

FUNCTIONAL OCCLUSION AND TEMPEROMANDIBULAR JOINT

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**ABSTRACT:** The ideal goal of modern dentistry is to restore the patient to normal contour, function, comfort, esthetics, speech, and health. Optimal functional occlusion is necessary for maintaining stability, prevent and treat temporomandibular joint disease syndrome . This article reviews the concepts of functional occlusion in the context of orthodontics

**KEYWORDS:** Functional occlusion, Orthodontics, tempero Mandibular Joint, TMJ

INTRODUCTION

Orthodontics, a branch of dentistry that strives for straight teeth in the maxillary and mandibular arches is mainly concerned with correction of malaligned skeletal or dental relations that lead to functional and esthetic balance in the face<sup>1</sup>. Despite the contributions of great authors (Kingsley) and their contemporaries, the emphasis in orthodontics remained for the alignment of the teeth and the correction of facial proportions while little attention was paid to the dental occlusion<sup>2</sup>.

Functional occlusion, an entity of its own determines the well being of temporomandibular joint and its associated structures such as ligaments, muscles, nerve conduction and its impact on muscle contraction where each component has its impact and influences the post orthodontic retention, stability and healthy functioning temporomandibular joint. Form and function are considered to be closely linked, and it follows that the morphology of the temporomandibular joint (TMJ) might be related to functional forces.

The relationship between dental malocclusion and TMJ dysfunction has been discussed in dentistry for over sixty years. Historically, the greatest emphasis has been placed on malocclusion as the primary etiologic factor in TMJ dysfunction. In 1920, Monson was one of the first to propose that malocclusion was responsible for the encroachment of the condyle on the auditory canal and associated nerve structures. More recently, while malocclusion has continued to be accepted as an important element in many of these problems, other conditions have also been recognized as important etiologic factors.

Optimal functional occlusion is necessary for maintaining stability, prevent and treat temporomandibular joint disease syndrome. Many concepts of occlusion have

been proposed when evaluating the literature. One should realize that with the continued increase in knowledge of the stomatognathic system, the concept of what ‘IDEAL’, ‘ACCEPTABLE’ and ‘HARMFUL’ occlusions continue to evolve<sup>16</sup>.

Historically, much of the early development of dentistry was inductive, reasoning from the particular to the general. The development of the idea of occlusion can be through fiction, hypothesis to fact. The development of the concept of the occlusion is divided into three periods as

1. THE FICTIONAL PERIOD ( PRIOR TO 1900 )

2. THE HYPOTHETICAL PERIOD ( 1900 – 1930 )

3. THE FACTUAL PERIOD ( 1930 TO PRESENT DAY )

1. THE FICTIONAL PERIOD (PRIOR TO 1900)

Pioneers like Fuller, Clark and Imric talked of antagonism, meeting or gliding of teeth. Others relied on anatomic descriptions of the morphology of the teeth as individual units. The creation of a normal standard, a typical relationship, a basis on which to compare departures from normal was lacking.

Kingsley wrote in 1880 “peculiarities of the permanent teeth are recognized by everyone of extended observation because they are a greater or less departure from a normal standard...such a standard cannot...be one shape to which all must conform... the standard normality of the dental arch is a curved line expanding as it approaches the ends, and all the teeth standing on that line served as a working hypothesis or subsequently became established fact after definite research. Eugene Talbot’s text “Irregularities of the teeth and their treatment”

went through five editions, the last in 1903, before succumbing to progress.

2. THE HYPOTHETICAL PERIOD (1900 – 1930)

EDWARD HEARTLY ANGLE (1899) crystallized the Orthodontic thinking on occlusion and brought the concept out of the realm of fiction. He did much to organize the existing concepts and formulate definite principles of diagnosis and treatment.

The best example of a hypothesis was his “KEY TO OCCLUSION”. He noted that “ All teeth are essential, yet in function and influence some area of greater importance than others, the most important of all being the first permanent molar they are by far the most constant in taking their normal positions especially the upper first molars which we call the key to occlusion.

MATHEW CRYER AND CALVIN CASE, Angle’s two most formidable contemporary adversaries, were quick to leap to the attack as Angle showed the straight profile of Apollo Belvedere as his ideal and old glory skull as ideal occlusion.\_He accepted Angle’s hypothesis of constancy of the first molar as strongly as he rejected the fiction that normal occlusion and normal facial lines are inseparable. He advised that the terms ‘protrude’ and ‘retrude’ when used in reference to the relative position of the teeth should always refer to the relation they bear to the normal dentofacial position and not to the normal occlusal position.

Case (1908) stated , the static empiric nature of the concept of occlusion, that “There has been a recent effort among a certain class of orthodontists to make the word occlusion stand for a far wider scope of meaning than any of the lexicographers’ would think of claiming for the word.

The first suggestion of a function analysis or a dynamic approach to occlusion came with some experiments by Bennet in 1908. After the stimulus supplied by Case and Bennet, Lischer and Simon tried hard to broaden the concept of occlusion by relating the teeth to the rest of the face and cranium. The concept of the Orbital plane as a basis for determining Anteroposterior position of the denture in the face did not stand up. Recognition of the interdependence of the teeth, occlusion, Jaw relationships, Craniofacial morphology and their effects on the ultimate concepts of occlusion formed the basis of the science of **gnathostatics**.

Hellman saw in anthropology the same promise for method and interpretation of the fact as did Simon. He and others studied the prognathism of the human denture in relation to a cranial base despite its recognition of interdependence of the denture and the supporting craniofacial super structure was primarily a static approach as far as occlusion was concerned. FRIEL, at the first International orthodontic congress in 1926 again

called attention to function. “I would like for you to distinctly understand that the real objective is function, whatever that function may be and that each orthodontist, as far as I can determine must decide this for himself.

3. THE FACTUAL PERIOD (1930 TILL DATE)

The good reasons for picking 1930 as the dividing line between the hypothetical and factual periods, between static and dynamic concepts between ambiguous and more precise terminology are. The death of Angle, removed a powerful sustaining influence for a concept open to some questions from factual and functional points of view. HOLLY BROADBENT (1930) introduced an accurate technique of Roentgenographic Cephalometry which eliminated most disadvantages of anthropologic Cephalometry.

PLANER then told when bites should be opened and when they should not, depending on the amount of space between two positions. In the past 40yrs or since 1930, a third element of occlusion, “Time” has received more attention.

OCCLUSION

**DEFINITION:** The relationship between the occlusal surfaces of the maxillary and mandibular teeth when they are in contact or maximum intercuspation“

**IDEAL OCCLUSION:** “It is a pre-conceived theoretical concept of occlusal structural and functional relationships that include idealized principles and characteristics that an occlusion should have”.

**CENTRIC OCCLUSION:**“The relationship of the maxillo-mandibular Occlusal surfaces when they are in maximum intercuspation (tooth to tooth relation)”.

**ECCENTRIC OCCLUSION:**“An occlusion other than centric occlusion”.

**FUNCTIONAL OCCLUSION:**“Refers to tooth contacts that occur in the segment of the arch towards which the mandible moves”.

- a. **LATERAL FUNCTIONAL OCCLUSION:**“Tooth contacts that occur on canines and posterior teeth on the side towards which the mandible moves”.
- b. **PROTRUSIVE FUNCTIONAL OCCLUSION:**“Eccentric contacts that occur when the mandible moves forward”.

**NON FUNCTIONAL OCCLUSION:**“Refers to tooth contacts that occur in the segment away from which the mandible moves”.

**PHYSIOLOGIC OCCLUSION:**“Dentition with its anatomical form and with the physiologic adaptation of the system is in harmony while in function or parafunction”

**PATHOLOGIC OCCLUSION**

- a. **TRAUMA FROM OCCLUSION:**“Defined as periodontal injury caused by occlusal forces through abnormal occlusal contacts”.
- b. **TRAUMATIC OCCLUSION:**“An abnormal occlusal stress which is Capable of producing or has produced an injury to the periodontium”.

**STATIC OCCLUSION:**“ The form, alignment and articulation of teeth within and between the arches and the relationship of teeth to their supporting structures”.

**DYNAMIC OCCLUSION:**“The function of the stomatognathic system as a Whole comprising teeth, supporting structure, Temporomandibular joint, neuromuscular and nutritive systems”.

**THERAPEUTIC OCCLUSION:**“An occlusion that has been modified by appropriate therapeutic modalities in order to change a non-physiological occlusion to one that is least physiologic if not ideal”.

**BALANCED OCCLUSION:**“The simultaneous contacting of the maxillary and mandibular teeth on the right and left and in anterior and posterior occlusal areas when the jaws are either centric or eccentric relation “.

**ORGANIC OCCLUSION:**“It is the concept that any jaw movements away from centric occlusion will result in disocclusion of all posterior teeth on both sides of the arch”.

**ACQUIRED OR HABITUAL OCCLUSION:**“Maximum intercuspation that occurs without the condyles being in centric relation”.

**THE ENVELOPE OF MOTION**

Every tooth in the mandible (the only moving jaw) has an *envelope of motion* that outlines the outer limits to which each lower tooth can be moved. These limits of movement are imposed on the mandible. To a larger degree, the limits of mandibular movement are directly related to limits imposed by ligaments, bone, and muscle on the temporomandibular joints (TMJs). The condyles can go back and up only so far, rotate to open the mouth only so far, move forward only so far, and rotate the mandible laterally only so far. Therefore, the TMJs have an envelope of motion that sets the border paths (the envelope) for all movement of the teeth that are attached to the mandible. The envelope of motion can be altered in a limiting way by teeth that interfere with physiologic masticatory muscle

function.

**THE ENVELOPE OF FUNCTION**

The first thing to understand about the envelope of function is that the functional movements of the mandible occur within the envelope of motion and cannot be determined by recording the border movements of the condyles. Pantographic tracings use a central bearing point to separate the teeth so the condyles are free to travel along all of their border paths without interference from deflective tooth inclines. These tracings do a good job of accurately recording the condylar border paths. But they record only the condylar border paths. That is not enough information to determine an envelope of function that occurs within the envelope of motion

**FUNCTIONAL OCCLUSION AND ORTHODONTIC CONSIDERATION**

**Force vectors**

Force vectors are nothing but the loading forces or compressing forces that act on the joint to bring the internal derangements, which may be either compensated, decompensated or regressively adapted. These force vectors are 1. Anterior, anterosuperiorly, anteroinferiorly 2. Posterior, posterosuperior, Postero lateral, Posterior medial, posteriosuperiolateral 3. Superior 4. Inferior 5. Specific or non specific 6. Medial or lateral.

**Three important concepts for eccentric occlusion are**

- 1. Anterior or canine protected occlusion: the incisors and canines provide disclusion of all other teeth. Anterior or canine guidance is the occlusal concept most easily achieved clinically and In the laboratory
- 2. Unilateral balanced occlusion (group function) : guidance on all the teeth of the laterotrusive side with disclusion of the opposite side. The majority of young adults exhibit a more or less unilaterally balanced occlusion. However half of them make balancing contacts on the nonworking side after a laterotrusive movement of 1.5 mm in another third, balancing contacts are present after an excursion of 3mm.
- 3. Bilateral balanced occlusion: all teeth remain in contact during laterotrusion.

The bilateral balanced occlusion is difficult to achieve in the natural dentition. Nevertheless, balancing contacts can offer protection for the joints in some cases.

**Orthodontic consideration**

Different malocclusions lead to premature contacts or cross bites or deep bites etc. Exhibiting one or combination of the force vectors leading to temporomandibular joint disorders.

**PROPRIOCEPTION AND ITS SIGNIFICANT ROLE IN ORTHODONTICS**

Proprioception can be defined as, which senses and indicates the position of the mandible in three dimensional space of craniofacial region to the brain, where the neuromuscular system holds the mandible in dynamic equilibrium state. It can be achieved primarily from centric relation by the anterior teeth contact i.e. incisor contact and guided as Anterior Guidance and Canine Guidance for initial tooth contact to maximal intercuspation of centric occlusion. People try to achieve this in many ways, which finally alters the condyle fossa relation, leading to temporomandibular disorders.

**CASE OF CLASS – I OCCLUSION**

In this the condyle-disk-fossa relationship is maintained by neutralizing the anterior and posterior components of force by class – I incisor relationship and class – I molar relationship balancing the mandible in dynamic equilibrium position with good proprioceptive impulse.

**CASE OF CLASS – I MALOCCLUSION**

This malocclusion is characterized by class – I molar relationship, with Proclination, rotation etc of anterior teeth.

1. In centric relation to sense(propriocept) the mandible in three dimensions of space the patient tries to move the mandible forward and adapts it in that position which is commonly known as habitual rest position.
2. In this position the mandible is brought forward anteriorly, loading the disk superiorly on to the condyle there by adapting the joint and on mouth opening may lead to Posterior disk displacement on further opening of the mouth.
3. In centric occlusion or in Functional occlusion, due to cuspal guiding planes a anterior vector of force generates, directing the mandible more anteriorly, finally leading to Anterior disk displacement.

**CASE OF CLASS – II MALOCCLUSION  
CLASS – II DIVISION – I**

This malocclusion is characterized with Proclination of upper incisors with upright or Proclination of lower incisors.

**In case of Upright lower incisors :**

1. In centric relation to sense(propriocept) the mandible in three dimensions of space the patient tries to move the mandible forward and adapts it in that position which is commonly known as habitual rest position.

2. In this position the mandible is brought forward anteriorly, loading the disk superiorly on to the condyle there by adapting the joint and on mouth opening may lead to Posterior disk displacement on further opening of the mouth.
3. In centric occlusion or in Functional occlusion, due to cuspal guiding planes a posterior vector of force generates, directing the mandible posteriorly finally leading to Anterior disk displacement.

**In case of proclined Lower incisors**

1. In centric relation, the condyle is ideally placed in relation to the eminence and the disk i.e. most anterosuperiorly.
2. On centric occlusion or functional occlusion, due to cuspal guiding planes a posterior vector of force generates, directing the mandible posteriorly finally leading to Anterior disk displacement.

**CLASS – II DIVISION – II**

This malocclusion is characterized by Retroclined upper incisors with upright lower incisors

**In case of Upright lower incisors :**

1. In centric relation, the condyle is posteriorly placed in relation to the eminence and loading the disk most anteriorly.
2. On centric occlusion or functional occlusion, due to cuspal guiding planes a posterior vector of force generates, directing the mandible posteriorly finally leading to Anterior disk displacement.

**CLASS – III MALOCCLUSION**

1. In centric relation to sense(propriocept) the mandible in three dimensions of space the patient tries to bring the mandible backwards, where the condyle is placed posteriorly to the eminence and disk and adapts it in that position which is commonly known as habitual rest position. In this position the mandible is brought forward anteriorly on opening, loading the disk superiorly on to the condyle there by adapting the joint leading to normal condyle-disk-fossa relationship or
2. Leaves as such where the condyle is placed anteriorly to the eminence and disk and adapts it in that position which is commonly known as habitual rest position. In this position the condyle is brought forward anteriorly, loading the disk posteriorly on to the condyle there by adapting the joint and on mouth opening may lead to Posterior disk displacement.

- 3. In centric occlusion or in Functional occlusion, due to cuspal guiding planes a posterior vector of force generates, directing the mandible posteriorly finally leading to posterior disk displacement.

CANINE GUIDANCE

Canines guide the lateral movements on opening and closing thereby preventing lateral or medial disk displacement.

MOLAR RELATIONSHIP

It acts as a distal stop on centric occlusion limiting the mandible moving further back by having an anterior direction of force vector during function, where it is limited by the class – I incisor relation acting as mesial stop preventing the further movement of the mandible anteriorly, thereby establishing a healthy condyle-disk-fossa relationship .

In recent years, orthodontists have voiced more and more interest in occlusion and functional occlusion. Questioning of orthodontic concepts by dentists interested in occlusion, have caused the orthodontist to seek more knowledge in the area of functional occlusion and treatment of temporomandibular joint disease. Stability of the treated orthodontic case would at least partially rest in the functional dynamics of occlusion. Application of functional occlusion concepts clinically is not a quick and simple task in orthodontics<sup>36</sup>.

CONCLUSION

The gross evaluation and analysis of occlusion is still important in the diagnosis and treatment of TMD. Assessment of occlusion is necessary as part of the initial oral examination to identify and eliminate gross occlusal

discrepancies such as those that may inadvertently occur as a result of malpositioned teeth, skeletal malrelationship and restorative procedures. Although a stable occlusion is a reasonable orthodontic treatment goal, not achieving a specific gnathologic ideal does not result in TMD signs and symptoms.

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