Concepts in full mouth rehabilitation: An overview

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Abstract:
Aim:
To determine treatment modalities for complete denture patients and patients with worn-out dentition.

Materials and Methods:
This article gives and overview about the earlier and current occlusal concepts in full mouth rehabilitation, and help the clinician select which occlusal scheme is best appropriate for individual patients.

Background:
Restoration of occlusion in patients with severely mutilated dentition and those who are completely edentulous is a challenging situation as every case is unique in itself. More clinical skills is required when it comes to reconstructing mutilated and worn out dentition due to widely divergent views concerning the choice of an appropriate occlusal scheme for individual patients will result in successful full mouth rehabilitation. Subsequent validation and critical assessment of available occlusal scheme concepts in full mouth rehabilitation require an understanding of their evolution in the formative years and newer advancements of effective models for clinical practise.

Keywords: Complete denture, occlusal concepts, full mouth rehabilittation, mutilated dentition.

Introduction:

The restoration of normal functioning of the masticatory apparatus and the peri oral musculature is the ultimate goal of full mouth rehabilitation. Full mouth rehabilitation helps to convert all unfavourable forces on the teeth and the adjoining structures of the oral cavity, which inevitably induce pathological changes into favourable favourable forces there by promoting normalcy in the oral cavity.
Occlusion plays a key role in establishing the needed harmony between the muscles of mastication, teeth, tempromandibular joint. So, the selection of an appropriate occlusal scheme will result in a successful full mouth rehabilitation. After through diagnosis and clinical examination of worn out dentition and patients who are wearing complete dentures, appropriate occlusal schemes should be chosen that would promote not only occlusal function but also muscle and joint function in a individual.

Occlusal classifications:

The most accepted classification widely accepted is the one given by Turner and Missirlian.

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

Category-1:

- Excessive tooth wear with a loss of vertical dimension.

- The patients 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 corners of the mouth.

- All teeth of one arch must be prepared in a single sitting once when the final decision is made. This increases the VDO and allows better control of esthetics.

Category-2:

- Excessive wear without loss of Vertical dimension occlusion with space available
- Patients will have a history of gradual wear caused by bruxism, oral habits, but the occlusal vertical dimension (OVD) is maintained by continuous eruption.
- By means of doing 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, with minimal wear of posterior teeth.
- Centric relation and centric occlusion are coincidental with a closest space of 1 mm and an interocclusal distance of 2–3 mm. This can be accomplished by orthodontic movement, restorative repositioning, and surgical repositioning of segments.

Occlusal approach:
Occlusal approach for restorative therapy can be either conformative approach or a reorganised approach.

In conformative approach, occlusion is reconstructed according to the patient's existing intercuspal position. 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 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 optimise patient's occlusion.
Indications for reorganised approach are loss of vertical dimension, repeated failure of teeth or restorations, severe bruxism, lack of interocclusal space for restorations, trauma from occlusion, unacceptable function and esthetics, 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 while treating full mouth rehabilitation patients which 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 by means of fixed prosthodontics.
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 which was taken from the gnathologic society founded by McCollum in 1926. 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 not related to the condylar path and described that the condylar path can be a fixed entity in adults. The concept of balanced occlusion which proves the theory 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.

Centric relation was the rearmost, uppermost, and midmost position of condyle in the glenoid fossa, which no longer holds true. The Point Centric concept was proposed wherein the condyles should seat in a rearmost position in the mandibular fossae exactly at the time when maximum intercuspation of the teeth occurs in the retruded contact position. In this concept, supporting cusps must make occlusal contact at a point when the condyles are only, and precisely, in centric relation. von 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 result in lock-in of 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 inter-proximal 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, anteroposterior 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 esthetic demands. The system can be adapted to most anterior guidances and varying degrees of group function. Occlusal adjustment is simple.

An organised 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 esthetic 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 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. 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 [8]. However, Hobo and Takayama 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 disclusion and gave the Twin-tables Technique. According to him, posterior disclusion 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 disclusion is achieved by the use of two incisal 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.

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.

On literature review it was found that occlusal schemes were also formulated for oral rehabilitation in patients with periodontal diseases. 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. Cuspal anatomy is so arranged that if the canine spacing is lost through wear or tooth movement, the posterior teeth drop into group function. Both fully and semi adjustable articulators can be used.

According to Nyman and Lindhe Scheme for extremely advanced periodontitis cases even contact should be provided in the intercuspal position, although no great emphasis is placed upon the type of contacts. When distal portion is present, anterior spacing should be provided. When there are long tooth-borne arch cantilever restorations to be done, aim is to achieve simultaneous working and non-working side contacts on the cantilever as in balanced occlusion. All restorations should be fabricated on semi-adjustable articulators with average settings and supra-gingival margin placement.

Before beginning the treatment procedure, one must decide whether there is need for full mouth simultaneous technique which advocates simultaneous restoration of both arches, or quadrant/segment technique, where completion of restorations of single quadrant in a programmed manner is done before going ahead to the next. In case of segmented multiple technique, a combination of desired characteristics for full mouth simultaneous rehabilitation and the programmed quadrant approach into a single reconstructive technique is done. This technique simplifies basic procedures for reconstructions while permitting the dentist to use a suitable occlusion for a particular patient.

Discussion:

Of all the concepts discussed in the literature, two have found acceptance for natural dentitions and fixed prosthesis: the "gnathologic" and the "freedom-in-centric" concepts.

The bilateral balanced occlusion scheme was applied for natural dentition by McCollum but later mutually protected occlusion was adopted by Stuart and Stallard as clinical failures were observed with bilateral balance.

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 placed independent from the condylar path. 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. Schuyler suggested that incisal guidance from a centric occlusion to a more anterior tooth intercuspation will "lock-in" the posterior occlusion and proposed the freedom in centric concept.

In 1960, an organised clinical approach to full mouth rehabilitation was given by Pankey and Mann, based on the principles of occlusion advocated by Schuyler. 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). This may have the effect of increasing tooth wear. 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 in their study made observations similar to those of Schuyler 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 the twin-stage procedure, as cusp angle was the main determinant of occlusion, the need to record condylar path was not necessary. Therefore, complicated instruments such as the pantograph and fully adjustable articulators are not required.

Wiskott and Belser combined anterior disclusion mechanics and anteroposterior freedom with the advantage of one occlusal contact per tooth. Instead of tripod contacts, cusp-fossa relation was achieved which facilitated mastication. This design provided occlusal stability and esthetics and could be adapted to anterior guidances and group function. The occlusal concepts discussed for periodontally weak teeth can be applied in similar clinical situations. 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 out rightly dismissed. Indeed, some of the PMS concepts such as establishing an acceptable occlusal plane prior to occlusal rehabilitation are incorporated into everyday occlusal practice. Furthermore, as the tripod contacts are very difficult to equilibrate it is recommended that cusp-to-fossa contacts be achieved in the reconstructed occlusion.

It mainly depends on the clinician choice of 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.

Full mouth rehabilitation is a radical procedure and should be carried 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 mechanisms.

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