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Review Article

# ENHANCING STABILITY : A REVIEW OF VARIOUS OCCLUSAL SCHEMES IN COMPLETE DENTURE PROSTHESIS

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Abstract :
A practical approach to rehabilitate the edentulous patients to optimal occlusion is not an easy task. Complete denture prosthesis when compared to natural teeth have relatively unstable bases and have no proprioception comparable to the periodontal ligament of the natural tooth and acts as the single unit instead of an individual tooth. To enhance the stability of the complete dentures, the philosophy of the balanced occlusion has been proposed. Balanced occlusion in dentures implies occlusal contacts that contribute to equilibrium of the denture bases on their respective ridges.

The search for the ideal occlusal scheme, one which provides stability, comfort, function and esthetics is still underway. While there is little research to support one occlusal scheme over the other, it is known that the prosthesis is less efficient than natural teeth and the ability to chew with it varies with the individual, regardless of the occlusal schemes. Poor oral awareness makes it more difficult for a patient to adapt to the function with the prosthesis especially one with a complicated occlusal scheme. This article reviews several occlusal schemes, their characteristics, recommendations for usage along with their advantages and disadvantages.

Keywords : Occlusal schemes, neutrocentric occlusion, lingualized occlusion, balanced occlusion, monoplane occlusion.

## Introduction :

There has been search for the ideal denture occlusion in an effort to find out the tooth forms which provides esthetic, stability, and masticatory efficiency without compromising the health of underlying hard and soft tissues of the edentulous arch. The main aim of clinician is to fulfill these objectives, regardless of posterior tooth form selected [1,2].

This article reviews literature published from 1930 to 2011 with various approaches in the occlusal schemes to enhance the stability of complete denture prosthesis designs. A search in the National Library of Medicine's PubMed database, Google search and Science Direct was performed to include all reviews on various occlusal schemes. A total of 35 articles were included for discussion in the review found by search to be giving various occlusal schemes considering only relevant data. The key words used for the search were occlusal schemes, neutrocentric occlusion, lingualized occlusion, balanced occlusion, monoplane occlusion.

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Numerous concepts, techniques and philosophies have been documented concerning about complete denture occlusal schemes. There are several schools of thoughts on occlusal schemes in complete denture and some clinician believe there should be cusps on the teeth and must be in complete harmony with the stomatognathic system. Some believe that cuspless teeth create minimum horizontal force to unseat denture. Many investigations on a scientific level have not proved that which occlusal schemes is superior in function or that best meet the requirements of biologic and physiologic concepts for each patient[3].There are many studies states that the merits of a given concept or pointing out the deficiencies of another[4].

Occlusal scheme is defined as the form and the

arrangement of the occlusal contacts in natural and artificial dentition. The pattern of occlusal contacts between opposing teeth during centric relation and functional movement of the mandible will be determined by the occlusal schemes. The quantity and the intensity of these contacts determine the amount and the direction of the forces that are transmitted through the bases of the denture to the residual ridges. That is why the occlusal scheme is an important factor in the design of complete denture prosthesis.

Occlusal schemes have been classified into:

- Neutrocentric occlusion
- Lingualized occlusion
- Non anatomic occlusion (Monoplane occlusion with balance)
- Linear occlusion
- Balanced occlusion

Neutrocentric occlusion :

Neutrocentric occlusion is at the far right of the occlusal spectrum and the exact opposite of the anatomic occlusion, was developed by De van.

De Van coined the term neutrocentric to embody the two key objectives of his occlusal scheme,

1. The neutralization of inclines.
2. The centralization of forces which act on the basal seat when the mandible is in centric relation to the maxillae.

There are five elements in this occlusal scheme:

- Position:
  - Positioned the posterior teeth over the posterior residual ridge as far lingually as the tongue would allow, so that forces would be perpendicular to the support areas.
- Proportion:
  - Reduction of tooth width upto 40%.
  - Reduced vertical stress on the ridge by narrowing the occlusal table.
  - Forces were centralized without encroachment on the tongue space.
- Pitch:
  - Pitch or inclination or tilt
  - There was no compensating curve and no incisal guidance.
  - This positioning directed forces perpendicular to the mean osseous foundation plane.
- Form:
  - Flat teeth with no deflecting inclines•Reduced destructive lateral forces and helped to keep masticatory forces perpendicular to the support.
  - Reduced destructive lateral forces and helped to keep masticatory forces perpendicular to the support.
- Number:
  - The posterior teeth were reduced in number from eight to six.
  - This decreased the magnitude of the occlusal force and centralized it to the second premolar and first molar area.

Advantages :

- Technique is simple and requires less precise records.
- Ideal for a patient who have resorbed friable ridges.
- By removing inclines, the lateral forces, which are very destructive to the residual ridges, are reduced.
- Because the neutrocentric technique provides an area of closure and does not lock the mandible into a single position. Ideal for Geriatric patient with limited oral dexterity.
- It is especially good for Class II (retrognathic), Class III (prognathic) and crossbite cases.

Disadvantages

- It is the least esthetic of the five basic occlusal schemes.
- Moving the teeth lingually and altering their vertical position may not be compatible with the tongue, lip and cheek function.
- Impair mastication because of poor bolus penetration.
- This flat type of occlusion cannot be balanced[5].

When using this concept of occlusion the patient is instructed not to incise the bolus, with this tooth arrangement Devan noted that "the patient will become a chopper, not a chewer or a grinder"[6].

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Lingualized occlusion

Concept was introduced by Alfred Gysi in 1927

S.H. Payne (1941): 'cusp-to-fossa occlusion'

Pound: 'lingualized occlusion'

Lingualized occlusion can be defined as, the form of denture occlusion that where the maxillary lingual cusps articulate with the mandibular occlusal surfaces in centric working and non-working mandibular positions[7].

Lingualized occlusion should not be confused with placement of the mandibular teeth lingual to the ridge crest[8-12].

Indications :

- When patient places high priority on esthetics but oral conditions indicate a non-anatomic occlusal scheme such as:
  - Severe alveolar resorption
  - Class II jaw relationship
  - Displaceable supporting tissues.
- When a complete denture opposes a removable partial denture.
- When a more favorable stress distribution is desired in patients with parafunctional habits.

Advantages :

- Lingualized occlusal concept is a simple technique requiring less precise records than fully balanced occlusion and is similar in requirements to non-anatomic teeth set on a curve.
- Most of the advantages attributed to both anatomic & non-anatomic forms are retained.
- Cusp form is more natural in appearance compared to non-anatomic tooth form.
- Good penetration of food bolus is possible. This may reduce the lateral chewing component.
- Vertical forces are centralized on mandibular teeth & it provides an area of closure, allowing easier accommodation to unpredictable basal seat changes.
- With lingualized occlusion, additional stability is imparted to the denture during parafunctional movements when balanced occlusion is used.
- Can be used in Class II, Class III & cross-bite situations[1].

Disadvantages :

- Wear of maxillary lingual cusp or mandibular fossa rapidly results in buccal and lingual contact of equal intensity results in negotiation of centralization of forces on the mandibular posterior teeth and increase the like hood of lateral displacement.

Monoplane occlusion :

Sear introduced monoplane occlusion with balancing ramps or tooth at the distal part of the mandibular arch which comes in contact only in eccentric excursions[13].

De Van has used the same principle without the balancing ramp[5].

According to this concept teeth which are flat mesiodistally and buccolingually are used, oriented as close as possible parallel to the maxillary and mandibular mean foundation plane.

Indication :

- Abnormal closure imbalance, pathosis, trauma, neuromuscular disturbances.
- Posterior displaceable mucosa.
- Multilated, tortuous ridges with an excessive denture space[14].
- Ridges are flat or knife edge, rendering dentures more suspectible to horizontal force.
- When chewing pattern is milling type with broad excursions.
- Maximum of vertical force and a minimum of horizontal stress is desired[15].

  The amount of horizontal overlap is determined by jaw relation, ranges from 0mm (edge to edge) Class III relation to as much as 12mm for severe class II relation[17].

Usually the mandibular second molar will be placed on the molar slope area, called 'skid row'.

In this the occlusal surface of the maxillary second molar set parallel to the occlusal surface of the mandibular second molar but 2 mm above the occlusal plane, well out of occlusion.

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Monoplane occlusion can be balanced by following methods:

Incline the mandibular second molar to provide contact with the maxillary denture in all excursions, the maxillary second molars are similarly inclined but left out of centric contact. The use of customized balancing ramp placed distal to the mandibular second molar. Ramp provides tripodal effect of contacts of denture bases.In eccentric relation, there is smooth contact anteriorly on teeth and posteriorly on the balancing ramp. Balancing ramp improves horizontal stability of the denture.

Advantages :

- They are more adaptable to the unusual jaw relation such as class II and class III relations, used easily in cases of variations in the width of maxillary and mandibular jaws, cross bite.
- These impart a sense of freedom to the patients, do not lock mandible in one position.
- They eliminate horizontal forces, more damaging than vertical forces.
- Because the monoplane teeth occlude in more than one relationship, so centric relation developed to an area instead of a point.
- Monoplane teeth permit the use of a simplified and less time consuming technique and offer greater comfort and efficiency for a longer period.
- They accommodate better to the negative changes in the ridge height that occur with aging[17].

Disadvantages :

- No vertical component to aid in shearing during mastication.
- Patients may complain of lack of positive intercuspation position.
- Esthetically limited.
- Occlude only in two dimensions, but the mandible has a 3D movement due to its condylar behavior.

Linear occlusion :

This concept advocates a straight line of points or knife edge contacts on artificial teeth in one arch occluding with flat non-anatomic teeth in the opposing arch, thereby reducing unfavourable occlusal forces[18].

Linear occlusion is a one dimensional contact between two opposing posterior teeth. The contact occurs only in one dimension which is the length of the contacting blade (not surface). This blade, being always in the form of a straight line, geometrically constitutes “length” without either “width” or “depth” of occlusal contacts.

Linear occlusion consists of following basic parameters

Zero degree (flat plane) teeth are opposed by bladed (line contact) teeth in which the blade is in a precisely straight line over the crest of the ridge.

One arch is set to a flat (monoplane occlusal plane).

There is no anterior interference to protrusive and lateral movements[19].

- Plane of occlusion

  The plane is set steeper.

  Esthetics and phonetics determine the maxillary anterior tooth position
- Stabilization of mandibular denture

  Mandibular dentures are almost always less stable than maxillary dentures, the linear ridge is usually placed on the lower ridge.
- Esthetics

  For esthetic purpose anatomic teeth are used in maxillary posterior region, which occlude with non-anatomic mandibular teeth[20,21].

Balanced occlusion :

The bilateral, simultaneous, anterior and posterior occlusal contact of teeth in centric and eccentric positions[7].

It is not seen in natural dentition.

Characteristic requirements of balanced occlusion:

- All the teeth of the working side (central incisor to second molar) should glide evenly against the opposing teeth.
- No single tooth should produce any interference or disocclusion of the other teeth.
- There should be contacts in the balancing side, but they should not interfere with the smooth gliding movements of the working side.

Keywords : Occlusal schemes, neutrocentric occlusion, lingualized occlusion, balanced occlusion, monoplane occlusion. - Krishna Prasad D.

- There should be simultaneous contact during protrusion.

Importance of balanced occlusion :

Balanced occlusion is one of the most important factors that affect denture stability, absence of occlusal balance will result in leverage of the denture during mandibular movement.

Sheppard stated that, "Enter bolus, Exit balance" according to this statement, the balancing contact is absent when food enters the oral cavity. This makes us think that balanced occlusion has no function during mastication; hence, it is not essential in a complete denture, but this is not true.

On an average, a normal individual makes masticatory tooth contact only for 10 minutes in one full day compared to 4 hours of total tooth contact during other functions. So, for these 4 hours of tooth contact, balanced occlusion is important to maintain the stability of the denture.

Hence, balanced occlusion is more critical during parafunctional movements.

Types of Balanced occlusion

Occlusal balance or balanced occlusion can be classified as follows

- Unilateral balanced occlusion
- Bilateral balanced occlusion
- Protrusive balanced occlusion
- Lateral balanced occlusion

Unilateral balanced occlusion:

This is a type of occlusion seen on occlusal surfaces of teeth on one side when they occlude simultaneously with a smooth, uninterrupted glide. This is not followed during complete denture construction. It is more pertained to fixed partial dentures.

Bilateral balanced occlusion :

This is a type of occlusion that is seen when simultaneous contact occurs on both sides in centric and eccentric positions. Bilateral balanced occlusion helps to distribute the occlusal load evenly across the arch and therefore helps to improve stability of the denture during centric, eccentric or parafunctional movements.

For minimal occlusal balance, there should be at least three points of contact on the occlusal plane. More the number of contacts, better the balance. Bilateral balanced occlusion can be protrusive or lateral balance.

Protrusive balanced occlusion :

This type of balanced occlusion is present when mandible moves in a forward direction and the occlusal contacts are smooth and simultaneous anteriorly and posteriorly. There should be at least three points of contact in the occlusal plane. Two of these should be located posteriorly and one should be located in the anterior region. This is absent in natural dentition.

Lateral balanced occlusion :

In lateral balanced there will be a minimal simultaneous three point contact (one anterior, two posterior) present during lateral moment of the mandible.

Lateral balanced occlusion is absent in normal dentition.

Advantages of Bilateral Occlusal Balance

- Bilateral simultaneous contact help to seat the denture in a stable position during mastication, swallowing and maintain retention and stability of the denture and the health of the oral tissues.
- Due to cross-arch balance, as the bolus is chewed on one side, the balancing cusps will come close or will contact on the other.
- Denture bases are stable even during bruxing activity.

Disadvantages of Balanced Occlusion :

- It is difficult to achieve in mouths where an increased vertical incisor overlap is present.
- It may tend to encourage lateral and protrusive grinding habits.
- A semi adjustable or fully adjustable articulator is required[3].

Occlusal schemes in class II jaw relation :

Arrangement of anterior teeth in class II ridge relations:

- Select lower anterior teeth of a narrower mesiodistal

width and try to achieve the normal canine relationship.
- If esthetics permit, a little crowding of the lower anterior teeth
- Slight spaces between the upper anterior teeth to attain normal canine relation.
- Lower first premolar must be eliminated from dental arch, if discrepancy is more.

Arrangement of posterior teeth in class II ridge relations:
- Upper posterior teeth can be placed slightly palatally to provide a working occlusal contact with the lower teeth.
- The lower posterior teeth are placed over crest of the ridge. The upper teeth are then set so that they occlude with the lower teeth. Then the buccal surface are built on the upper posterior teeth in wax is replaced by tooth-colored acrylic resin to fulfill esthetic requirements and to provide support for the cheek[22, 23].

Occlusal schemes in class III jaw relation

Arrangement of anterior teeth in class III ridge relations:
- If the ridges are in an edge-to-edge relation, the incisal edges of the upper and lower incisors and canines will also meet in edge-to-edge relationship.
- In case of extreme protrusion of the mandible, a negative or reverse horizontal labial overlap must be used.
- Select a larger lower tooth mould, to compensate for wider lower arch width.
- Crowding in upper anterior teeth, if esthetically acceptable.
- An extra lower incisor should be included to avoid the spaces between the lower anterior teeth so that denture appears esthetically better.

Arrangement of posterior teeth in class III ridge relations:
- Upper posterior teeth can be placed slightly buccal to the crest of the upper ridge.
- Cuspless teeth may be used to allow freedom of buccolingual placement and provide occlusal contact in upper and lower teeth.
- In case of wider lower arch, an interchange can be done by using upper teeth on the lower denture and lower teeth on the upper denture[24].

Discussion :

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

In a study by Heydecke et al it was found that patient ratings of the prosthesis were not significantly different for a lingualized scheme as compared to a simple scheme with anatomic teeth[28.] Participants provided with complete dentures having lingualized or anatomic posterior occlusal forms exhibited significantly higher levels of self-perceived satisfaction compared to those with 0-degree posterior occlusal forms[25].

Effect of occlusal scheme on vertical dimension at occlusion, results shown that increase in vertical dimension is similar to set in conventional balanced occlusion and lingualized balanced occlusion[29.] Chewing efficiency of monoplane occlusion versus lingualized occlusion and found that 67% of the patients preferred lingualized articulation[26].

In a study by Ohguri to estimate which occlusion scheme shows best conditions of pressure distribution on supporting structures in a complete denture prosthesis it was found that 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[30].

In a study by Matsmaru , he evaluated the influence of mandibular residual ridge resorption on masticatory measures of lingualized and fully bilateral balanced denture articulation and he found that lingualized occlusion is the preferred occlusal scheme for patients with severe RRR[32].

However on the contrary it was found in a study by Kimoto et al that among patient's provided with complete dentures with lingualized occlusion and bilateral balanced occlusion. Those with lingualized occlusion displayed greater satisfaction with their denture retention[33].

In another study by Heydecke et al, they found that comprehensive methods used for fabrication of complete

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dentures including semi-anatomical lingualized 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[34]. Anatomic denture teeth made up of all ceramic show high average pressure transmission compared to zero degree non anatomic teeth[31].

Using Linear occlusal scheme in combination syndrome showed that it is esthetically pleasing, no problem in phonetics and ability to chew better[35]. Effect of occlusal scheme on muscular activity shown that least activity for all occlusal schemes and external pterygoid muscle activity was found to relatively constant for all occlusal schemes[27]

When forces act on a body in such a way that no motion results, there is balance or equilibrium. This should be a primary consideration of the dentist when considering the forces that act on the teeth and the denture bases with their resultant effect on the movement of the base. A stable base is the ultimate goal.

Total stability is not possible because of the yielding nature of the supporting structures, but control of the physical factors that apply to the relationship of the teeth to each other and that apply to the position of the teeth in the denture base as related to the ridge must be understood.

Conclusion :

Differing ideas about occlusion relative to centrics, gnathology, occlusal adjustment have led to controversial in the literature. In resorbed ridges, the chances for arch relationship discrepancies are increased due to greater horizontal overlap and lack of specific interdigitation make neutrocentric occlusal scheme ideal. With Lingualized occlusal scheme, additional stability is imparted to the denture during parafunctional movements when balanced occlusion is used. Monoplane occlusal scheme are more adaptable to the unusual jaw relation such as class II and class III malocclusions and cross bite cases. Linear occlusal scheme stabilizes the denture bases by minimizing lateral occlusal forces.

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