

OCCLUSION CONCEPTS IN COMPLETE DENTURE PATIENTS: A LITERATURE REVIEW

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ABSTRACT

The ideal denture occlusion aims for tooth form which provides esthetics, stability, masticatory efficiency without compromising the health of underlying hard and soft tissues of the edentulous arches. The study of occlusion and its relationship to function of the masticatory system has been a topic of interest in dentistry since many years. This article presents a literature review of occlusion in complete denture patients.

Key Words: Balanced occlusion, linualised occlusion, monoplane, occlusion, neutrocentric occlusion

INTRODUCTION:

The balanced articulation is the most appropriate articulation as the tooth contacts are observed during the nonfunctional activities of the the patients. One of the chief aims of preventive and restorative dentistry has been to maintain an occlusion that will function in harmony with the other components of the masticatory mechanisms, thereby preserving their health and at the same time providing the optimum, if not maximum masticatory function.^{1,2}

This article presents a literature review in occlusion in complete denture patients.

REQUIREMENTS OF COMPLETE DENTURE Occlusion :-²

1. Stability of occlusion at centric relation position and in an area forward and lateral to it.

2. Balanced occlusal contacts bilaterally for eccentric contacts.
3. Unlocking the cusps mesiodistally to allow for gradual but inevitable settling of the bases due to tissue deformation and bone resorption.
4. Control of horizontal force by buccolingual cusp height reduction according to residual ridge resistance form and interarch distance.
5. Functional lever balance by favorable tooth to ridge crest position.
6. Cutting, penetrating and shearing efficiency of occlusal surfaces.

Mehring³ – studied force needed for food penetration and reported that 20.2 lb is needed for both cusped and non-cusp teeth. So in patients with good ridges

which can tolerate 20lb the type of teeth to be used in not critical.

PLANNING OF OCCLUSION IN COMPLETE DENTURE.

Harold.R. Ortma (1971)⁴:- described the 3 basic schemes of posterior occlusion

- Spherical scheme- use of anatomic teeth, used in balance occlusion and lingualized occlusion etc.
- Flat occlusal scheme- non-anatomic teeth are used. Balance occlusion does not exist unless compensating curve, balancing inclines are used.
- Reverse curve – Modified anatomic teeth may be used, usually non anatomic teeth without balancing contacts are used.

Balancing is possible introducing a spherical buccal incline in the posterior region of occlusion. This is called the “Pleasure curve”.

Concepts Of Occlusion: ^{5,6}

BALANCED OCCLUSION²

Balance articulation is need for stability and comfort of complete denture. Hanau described the interdependence of the 5 articulation factors and named it “articulation quint”. **Thielemann** subsequently simplified hanau’s factors in a formula for balanced articulation.

$$K * L$$

$$OP * C * OK$$

Where k = condylar guidance

L = incisal guidance

Op= inclination of the occlusal plane

C = cusp height inclination

Ok= curvature of the occlusal surface.

Bonwill ⁷ (1864) is known as the father of anatomic /balanced 3 point contact occlusion. It is mainly derived from various theories of occlusion. Our modern concepts of balanced occlusion are derived from geometrical theories of gysi. It is the ideal occlusal concept of complete denture, but never exist in natural dentition.

Trapazzano⁷ (1963): - reviewed hanau’s five factors and decided only 3 factors were actually concerned in obtaining balanced occlusion. He eliminated need for compensating curve and called triad of occlusion.

Boucher (1963): - disagreed with **Trapazzano** and felt that there was need for a compensating curve. He also stated that the occlusal plane should be included only in its correct anatomic position.

Bernard Levin^{8,9} (1978): - described the laws of articulation in a quad. However hanau’s five laws are found most acceptable.

Advantages:-

- Increase stability of denture attained by occlusal lever balance.
- It is also important even in efficient load transmission with eccentric movements.

- Provides a harmonious relation with surrounding stomatognathic system.

Disadvantages: -

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

French^{10,11}. –The occlusal surface of the mandibular posterior teeth has been reduced to increase the stability of denture occlusal table width of lower posterior. He developed a curved plane to attain lateral balance by using progressive lingual tilt (5° for 1st premolar), (10° for 2nd premolars), (15° for 1st molars).

- **Sears**^{10,11} (1922) used channel type posterior teeth. He used modified nonanatomic teeth to attain balanced occlusion by having curved occlusal plane anteroposteriorly and laterally and a 2nd molar ramp.
- Posterior reverse lateral curvature except for the 2nd molar which is set with customary Wilson's curve to provide balanced occlusion.

Factors that affect occlusal balance:-

1. **Condylar guidance:-** is the mandibular guidance generated by the condyles traversing the contours of the glenoid fossa. It is one of the end controlling factors. It is independent of tooth contact. The condylar path is determined on

the patient by a protrusive record and set on the instrument. It acts as a posterior control factor.

2. **Incisal guidance:-** is the influence of the contacting surfaces of the mandibular and maxillary anterior teeth on mandibular movements. Dentist can set it with accordance with esthetics and phonetics. If the incisal guidance is steep it calls for steep cusps, steep occlusal plane or a steep compensating curve to effect an occlusal balance. This type of occlusion is detrimental to the stability and equilibrium of the denture base. For complete dentures the incisal guidance should be as flat as esthetics and phonetics will permit. When the arrangement of the anterior teeth necessitates a vertical overlap, a compensating horizontal overlap should be set to prevent dominant incisal guidance, from upsetting the occlusal balance on the posterior teeth. Incisal guidance should never exceed the condylar guidance. It is the anterior controlling factor.

3. **Inclination of the occlusal plane:-** plane of orientation is established in the anterior by the height of the lower cuspid and in the posterior by the height of the retromolar pad. Its position can be altered only slightly.

Methods of determining occlusal plane:-

-Parallel to and midway between the residual ridge¹².

-Parallel to resting upper lip and parallel with campher line.

-Parallel with lateral border of tongue.

-From middle/upper third of retromolar pad.

-Parallel with interpupillary line and alatragus line.

-In relation to parotid papilla.

-Parallel with interpupillary axis and camphers line.

-Use of cephalometric.

4. The compensating curve:- The compensating curves eliminate Christensen's phenomenon to achieve balance. It is determined by the inclination of the posterior teeth and their vertical relationship to the occlusal plane so that the occlusal surface results in a curve that is in harmony with the movement of the mandible.

5.Cusp height and inclination:-

Intercondylar distance influences positions and direction of ridge and groove placement. The greater the intercondylar distance, the more distal are the working and balancing cusp paths on the mandibular teeth and the more mesial they are on the maxillary teeth.

Greater the Bennett movement, more mesial must be directional placement of ridges and grooves on the mandibular teeth and more distal on maxillary teeth, shorter must be cusps relative to fossa depth and greater must be the lingual concavity of anterior maxillary teeth. Fischer angle also influences grooves and cusp ridges.

LINGUALIZED OCCLUSION

It was originally given by Alfered Gysi (1927) and Payne in 1941 familiarized it. Pound and murrel (1973) also advocated this concept of occlusion.(Figure 1)

Indications:-

- 1) In patients with severe ridge resorption, which need non-anatomic teeth and patient, desires on increased esthetics and efficiency of denture.
- 2) Class II jaw relation
- 3) Highly displaceable tissue
- 4) When complete denture opposing an removable partial denture.

Principles of lingualized occlusion: -

- 1) Maxillary teeth- anatomic teeth (30-33⁰) with prominent lingual cusps.
- 2) Mandibular teeth- non-anatomic with narrow occlusal table. They may be modified by selective grinding to create smooth central fossa with concavity.
- 3) Maxillary lingual cusp should contact mandibular teeth in contact mandibular teeth in contact maxillary buccal cusps are trimmed to decrease interference.

Lingualized occlusion with cutter bars:

use metal blade teeth for maxillary denture and flat nonanatomic mandibular porcelain teeth.

Nonbalanced lingualized occlusion:

Indications: -

- Severely resorbed ridges/ flabby ridges.
- Poor oral dexterity
- Who are not able to adjust to intricate occlusal patterns.
- Patients who receive transitional / immediate dentures, and insist on unlocked occlusal scheme that is easy to adjust at the time of insertion.
- Patients who show poor accuracy of oral records (jaw relation)
- If patients who do not accept monoplane occlusion for esthetic reasons.
- Used more easily when variations in the width of upper and lower jaws indicate a cross bite set-up.
- 0° teeth provide sense of freedom in mandibular movement.
- Eliminate horizontal force-king to alveolar ridge
- 0°teeth –occlude in more than one position.
- It is simple, less time-consuming technique and efficient for longer duration.

Clough

HE,KnodleJM,LeeperSH,PudwillML,Taylor DT¹³ 1983 - compared efficiency of lingualized occlusion and monoplane occlusion in complete dentures. Two sets of dentures, one with lingualized occlusion and the other with monoplane occlusion, were made for each of 30 edentulous patients. 67% of patients preferred lingualized occlusion done to improved masticatory abilities, comfort, and esthetics..

MONOPLANE OCCLUSION¹⁴

It is a type of nonbalanced occlusion where posterior teeth have masticatory surfaces that lack any cusp height.

Advantages: -

- More adaptable to class II and III malocclusions.

.PHYSIOLOGICALLY GENERATED OCCLUSION

It is mainly indicated for patients having adequate foundation with stable record bases and good neuromuscular control & can give functional movements consistently.

NEUTROCENTRIC OCCLUSION¹⁵

It mainly uses the concept of arranging teeth on a plane (flat) parallel with bony support.

It is independent of horizontal condylar guidance and has no compensating curves. It eliminated anteroposterior and mediolateral inclination of teeth, which directs force of occlusion on posterior teeth. There are no balancing contacts. The total number of teeth used is decreased with use of posterior protrusive balancing ramp, and the buccolingual width of teeth are also reduced.

LINEAR OCCLUSION¹⁶

Teeth are arranged on a flat plane, which extend from tip of maxillary incisors top of the retromolar papilla. The 2-3 mm interocclusal clearance is not needed (CR recorded at VDR with 0.020 inch vertical clearance). The anterior vertical overlap is absent and lead to non-interception in eccentric movements. The posterior teeth used are non-anatomic with mandibular blade form of teeth.

LINEAL OCCLUSION¹⁷

This type of occlusion uses straight line of points / knife edge contacts on artificial teeth in one arch against flat non anatomic teeth in opposing arch thereby decreasing unfavorable forces and simplifying occlusal adjustment.

ORGANIC OCCLUSION¹⁸

It is mutually protected occlusion in which posterior teeth are protect the anterior in centric occlusion and anterior teeth protect posterior teeth

in eccentric positions. If properly constructed and related this may also be the best type of occlusion for complete denture and removable partial denture.

The groove and ridge direction of cusp is determined as a result of condylar moment. Cusp fossa contact relation is used with centric relation.

METHODS OF STUDYING OCCLUSAL CONTACT: ³

- 1) Photo-occlusion (use thin sheet of photo-plastic material)
- 2) T-scan system (uses polyester film substance 60µm thick with a thin conductive system)

- 3) Dental prescale – use pressure sensitive sheets and occlusal a computer to analyze the contacts.

OCCLUSION IN SPECIAL SITUATION'S

Single Complete Denture:-

Robert W Bruce(1971)¹⁹:- discussed factors to be considered in developing occlusion for single complete denture

Planning of occlusion: -

Examination of remaining teeth- extruded / malposed teeth – extraction; occlusal plane, cusp height. Final occlusion should have plane of occlusion with low cusp height. Occlusal reshaping done using resin template. Mandibular single complete denture is usually contraindicated due to increased forces on mandibular ridge leading to increased resorption and chronic sore mouth.

Swenson in 1964 described a method where the teeth are set and any interference with the placement of the denture teeth are adjusted on the cast and area marked, the natural teeth are then modified using the marked diagnostic cast as a guide. After the occlusal modifications have been completed now diagnostic cast of the lower arch is made and mounted and the denture teeth reset.

Many techniques have been described explaining ways to achieve a balanced occlusion for a single complete denture.

- 1) Functional chew –in technique: -

Stansbury in 1951: the patient is instructed to perform eccentric chewing movements on a compound rim into which is added carding wax. This generated occlusion rim is remixed and stone is vibrated into the wax path of the cusps.

The denture teeth are first set to the lower cast of the patients teeth. The lower cast is removed and the lower chew-in cast record is then carefully ground to achieve a bilateral balanced occlusion.

Rudd (1973) has described a technique similar to stansbury, but he used sheets of medium hard pink base plate wax instead of compound rim.

2) Articulator equilibration techniques: -

If the denture bases lack stability or the patient is physically unable to form a chew-in record, the articulator equilibration method is preferred.

The upper cast is mounted on articulator using a face-bow record and the lower cast is related to the upper by a centric record.

SimieonBaron(1997)²⁰ described alternative arrangement to tooth arrangement for completely resorbed mandibular ridge.

Lower anterior teeth arranged edge-edge/ protrusive to maxillary anterior's- on protrusion no anterior contact and downward pressure on denture keeping it stable. The author recommends use of 22⁰ teeth and use posterior bilateral balanced occlusion.

Maxillary defects:

Shipman.B(1987)²¹ evaluated the occlusal force in obturator with and without use of

adhesives and found that the range of occlusal force found was 1-14 lb (less mainly due to the pain on chewing). There was no correlation between use of adhesive and retention.

Mandibular defects: -

In cases of complete resection of mandible use of functionally generated path of technique ²² can be used to get desired occlusion. It is applicable when reconstructed mandible show limited lateral and protrusive excursive movement. In case of limited resections of alveolar bone monoplane posterior teeth in neutral zone may be helpful.

Glossectomy:-

Ichikawa .T(1996)²³ – the main problem with such patients is difficulty in maintaining food on occlusal table. The modifications suggested were –

- Decrease VDO (helps in residual tongue contacting palate)
- Lower occlusal plane closer to body of tongue.
- Anterior palatal ramp increases stability and speech efficiency.

Ohkulo C (2000)²⁴: - advocated use of neutral zone for arrangement of teeth. The height of occlusal plane at level of body of tongue and not below it (to decreasing tongue biting). Use of tomograms may be helpful to determine buccolingual position of teeth. Lingualized occlusion can be used to apply forces on lingual side of denture to maintain balance..

Snorkel / Scuba Diver's Denture: -

Hurst TL,,TyeEA,Byrd C (1986)²⁵ stated that snorkeling / scuba diving is a common water sport in western countries. This causes fatigue, anxiety leading to increased muscle tension, TMJ symptoms and cause diver's mouth syndrome.

In edentulous patients there is difficulty in holding snorkel/scuba regulator in mouth leading to residual ridge soreness, TMJ pain, facial muscle pain and fatigue. With use of normal complete dentures there increased discomfort of mucosa and TMJ dislodgement of CD

The author modified the upper denture a 3-point occlusal contact and a modified snorkel regulator with an attachment apparatus for the denture.

Combination Syndrome:-

Saunders(1976)²⁶ described the changes observed when a maxillary complete denture opposes remaining lower anterior teeth with a RPD in the posterior segment. The symptoms are summed as "combination syndrome" (Figure 2)

Occlusal considerations in combination syndrome:-

The ridge in maxillary and mandibular posterior region is resorbed and poor. The most important requirement is the occlusal scheme which will stop further progress of pathologic changes.

- No contact in incisors in centric and minimal contact in eccentric movements.
- Balanced occlusion to be used with proper cusp angulations

relating to condylar and incisal guidance

- **NarwalA,ChughA,RohtakP,Swami R 2015²⁷** suggested to make mucostatic impression technique with relief in the anterior maxillary flabby tissue to accurately record the entire functional denture bearing area in patients with combination syndrome.

Occlusion In Implant Supported Complete Denture²⁸: -

Implants have no periodontal ligament so the selected occlusal scheme should provide forces directed more vertical than horizontal. (Figure 3)

For fully bone anchored complete denture mutually protected occlusion is recommended. Balanced occlusion creates lot of lateral forces component leading to implant failure. So it is contraindicated in fully bone anchored prosthesis. In case of implant-supported over-denture balanced occlusion is recommended.

MaheswariR,HansS,MittalS,AnejaS,Du han J 2015²⁹ Reported implant supported mandibular denture are more stable,mastication is more easier and speech dramatically improved.

CONCLUSION:

A thorough understanding of force management in complete denture through selecting and delivering a correct occlusion scheme is important for the long term success of denture.

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