NUJHS Vol. 2, No.1, March 2012, ISSN 2249-7110
Nitte University Journal of Health Science

Review Article

# CONCEPTS OF ARRANGEMENT OF ARTIFICAL TEETH, SELECTIVE GRINDING AND BALANCED OCCLUSION IN COMPLETE DENTURE PROSTHODONTICS

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Abstract:

Prosthodontic rehabilitation aims at restoring the patient to a state of normal function, health and optimum esthetics.

Numerous factors come together during various phases of complete denture construction. One such factor, the position of artificial teeth, is dependent to a large extent on the state, morphology and position of the denture area existing in the patient's mouth.

Artificial teeth must be placed in a position which will be esthetically acceptable to the patient and the clinician, functionally sound and in harmony with the other structures of the masticatory system.

Factors governing artificial tooth position include maxillo-mandibular relationships, changes in the residual ridge, dislodging forces, presence of para-functional activity and the esthetic requirements of the patient.

While the importance of occlusion in ensuring success of dental therapy cannot be undersated, that seems to be the only point of agreement between authors on this topic. Over the years numerous concepts of occlusion have been proposed which may be indicated and contraindicated based on their benefits and limitations in restoring an edentulous patient. This article explores concepts related to occlusion and esthetics in provision of a complete denture prosthesis.

Keywords : complete denture, balanced occlusion, teeth arrangement, selective grinding, history of occlusion, dentogenics and dynesthetics.

## Introduction:

The goal of prosthodontic treatment is restoring the patient to a state of normal functioning, health and optimum esthetics[1].

The position of artificial teeth in complete denture prosthodontics is dependent to a large extent on the state, morphology and position of the denture area.[2]

The position in which artificial teeth are to be placed must be physiologically and esthetically acceptable.

When selecting an occlusal concept for a patient a prosthodontist must review various factors before deciding which concept of occlusion will be best suited to the individual's requirements. These include maxillo-mandibular relationships, changes in the residual ridge, dislodging forces, presence of parafunctional activity and the esthetic requirements of the patient [3]

The main criteria that must be remembered are that natural teeth are surrounded by bone, they have periodontal ligament which permits movement as well as provides for proprioception. On the other hand a complete denture is wholly dependent on the condition of the remaining tissues for success of the prosthesis. Since the complete denture is a single prosthesis, deflective contact on one side of the prosthesis can result in displacement of the prosthesis on the other side due to unfavorable forces acting on it, affecting retention and also favouring residual ridge resorption

Resorption may also result due to compression of the tissues underlying the denture due to excessive unfavourable forces beyond the physiological limits of tissue tolerance or due to lack of stimulative proprioceptive impulses resulting from the loss of teeth.[3]

There appears to be no doubt as to the importance of occlusion in ensuring health of the stomatognathic system. However that seems to be the only point of agreement between authors on the topic of occlusion.

There is no definite proof that one concept of occlusion can be considered adequate in all patients. There is likewise no definite scientific evidence to suggest that a perfect tooth form or position or material exists which can ensure success of the prosthesis. Most of the studies related to the topic are observational studies and patient satisfaction plays a crucial role in them, the reliability of their accuracy in application to patients of varying physiologic conditions may not be predictable. To better understand the topic one must evaluate individual concepts related to occlusion and the conditions under which these concepts were proposed so as to apply them to individuals who can best benefit from them.

Historical Perspective :

Since the last 70 years occlusal concepts have changed considerably. Prosthodontists now have the choice over essentially four occlusal concepts: (1) balanced articulation, (2) lingualized occlusion/articulation.(3) linear or monoplane occlusion/articulation, and (4) Non-balanced articulation [5]

Each concept involves the use of specific tooth moulds in specific arrangement to allow for fulfillment of the requirement of the individual concepts.

The different tooth molds or forms available for developing a particular scheme and ultimately an occlusal concept are (1) anatomic, (2) semi-anatomic, (3) non-anatomic, and (4) 0 degree teeth/ flat cusp teeth.

These artificial teeth have been described in terms of their cuspal angle and the corresponding schemes have developed based upon the position of the teeth in eccentric movements. [5]

In 1972 Beck [6] listed the uses of different tooth forms into 10 contemporary occlusal schemes out of which five were of the nature of a balanced articulation concept and five of a nonbalanced articulation.

The concept of balanced articulation can be traced back to Gysi [7,8] who introduced the 33 degree cusp form teeth. This anatomic tooth form was followed by a 30 degree posterior tooth form introduced by Pilkington and Turner [9]. These teeth mathematically designed , were the favorite for clinicians to develop a balanced occlusal scheme.

Gysi in 1927 proposed the concept of lingualized articulation. His initial publication was followed by numerous authors' propsing modifications to this concept. Payne [10] in 1941 reported on Farmer's posterior teeth setup that utilised 30 degree cusp form teeth that were reshaped to the requirementst of lingualized articulation.

The lingualized articulation was believed to permit use in different types of ridges, greater masticatory efficiency, elimination of lateral interferences and settling of the bases without unbalancing as a result of cuspal interferences.

Following this period Non-anatomic posterior tooth forms have been introduced. These teeth favor concepts which utilize non-balanced articulation. Sears [11,12] was one of the greatest proponents of this concept. Although initially these tooth forms were not preferred, since then modified non-anatomic tooth forms have been introduced which are more extensively used today.

Pound [13] proposed a non-balanced articulation in which importance was given to the position of the anterior teeth to preserve the phonetics and a lingualised occlusal scheme to allow increased denture efficiency and stability in the chewing cycle.

Jones [14] in 1972 proposed the concept of monoplane articulation This concept includes a non-anatomic occlusal scheme with a few specific modifications. With the introduction of 0 teeth, the monoplane scheme has become popular in certain patients requiring complete dentures.

Understanding Individual Concepts:

Balanced Occlusion: Balanced occlusion involves the use of anatomical moulds (however non-anatomical may be utilized with the incorporation of compensatory curves) in

a definite arrangement so as to provide stable uniform contacts between the opposing anterior and posterior teeth in centric relation and eccentric positions within the limits of normal function. Balance created in complete dentures is man-made and unique and does not normally occur in the natural dentition, its occurrence in the natural dentition may be considered pathologic. The purpose of providing balanced occlusion is to allow stabilization of the dentures as the mandible moves into eccentric positions by elimination of interferences and provision for smooth harmonious contacts.

Certain authors reject the concept on the grounds that as the teeth do not contact during mastication and when the bollus is interposed between teeth balance is impossible. However these authors ignore the importance of this occlusal scheme during activities such as swallowing of saliva, parafunctional activity such as bruxing. The shifting , torquing or tipping forces present in a non-balanced scheme cause abuse of the denture bearing tissues and may result in soreness, inflammation and favour bone resorption.. [15,16]

However, MacMillan [17] based on his studies suggested a shift from bilateral balanced occlusion to unilateral balanced occlusion while restoring both natural and prosthetic dentitions.

He observed that bilateral balanced occlusion commonly did not exist in nature. His evidence was based on the evaluation of "various types of masticatory excursions of lower animals." He stated that the cinematographic analysis of the masticatory process demonstrated that the teeth on the non-working side do not come in contact during mastication and hence a progression from the concept of Bilateral Balance to unilateral balance was seen during this period. [18]

Lingualised Occlusion: Lingualized occlusion is a concept in which maxillary palatal cusp functions as the main supporting cusp in harmony with the occlusal surfaces of the lower teeth. The maxillary teeth are generally more anatomically formed with greater cusp height. The mandibular teeth have an occlusal morphology that provides for interdigitation of the palatal cusps of the maxillary teeth. Based on the mold selected, some tooth forms may require minor adjustments. From the centric position, the maxillary palatal cusps glide over the opposing mandibular teeth without deflection eccentric movements. The maxillary palatal cusp is the main functional cusp and supports the vertical dimension as well as permits gliding over the opposing teeth. The mandibular teeth have shallower cuspal inclines to reduce interferences and horizontal forces.

The moulds selected should have a natural appearance to the buccal corridor. The facial surface and cusp for the maxillary teeth should provide the illusion of naturalness. [19]

Monoplane Occlusion: The concept of Monoplane articulation involves the initial positioning of the anterior teeth for proper length and lip support. Following this the posterior teeth are arranged with consideration to the concept. This concept attempts to increase denture stability by elimination of deflective cuspal inclines and lateral shifting of the denture bases. Hence the maxillary posteriors are arranged over the crest of the ridge with the help of a flat plate. The lingual cusps should be approximately over the crest of the mandibular ridge. The completed arrangement shows the incisal edges of the central incisors, cuspids and the occlusal surfaces of all of the bicuspids and molars flat against the occlusal plane arranged in a monoplane fashion with no compensatory curves which may produce the same effect as cuspal inclines. Some advantages include lesser resorption of the residual ridges, greater adaptability to Class II and Class III situations, reduction in horizontal forces , improve patient comfort due to no locking of the inclines. [14,20]

Neutrocentric Occlusion: Neutrocentric occlusion concept includes 2 main principles

1. Neutralization of inclines
2. Centralization of occlusal forces acting on denture foundation

Denture stability is the main feature in neutrocentric occlusion. The dentures are fabricated so as to preserve the ridge and provide for esthetics, phonetics and

mastication. The concept requires reduction in the size and number of teeth without provision for balancing contacts in the masticatory stroke.

The five factors specific to this concept in the relation of the form of the teeth to the denture foundation are: Position, Proportion, Pitch, Form, and Number.

Position: (centralized) Position teeth in as central a position in relation to the denture foundation as permitted by the tongue to provide greater stability for the denture.

Proportion: (reduced) A reduction of 40% in width without serious diminution of the food table. A reduction in width establishes centralization of forces without encroachment on tongue space, and reduction of frictional force.

Pitch: Is the inclination or angulation of teeth. The occlusal surfaces of teeth are made parallel to the foundation base planes. The occlusal plane resulting is parallel to the base and the teeth are set to a flat plane without incorporating compensatory curves.

Form: Cuspless teeth are used to limit horizontal forces.

Number: The number of teeth is reduced by eliminating the second molar.

Neutrocentric concept should not be identified with advocates of non-anatomic teeth, who merely do away with cuspation. It is dangerous to discard cusps without neutralizing other factors of articulation .[21]

Canine Guided Occlusion: Stuart and Stallard proposed the concept of anterior/canine protected occlusion along with D'Amico. Canine guided occlusion implies uniform contacts at maximum intercuspation position while during laterotrusive movement contact occurs only on the canine with every other tooth movement even non-working side contact considered as an interference. The basis of this concept is that reduction in tooth contact by allowing only the canines to contact in all eccentric motion favours reduction in activity of the jaw closing muscles. Presently this concept is described by the predominance of canine contact with sequential performance by the premolars. It is also known as sequential guidance with the prevalence of anterior teeth/canines or anterior posterior sequence of the guidance elements[22]

Selective Grinding: Selective grinding involves the correction of occlusal disharmony in a complete denture prosthesis. Occlusal errors are corrected by selectively grinding specific tooth surfaces, to preserve the desired form of the tooth and occlusion developed prior to processing [23]

Occlusal errors can include errors at the centric position and at eccentric position , that is errors during protrusive, and working and balancing side movements.

The procedure of correction of occlusal discrepancies begins by identifying errors on the articulator. Centric occlusion contacts are marked with thin articulating paper. Sufficient anteroposterior and buccolingual stabilizing tooth contacts must be provided. Deflective contact must be eliminated while striving to best preserve tooth morphology. The next step is to eliminate deflective occlusal contacts occurring during protrusive movement. In case of lateral movements deflective contacts are eliminated by performing lateral movements on the articulator, identifying contacts and by grinding of interceptive excursive contacts until contacts are obtained based upon the occlusal scheme being used. Centric contacts must not be ground as this causes alteration in the predetermined vertical dimension. This can be assured by using articulating paper of a different colour to identify centric contacts and another colour for eccentric contacts.

There are basically three types of occlusal errors:

A pair of antagonist teeth can be too long preventing uniform contact of the other teeth. Correction of this error is achieved by deepening the fossae by grinding without reducing the cusps so as to allow the teeth to telescope into each other.

Opposing teeth may be placed almost edge to edge. Correction of this error is by grinding of the cuspal inclines. The buccal/outer inclines of the maxillary and the lingual/inner inclines of the mandibular teeth must be ground. The maxillary palatal cusp is narrowed by reduction on the palatal side, and the mandibular

buccal cusp on the buccal side. The cusps are not reduced rather fossa are deepened.

Maxillary teeth may be buccally placed in relation to mandibular teeth. Correction of this error is acheieved by narrowing the maxillary palatal cusp and widening the central fossa, and grinding the mandibular buccal cusp on the buccal side by widening the central fossa. Again cusps must not be reduced.?

Working side occlusal errors may occur in frontal and sagittal plane. By selectively grinding specific cuspal inclines, correct contacts can be achieved based upon specific occlusal concepts. The concept of bilaterally balanced and lingualized occlusion advocates uniform contacts on all posterior teeth, whereas in a canine guided scheme only canines or the first premolars of the working side must be allowed to contact.

Lack of occlusal contact on the working side, may occur due to excessive contact on the nonworking side.

Correction of this error is achieved by grinding the paths traced over mandibular buccal cusp to allow reduction of the inclines of that part of the cusp that prevents teeth on the working side from contacting. According to the canine/anterior guided occlusal concept, each balancing contact should be removed.[23]

Discussion:

Numerous studies have been done which evaluate and compare occlusal concepts based on various parameters

In a study by Heydecke [24] et al it was found that patient ratings of the prosthesis were not significantly different for a lingualised scheme as compared to a simple scheme with anatomic teeth.

In a study by Rehmann [26] et al it was concluded that a bilateral balanced occlusion primarily influences patient satisfaction with complete denture prosthesis.[25]

However on the contrary it was found in a study by Kimoto et al that among patient's provided with complete dentures with lingualised occlusion and bilateral balanced occlusion that those with lingualised occlusion displayed greater satisfaction with their denture retention.

In another study by Heydecke[27] et al, they found that comprehensive methods used for fabrication of complete dentures including semi-anatomical lingualised teeth and a full registration did not greatly influence patients perceived chewing ability , when compared with more simple procedures. Anatomical teeth showed better patient satisfaction with chewing ability for tough foods.

In a study by Matsmaru[28], he evaluated the influence of mandibular residual ridge resorption on masticatory measures of lingualized and fully bilateral balanced denture articulation. And he found that Lingualised Occlusion is the preferred occlusal scheme for patients with severe RRR.

In a study by Ohguri[29] to estimate which occlusion scheme shows best conditions of pressure distribution on supporting structures in a complete denture prosthesis it was found that in a lingualized occlusion and fully balanced occlusion a great occlusal force was not required for crushing hard food, and the stress to the supporting tissues is smaller than with monoplane occlusion.

In a study by Clough[30] et al it was found that majority of people preferred a lingualized occlusal scheme over monoplane scheme because of improved masticatory ability, comfort, and esthetics.

While studies are numerous comparing other occlusal schemes, studies comparing Neutrocentric Occlusion to other schemes are lacking and hence the concept must be considered more theoretical than evidence based..

Studies have highlighted the importance of balance in complete denture prosthesis. It was found that apart from increasing the stability of the dentures, balanced occlusion improved patient satisfaction and control over the prosthesis even in the presence of fitting inaccuracies, resorbed ridges and peripheral extension errors. And hence while the other schemes do offer better results in compromised situations. Balanced occlusion must be considered as a basic requirement in complete denture

prosthodontics for restoration of a patient with ideal arch relationships so as to improve satisfaction and obtain maximal masticatory efficiency.[31]

What is crucial to understand is that presence or elimination of tooth contacts is the basic principle upon which individual concepts are formulated. As occlusal contacts can be closely co-related to the forces to which the denture bearing tissues are subjected.

Numerous studies have highlighted the advantages of performing clinical remount and the procedures involved as part of the remount procedure for correcting occlusal discrepancies of complete denture prosthesis [32-38] . However studies evaluating the presence , number and distribution of occlusal contacts of the remounted complete denture prior to this occlusal adjustment seem to be lacking.

There is general belief that sufficient occlusal contacts and fairly even distribution of contacts occur in constructed complete denture without clinical remount and occlusal adjustment may not be necessary due to its time consuming and nature. The few studies that do evaluate the occlusal contacts prior to remount demonstrate uneven and insufficient occlusal contacts at the centric relation position and excursive movements, and this can be corrected by the selective grinding procedure.[22,39]

The above mentioned concepts are based on occlusal concepts and arrangement of teeth to optimize function through increasing retention, stability and controlling forces acting on the denture bearing area. However of great importance in patient acceptance of complete denture is esthetics.

The concept of Dynesthetics and Dentogenics provides a more natural prosthesis, which not only pleases the patient but also is a quality of care that must be provided. Excellent esthetics can be obtained by simple techniques, using specific tooth molds for males and females, arranging teeth in synchronization with personality and age and sculpting the denture base with more natural contours.

Frush and Fisher [40] suggested the use of specific molds for males and females rather than making a single mold work for both. They also advocated rotational and positional changes with individual anteriors to achieve different light deflections; this enhances the appearance of vitality in non-vital substances. Using non-interceptive linear occlusion posterior teeth and a bilateral fulcrum of protrusive stability, anterior teeth are placed in the positions where they were prior to loss. This allows functional anterior rotational contacts to be avoided. Promoting stability and positioning that enhances phonetics and esthetics of the prosthesis. Besides this following this concept with lapping, rotation, and long axis angulation of individual teeth make prosthesis literally come alive.

What is essential to understand is that dentogenics is a guide to the prosthodontist and not a compulsion.

While the imaginative power of the dental professional is essential, it is necessary to understand the principles of the concept and their method of execution to able to provide the patients with the maximum benefit of it.[40-43]

Conclusion:

Success of prosthodontic treatment in edentulous patients depends upon acceptable function and esthetics of complete dentures.

Complete denture occlusion plays a role in providing uniform distribution of masticatory forces, better retention and stabilization of denture bases. Complete denture occlusion should satisfy the dynamic interrelationships between forces which stabilize and destabilize the denture, including freedom in centric, and the individual arrangement of denture teeth.

A good occlusal philosophy combined with esthetics is paramount in the patient acceptance of a complete denture prosthesis.

Although no single occlusal concept can be identified as adequate in all patients each philosophy has its own indications and limitations. Only through a thorough understanding of these and their benefits and drawbacks can we provide the best possible prosthetic rehabilitation to our patients.

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