1. Occlusion is untouched prior to tooth preparation although small changes can be made on restorations such as elimination of the non-working contacts.
2. 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.

In re organised approach, new occlusal scheme is established around a suitable condylar position which is the centric

relation position. If in case already existing intercuspal relation is not acceptable and which needs to be altered, the occlusion of the patient may be “reorganized”.

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.

An early concept of comprehensive dentistry originated from the gnathologic society founded by McCollum in 1926 [2, 10]. In the classic research report by McCollum and Stuart in the year 1955, gave the Gnathological concept. According to them incisal guidance is totally an independent entity and is totally independent from condylar guidance and on the side they stated the condylar path or posterior guidance is a fixed entity [11].

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 [12], Schuyler [13] and others. Schuyler supported balanced occlusion during his early clinical years but later began to observe clinical failures [14]. 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 [15].

Stuart and Stallard [15] observed that the upper lingual cusps stamp into lower fossae and lower incisors, canines and buccal cusps stamp into the upper fossae and stated that “Canines” disengaged all other teeth in laterotrusion, i.e. working side excursion, this is quite similar to the findings of D Amico. In their report in 1960 [16], they adopted the concept of mutually protected occlusion (canine-protected¹⁷/organic occlusion) which replaced the concept of balanced occlusion.

In mutually protected occlusal scheme, both the teeth from upper and lower anterior segment protects the teeth of upper and lower posterior segment during eccentric movements/protrusion, vice versa teeth from upper and lower posterior segment protects the anterior teeth during maximum intercuspation [18]. 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. Von Spee in 1890 had referred to the vertical overlap “overbite” of the cuspids which was overlooked entirely [19].

In 1915, Gysi described the masticating functions of the teeth and he was the first to describe the scheme of canine-protected occlusion [20]. In 1958, D Amico given the concept of “canine guided” occlusion in which upper canine guide the mandible during eccentric movements and during their contact with mandibular canine and mandibular first premolar determine both protrusive and lateral movement of the mandible.

Thus preventing any force other than along the long axis to be applied to the opposing incisors, premolars and molars [21]. 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”.

According to Schuyler incisal guidance without liberation of motion from centric relation to a more anterior tooth intercuspation will eventually result in “lock in” posterior occlusion [22, 23]. 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 [24].

An organized approach to oral rehabilitation was introduced by Pankey [25, 26] utilizing the principles of occlusion advocated by Schuyler [24], known as the Pankey–Mann–Schuyler (PMS) Philosophy of Oral Rehabilitation [24].

Their philosophy of occlusion ground on the spherical theory of occlusion, the “wax chew-in” as narrated by Meyer [27] and Brenner [28], and on the significance of cuspid teeth as talk about by D’Amico [21]. As a modification of canine disclusion, the PMS philosophy [25] 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.

In PMS technique, the incisal guidance was the developed intra orally with acrylic resin to satisfy esthetic and functional requirements. Plane of occlusion should be selected such that it follows the curve of monsoon and posterior mandibular teeth should be in harmonized with incisal / anterior guidance such that they will not hinder with posterior / condylar guidance. Maxillary posterior occlusal surfaces are developed after the completion of mandibular restorations by the functionally generated path technique (FGP) [27].

The definitive restorations are equilibrated into a centric relation position with mandibular buccal cusps onto a flattened fossae–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. Hobo and Takayama [29] in their study revealed that anterior/ incisal guidance determined the operational working condylar path and stated that they were dependent factors.

Hobo followed posterior teeth disengagement and firstly gave the Twin-tables Technique. As stated by HOB0, posterior disengagement is totally dependent on hinge rotational angle which was generated by angular dissimilarity in between incisal guidance and condylar path or posterior guidance, and is also dependent on inclines of posterior cusp and shape of posterior cusps which are helpful in controlling lateral forces.

In HOB0 twin table technique, disocclusion of molars is attained by using two different twin tables. The first incisal guide table termed as the incisal table without disclusion is used to fabricate restorations for posterior teeth. The second incisal table termed as the incisal table with disclusion is used to achieve incisal guidance with posterior disclusion.

Hobo and Takayama in their research concluded that cusp angle be considered as the most reliable determinant of occlusion [30] as cusp angle does not deviate and is four times more reliable than the condylar and incisal path which show deviation [31].

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. Youdelis in 1971 proposed an occlusal scheme for advanced periodontitis cases.

The aim was to achieve simultaneous interocclusal contact of posterior teeth in centric relation position (usually coincident with intercuspal position) with forces directed axially. Anterior disclusion is provided for protrusive excursions and canine disclusion for lateral excursions.

Table 1

Condition	Condylar Path		Anterior Guide Table	
	Sagittal condylar path inclination	Bennett angle	Sagittal inclination	Lateral wing angle
Condition 1 without anterior teeth	25	15	25	10
Condition 2 with anterior teeth	40	15	45	20

As stated by Nyman and Lindhe occlusal scheme for exceptionally proceeding periodontitis cases, there should be even proximity should be provided in maximal intercuspal location, in spite of the fact that no great significance was put down over the type of contacts.

When distal support is present, anterior disclusion should be provided. In cases when there is long span cantilevered tooth supported prostheses, there should be concurrent working and balancing side contacts on the cantilevered prosthesis as in balanced occlusion.

Discussion

Out of all the concepts of occlusion as discussed in the literature, two have established recognition for natural dentitions and fixed prosthesis i.e. first one is the “gnathologic” and the second one is the “freedom-in-centric” concepts. The bilateral balanced occlusion scheme was applied for natural dentition by McCollum [12] but later mutually protected occlusion was adopted by Stuart and Stallard as clinical failures were observed with bilateral balance [15].

It was believed that condylar path does not change during

adulthood and that determination of anterior guidance is in the hands of the dentist. Anterior guidance was considered independent of the condylar path [11]. The importance of anterior guidance on functional occlusion of natural teeth was recognized by Schuyler. He stated that anterior guidance had equal or greater influence on occlusal morphology than TMJ’s and that unfavourable incisal guidance may tend to produce abnormal functional movements of the condyles [25].

He suggested that if there is no liberation of movement from occlusion in centric relation to a more anterior tooth intercuspation will result in “lock in” the posterior teeth occlusion and hence introduced the freedom in centric concept [14]. In 1960, an organized clinical approach to full mouth rehabilitation was given by Pankey and Mann [25, 26] based on the principles of occlusion advocated by Schuyler [14].

The PMS occlusal scheme, unlike the gnathologic concept, encouraged multiple occlusal contacts during lateral movements (group function or wide centre) and during protrusive movements (long centric, an essential feature of this technique). The concept of posterior disclusion has made the use of FGP technique advocated by PMS unnecessary in

most occlusal restorations.

As FGP technique utilizes wax to obtain the record there is great potential for errors. Furthermore, PMS technique cannot be used if the teeth are periodontally weak as FGP cannot be accurately recorded. Hobo and Takayama^[29] in their study made observations similar to those of Schuyler^[23] that anterior guidance and condylar guidance were dependent, not independent factors.

They believed in posterior disclusion in eccentric movements unlike the PMS philosophy where group function is achieved on the working side. They did not include freedom in centric. In HOBOTWIN twin table technique, main determinant of occlusion was “cusp angles”, while on the other side there is no need to record the condylar path. Therefore, complicated instruments such as the pantograph and fully adjustable articulators are not required. This procedure is much simpler than the standard gnathological procedure, yet it follows gnathological principles.

After reviewing the various occlusal concepts, we are of the opinion that it is best to achieve posterior disocclusion in full mouth rehabilitation to avoid harmful lateral forces as was suggested by Hobo^[32]. Although, the concept of gnathology provides stable long-term results due to mutually protected occlusion and tripod contacts, in some patients, freedom in occlusion may be required and therefore the PMS concept cannot be outrightly dismissed.

Indeed, some of the PMS concepts such as establishing an acceptable occlusal plane prior to occlusal rehabilitation are incorporated into everyday occlusal practice^[25, 26].

Finally, it is dependent on the clinician to choose an appropriate occlusal scheme for a particular reconstruction case after comprehensively reviewing the existing clinical condition so as to achieve predictable long term results and a functional occlusion.

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 etiology 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 of full mouth is a thorough course of action and must be carried out in conformation with dentist choice of treatment modality established on his knowledge of various philosophies of full mouth rehabilitation followed and clinical skills.

A broad scope or content as well as practical perspective must be directed towards reconstruction, restoration and conservation of health of entire oral mechanism.

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