The Effect Of Different Occlusal Schemes On Strain Induced In Lower Complete Denture

A Thesis

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By

Marwa Kothayer Abdelhakeem Elhamalawy

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Faculty of Dentistry

Ain Shams University

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Supervisors

Dr. Hany Ibrahim Eid

Professor of Prosthodontics

Faculty of Dentistry

Ain Shams University

Dr. Tamer Omar Ibrahim

Associate Professor of Prosthodontics

Faculty of Dentistry

Ain shams University

Dr. Mohammed Salah Abdel-Aziz

Lecturer of Dental Biomaterial

Faculty of Dentistry

Ain Shams University

Introduction

There are many philosophies concerning the most appropriate posterior occlusal forms for conventional complete maxillary and mandibular dentures, it is assumed that the form of the occlusal surfaces and the way they arranged become critical for successful complete denture function. [(1)]

There are many occlusal schemes for complete denture construction; spherical theory of occlusion, lineal occlusal concept, flat teeth arranged with balancing ramp, flat teeth arranged with compensating curve, centralizing concept of occlusion, organic occlusal concept, lingualized occlusal concept and monoplane occlusal concept.

Two most popular schemes of occlusion for complete denture construction; lingualized balanced occlusion and monoplane occlusion.

Some prosthodontists recommended protrusive record, semiadjustable articulators and anatomic teeth for balanced occlusion, others deny the value of these principles and recommended simple instruments and non-balanced monoplane occlusion.

The biting force is influenced by the teeth material, the occlusal form, the occlusal table width and length, the occlusal scheme, the vertical dimension of occlusion, the mechanical properties of food and the individual variation.

Many methods have been used to assess the strain induced within the denture base, among which is the strain gauge analysis. It is a simple, accurate and repeatable assessment method. [2]

Review of literature

I- Complete denture occlusion

Complete denture occlusion is defined as "the contact between the upper and lower teeth while the mandible is stationary". It was also defined as the static relationship between the incising or masticatory surfaces of the maxillary and mandibular teeth. (3)

To create successful complete denture the clinician should consider retention, stability, and support issues. There are several philosophical positions that guide the choice of the most appropriate posterior occlusal forms for conventional complete maxillary and mandibular dentures. Current evidence has been inadequate to support any particular type of posterior occlusal form as the best choice. (1)

Occlusal designs and their resulting functions are of concern to the dentist so that loss of the remaining tissues of the mouth, which may be attributed to the occlusion, can be minimized. This is difficult to assess since living tissues change and physiologic tolerances vary. More long-term statistical investigations are necessary to compare the various occlusal designs so that more definable guidelines may evolve. Until such guidelines are available, the dentist must rely on his clinical experience and clinical judgment to select the occlusal design or designs of his choice in the treatment of complete denture patients. (4)

It was stated that the occlusal schemes of the posterior denture teeth are considered to be important factors affecting denture stability and chewing efficiency. (5)

The occlusal imbalance is one of the most important displacing forces that act on the occlusal surface of the denture tooth contact on one side of the dental arch resulting in tipping of the denture with subsequent breakage of border seal and loss of retention. (6)

The health of the supporting structures depends on the intelligent use of the occlusal form of the artificial teeth. It seems that no one occlusal form is ideal for all types of ridges. (7)

The occlusion of complete denture should be designed to be in harmony with the unconditioned reflex of the patient. Hence, the position of the mandible during swallowing should be in harmony with the centric relation. As swallowing is apparently, a type of survival mechanism which occurs during the day and night and it involves occlusal contact of considerably longer duration than those of mastication. This suggests that complete denture occlusion must be compatible with the forces developed during deglutition to prevent any disharmony in occlusal contacts that could cause trauma to the basal seat of the denture. (8)

A-Balance in complete denture occlusion

1-Lever balance

This type of balance is dependent on tooth position as related to its base. Lever balance stabilize the denture during

mastication until the teeth contact by favorable tooth denture relationship. [8]

The application of physical laws in relation to lever can be expressed by the following:

- The wider and larger the ridge, and the closer the teeth are to the ridge, the greater the lever balance.
- Conversely, the smaller and narrower the ridge, and farther the teeth from the ridge, the poorer the lever balance.
- Conversely, the narrower ridge and the wider the teeth buccolingually, the poorer the lever balance.
- The more lingual the teeth are placed in relation to the ridge crest, the greater the balance.
- The more buccal the teeth are placed in relation to the ridge crest, the poorer the balance.
- The more centered the force of occlusion antero-posteriorly, the greater the stability of the base.

Unilateral lever balance

This is represent when there is equilibrium of the base on its supporting structures when a bolus of food is interposed between the teeth on one side and space exists between the teeth on the opposite side. The state of equillibrium could be obtained by covering as large area on the ridge as possible by the denture base, placing the teeth so that the resultant forces on the functioning side are centralized on the ridge or slightly lingual to

it, placing the teeth closer to the ridge, and decreasing the buccolingual width of the occlusal table as possible.[8]

B-Concepts of occlusion

The concepts of occlusion for complete denture were classified into:

1- Concepts of occlusion in centric position.

2- Concepts of occlusion in eccentric position that are all subtitled under two main categories, which are: [9]

a - Balanced occlusal concept.

b - Unbalanced occlusal concept.

1-Concepts of occlusion in centric position.

a-Point centric concept

It implies that the position of maximum planned centric occlusion is established to coincide with the patient's centric relation. With the natural occlusion, the point centric is not applicable, where centric occlusion is usually anterior to centric relation. [8]

b-Long centric (freedom of centric)

It provides a relatively flat area created between centric relation and centric occlusion positions on the occlusal surfaces of the teeth. Long centric is the most favorable concept because it provides stable artificial occlusion inspite of continuous morphological changes occuring in denture bearing tissues. [10]

It is observed clinically that freedom of centric is well tolerated by the neuro-mandibular system because of the free movement from centric relation to centric occlusion. (11)

2-Concepts of occlusion in eccentric position.

a-Balanced occlusal concept.

The balanced occlusion can be defined as bilateral simultaneous anterior and posterior occlusal contact of the teeth in centric and eccentric position.(3)

Balanced occlusion in complete denture is defined as a stable simultaneous contact of the opposing upper and lower teeth in centric position and continious smooth bilateral gliding motion, free from cuspal interference maintaining even contact within the functional range of mandibular movements.(3)

i-The requirements of bilateral balanced occlusion include:

-Maximum extent of the denture base coverage.

-Lever balance.

-Occlusal balance with stable contact in area at the retruded border position (long centric).

-Intermediate occlusal balance for all functional or parafunctional excurtions to the right, left and protrusive movements. (7)

ii- Five factors affecting the occlusal balance in complete denture occlusion, these five factors are:

Incisal guidance, condylar guidance, plane of orientation (plane of occlusion), cusp inclines (cusp plane angle), and compencating curve.[3,12]

a-Incisal guidance

Incisal guidance is the influence of contacting surfaces of the mandibular and maxillary anterior teeth on the mandibular movements.

b- Condylar guidance

Condylar guidance is the mandibular guidance generated by the condyle and articular disc traversing the contour of glenoid fossa.

c- Plane of orientation(plane of occlusion)

The plane of orientation is the average plane established by the incisal and occlusal surfaces of the teeth.

d- Cusp incline (cusp plane angle)

Cusp angle is the incline of the cusp plane in relation to the occlusal plane, where the cusp plane is the plane determined by the two buccal cusp tips and the lingual cusp of a molar.

e- Compensating curve

The compensating curve is defined as the antero-posterior curvature (in the median line) and the mediolateral curvature (in

the frontal plane) in the alignement of occluding surfaces and incisal edge of artificial teeth used to develop balanced occlusion.

3-Different concepts of occlusion

Balanced occlusal concepts:

- Spherical theory of occlusion.
- Lineal occlusal concept.
- Flat teeth arranged with balancing ramp.
- Flat teeth arranged with compensating curve.
- Centralizing concept of occlusion.
- Lingualized occlusal concept.

Non-balanced occlusal concepts:

- Organic occlusal concept.
- Monoplane occlusal concept.

a-Spherical theory of occlusion

Spee had considered the movement of the lower teeth over the surface of the upper teeth having the shape of the surface of a sphere with a diameter of 8 inches (20 cm). The center of the sphere located in the region of the glabella and the surface of the sphere passed through the glenoid fossae along or concentric with the articulating eminence. In this occlusal scheme, artificial anatomic posterior teeth are positioned to simulate natural occlusion. The teeth are arranged in a compound curve running anteroposteriorly and mediolaterally.[13]

b-Lineal occlusal concept

A concept based on a line of occlusal contacts in one dental arch opposing a flat occlusal table (non anatomic teeth) has the potential of reducing frictional resistance and hence minimizing the force of food penetration, as the area of contact between occluding surfaces is minimal. The lineal ridge of occlusal contacts may be located in either dental arches. The decision as to whether to locate the ridge of contacts in the maxillary or mandibular arches depends on the denture stability and esthetics.(14)

c-Flat teeth with balancing ramp

To attain balance in non-anatomic teeth, setting up is done in a flat plane and utilize a balancing ramp just distal to the second molar.(4)

d-Flat teeth with a commpensating curve

The arrangement of non-anatomic posterior teeth in a compensating curve harmonious with reasonable balance contacts in protrusive positions.(4)

This occlusal scheme will solve the problem of non-anatomic teeth arranged in monoplane occlusion that exert heavy pressure in the anterior segment during protrusion.(9)

It is considered the ultimate harmonoious balanced occlusal sheme, because the patient generates it by himself resulting in an occlusion that is in harmony with tempro-mandibular joint and neuro-muscular system. This scheme will

allow freedom in lateral excursions and maintain maximum bilateral contact in function. [7]

e-The centralizing occlusion concept

The concept of centralizing the forces requires bringing the occlusal surfaces of anatomic or modified anatomic teeth toward the center of denture foundation. In the anteroposterior direction, the center of the basal seat is the area of bicuspids and the first molars where the food is masticated. These working occlusal units ideally consist of lingual halves of the maxillary bicuspids, the first molar and their corresponding maxillary teeth. Depending on the maxillo-mandibular relation records, the working occlusal units may consist of the distal half of the second bicuspid and the first molar. The second molars are not always placed in the arrangement or out of occlusion if they are placed. Most favorable leverage is obtained when the occlusal working surfaces are placed to the lingual sides of ridge crest.[15]

Hence, in centric occlusion, only the working occlusal units are in contact, so the first bicuspids, the cuspids and the incisors have at least one millimeter clearance when the teeth are in centric occlusion. Also, in mediolateral direction, the buccal surfaces of the posterior teeth extend over the lateral half of the residual ridge and are ground to have at least one millimeter clearance with their antagonists. The upper and lower incisal units meet only when the mandibular teeth are protruded where they act as protrusive balancing units. During lateral movement, the lingual surface of the maxillary first molar provides bilateral

balance, even though the maxillary working occlusal units must be placed on the labial side of the crest.[15]

f-Organic occlusion concept

This concept implies that any jaw movements away from centric occlusion results in disocclusion of all posterior teeth on both sides of the arch. So, the cuspids should prevent contact of all other teeth during lateral movements, while cingulae of the maxillary incisors should be contoured to cause separation of the posterior teeth during protrusion.[16]

g-Lingualized occlusal concept

The lingualized concept of occlusion was considered by many investigators as the occlusal scheme of choice for complete denture wearer, as well as for those rehabilitated by over denture prosthesis where the basic guidelines of the lingualizedocclusion were first suggested.[17]

A similar concept was discussed and the term “lingualized occlusion” was introduced. The lingualized concept of occlusion requires the modification of the anatomic teeth to provide a limited range of excursive balance and a lingual to lingual working side cusp contact, such a contact will direct the force to the lingual side of the ridge to enhance te lever balance of the lower denture.[18]

In lingualized balanced occlusion, only the maxillary palatal cusps occlude in the mandibular central fossae and marginal ridges, in the centric relation position, simultaneous

contacts must exist on the working and non-working sides during lateral movements and on the anterior and posterior teeth during protrusive movements. [19]

Compared to the conventional balanced occlusion the lingualized balanced occlusion is a less complicated occlusal scheme, having only half of the centric relation contact points that are usually obtained in the conventional balanced occlusion. In addition, because of the procedures adopted to avoid contacts in the mandibular buccal cusps, such as raising of the maxillary buccal cusps, the occlusal surfaces of the maxillary and mandibular teeth are not as close as they are in conventional balanced occlusion. Considering the level of complexity of each occlusal scheme, it is not clear whether alterations in tooth position occurring as a result of the processing technique may result in deflective contacts that could produce a greater increase in occlusal vertical dimension in dentures arranged in conventional occlusion than in dentures arranged in lingualized occlusion. The lingualized balanced occlusion may result in easier occlusal adjustments, as the less complicated occlusal scheme uses a smaller number of centric occlusion contact points. [19]

h-Monoplane occlusal concept:

Monoplane occlusion involves the use of cuspless teeth that are arranged anteroposteriorly parallel with the plane of the denture foundation. In a mediolateral direction, the teeth are positioned flat with no medial or lateral inclination. In reference to the residual ridge as much as the tongue function will allow,