Concepts of natural occlusion

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Introduction

• The study of occlusion is an important aspect of dentistry. The study and practice of most branches of dentistry should be based on a strong foundation of knowledge of occlusion.

• The dentist should know what constitutes normal occlusion in order to recognize abnormal occlusion.
THE DEVELOPMENT OF THE CONCEPTS OF OCCLUSION

The development of concept of occlusion can be traced through fiction and hypothesis to fact.
The fictional approach was a convenient arrangement of a series of observation and thoughts more or less logically arranged.
The hypothetical approach was based on provisional acceptance of certain logical entities.
Fact is a truth known by actual experience or observation. Both the fictional and hypothetical approach are necessary for the establishment of fact.
The fictional period, prior to 1900

The hypothetical period from 1900 to 1930

The factual period from 1930 to present
Pioneers like Fuller, Clark and Imrie talked of “Antagonism”, “Meeting” or “Gliding” of teeth.

The creation of normal standard, a basis on which to compare departures from normal was lacking. But this served as a working hypothesis or subsequently became established fact after definitive research.
Eugene Talbot published his book *Irregularities of the teeth and their treatment* in 1903.

The Talbot concept of normal occlusion was that it was a historical event, passed in the decline of the species and normality was possible only with atavism or throwback to our primitive ancestors.
Edward H. Angle,

- It was him, who channelised orthodontic thinking on occlusion and brought the real concept out of fiction.

- In 1907, Angle summarised his views as 'occlusion shall be defined as being the normal relation of the occlusal inclined planes of the teeth when the jaws are closed'.

- Angle cites the example of a skull of Negro male from Broomell which he names 'Old Glory'. In 'Old Glory' all the teeth are present and arranged in a graceful curve. He emphasizes that all teeth are necessary for maintaining occlusion. He compares 'Old Glory' with the profile of Appollo Belvedere a white male.
Angle furnished his ‘key to occlusion’ and emphasizes the first permanent molars especially the upper first permanent molar and considers them to be most constant in taking normal position.

From the hypothesis of constancy of first molar and the ‘line of occlusion’, Angle developed the concept that all teeth should be present if normal occlusion is to be achieved.
Cryer pointed out that Angle showed the straight profile of Apollo Belvedre and chose a skull of negro male ‘Old Glory’ to exemplify ideal occlusion. He questioned how one could mix a prognathic denture with an orthodontic profile.

Case accepts Angle’s hypothesis of constancy of first molar. Case related the facile profile to each type of occlusion.
He proposed the concept of apical base and divided dentofacial area into four segments or zones of movement.

He was aware of the role of nose and chin button and their influence on profile.

Case proposed the concept of normal and ideal occlusion.

The idea that teeth should be present to obtain normal facial contour was losing ground.

In 1908 Bennett proposed that the condylar movement was primarily rotatory on opening from occlusion to rest position and later on after passing this point became translatory.
Lischer and Paul Simon

They broadened the concept of occlusion by relating the teeth to the rest of the face and cranium. They related teeth in occlusal contact to cranial and facial planes outside the denture proper.

Though the concept of orbital plane as basis for determining antero-posterior position of dentition did not stand up. It introduced the idea of facial ramification of malocclusion outside the dental area.
Milo Hellman

Hellman showed the racial variation in so-called normal occlusion through anthropological studies.

Hellman and others studied the prognathism of the human dentition in relation to a cranial base.
FACTUAL PERIOD

In 1930 Holly Broadbent and Hans Planer introduced an accurate technique of roentogenographic cephalometry. Investigators were able to follow longitudinally the orofacial developmental pattern and the intricacies of tooth formation, eruption and adjustment.

Planer laid emphasis on efficiency of masticating mechanism. He explained physiological rest position and vertical dimension.

A third element of occlusion, the TMJ has been receiving more attention. There is an intimate relationship between the interdigitation of the teeth, the status of controlling, musculature and the integrity of the TMJ.
The goal of modern orthodontics according to Profitt is “the creation of best possible occlusal relationship within the framework of acceptable facial aesthetics and stability of result”.

Angle defined—occlusion as the normal relation of the occlusal inclined planes of the teeth when jaws are closed.
Dental occlusion varies among individuals according to tooth size and shape, tooth position, timing and sequence of eruption, dental arch size and shape and pattern of craniofacial growth.

The position of the teeth within the jaws and the mode of occlusion are determined by developmental processes that interact on the teeth and their associated structures during the period of formation, growth and post natal modification.
TERMINOLOGIES USED IN OCCLUSION

Normal Occlusion:
- Normal occlusion implies a situation commonly found in the absence of disease. It should include not only a range of anatomically acceptable values but also physiological adaptability.
- It is always a range never a point.

Ideal Occlusion:
- The concept of ideal or optimal occlusion refers both to an aesthetic and physiologic ideal. It includes functional harmony, stability of masticatory system & Neuromuscular harmony.
Physiologic occlusion:
- The occlusion that shows no signs of occlusion related pathosis. It may not be an ideal occlusion but it is devoid of any pathological manifestations in the surrounding tissues.

Traumatic occlusion:
- The occlusion which produces abnormal occlusal stress which is capable of producing or has produced an injury to the periodontium.

Therapeutic occlusion:
- It is a treated occlusion employed to counteract structural interrelationship related to traumatic occlusion.
Recognition of the role played by muscles physiology and the TMJ has firmly entrenched the dynamic functional concept. The 13 muscle attachment to the mandible in addition to articular capsule and tendon provide a high degree of stability of position that occlusal equilibration and full mouth reconstruction can’t change permanently.

The teeth are in occlusal contact only 2 to 6% of the time. Therefore 94% of the time, they are apart. The largest segment of time is in postural rest position determined by musculature.

Postural rest position is a good place to start in an assessment of vertical status and harmony of orofacial features.
Occlusion is a dynamic entity showing variation according to age and sex. Most girls by the age of 12 achieve relatively stable occlusion whereas boys achieve that at a bit later due to continuing growth pattern.

Three components of occlusion can be summed up as

1. Occlusal position (or) tooth contact position
   - Masticatory habits, tooth inclination and malposition, shape of teeth, premature contact, faulty restoration, tooth loss, the condition of periodontium affect the occlusal positions

1. Postural resting position

2. TMJ
FACTORS & FORCES THAT DETERMINE TOOTH POSITION

The alignment of the dentition in the dental arches occur as a result of complex multidirectional forces acting on the teeth during and after eruption.

- Equilibrium position of opposing forces that are given by lips and cheeks from outer side and tongue from inner side determine the (stable) position of the teeth.

Hence the labiolingual and buccolingual forces are equal.
This is call "neutral position."
proximal and occlusal contacts are important in maintaining tooth alignment and arch integrity.

Mastication causing buccolingual and vertical movement of teeth results in wear of proximal contacts.

mesial drifting force helps to keep teeth in contact.
Centric cusps

Buccal cusps of the mandibular posterior teeth and lingual cusp of the maxillary posterior are the centric or supporting cusps.

These cusp plays major role in mastication and to maintain vertical dimension between maxilla and mandible.
Non centric cusps
The buccal cusp of maxillary posterior teeth and lingual cusp of the mandibular posterior teeth are also called as shearing or guiding cusps.

These are responsible for-

- Shearing of food.
- Minimizing tissue impingement.
- Maintain bolus of food on occlusal table for mastication gives stability to mandible in full occlusion.
- Guide the mandible during mastication by neuromuscular feedback
The curve of Spee given by F. Graf von Spee in Germany in 1890

It refers to the antero-posterior curvature of the occlusal surfaces beginning at the tip of the mandibular cuspid and following the buccal cusps of bicuspids and molars continuing as an arch through the condyle.
If the curve is extended, it would form a circle of about 4 inch diameter. This curvature is within the sagittal plane only.
Measurement of curve of Spee.

The maximum depth of the curve of Spee was measured as the maximum of the perpendicular distances between the buccal cusp tips of the mandibular teeth and a measurement plane described by the central incisors and the distal cusp tip of the most posterior tooth in the mandibular arch.
On average, the curve of Spee initially develops as a result of mandibular permanent first molar and incisor eruption. The curve of Spee maintains this depth until the mandibular permanent second molars erupt above the occlusal plane, when it again deepens.

During the adolescent dentition stage, the curve depth decreases slightly and then remains relatively stable into early adulthood.

Curve of Wilson

It is a curve that contacts the buccal and lingual cusps tips of the mandibular posterior teeth.

It helps in two ways:
- Teeth aligned parallel to direction of medial pterygoid for optimum resistance to masticatory forces.
- The elevated buccal cusps prevent food from going past the occlusal table.
Curve of Monson

Monson (1920),

connected the curve of Spee and curve of Wilson to all cusps and incisal edges, which forms a sphere of a 4 inch radius, mandibular arch adopted itself to the curved segment of a sphere.
Classification of Occlusion

Based on Mandibular Position
Centric Occlusion

- It is the occlusion of teeth in centric relation. Centric relation has been defined as the maxillomandibular relationship in which condyles articulates with the thinnest avascular portion of their respective discs with the complex in the anterosuperior position against the shape of articular eminence. This position is independent of tooth contact.

The Importance of the centric relation in orthodontics

- In orthodontics, diagnosis and treatment planning should be performed by an evaluation of an malocclusion with the mandible in centric relation (CR), i.e. the natural musculoskeletal position of the condyle in the fossa, in order to obtain the true maxillary - mandibular skeletal and dental relations in the three planes of space.
- If this is overlooked an incorrect diagnosis and treatment plan of the actual malocclusion, along with its unfavourable consequences, may result.

- During every appointment a patient has to be monitored in CR so that the mechanotherapy is guided to accomplish the final ideal static and functional occlusion with the mandible in position.

- If this disregarded several prematurity that may later cause traumatic occlusion or craniomandibular disorders may result.
Eccentric occlusion

- Refers to contact of teeth that occurs during movement of mandible.
  - Functional occlusion
  - Non-functional occlusion

a) *Functional occlusion*

Also called working side occlusion refers to tooth contacts that occurs in the segment of arch towards which the mandible moves.
According to movements functional occlusion can be of two types:

- Lateral functional occlusion
- Protrusive functional occlusion

It includes tooth contacts that occur on canines and posterior teeth on the side towards which the mandible moves. The lateral functional occlusion can be of two types.
1. **Canine guided occlusion**

During lateral mandibular movement, the opposing upper and lower canines of the working side contact there by causing disclusion of all posterior teeth on the working side and balancing sides.
2. *Grouped lateral occlusion* – In addition to canine guidance, certain other posterior teeth on the working side also contact during lateral movement of mandible, such type of contact during lateral movement is called grouped lateral occlusion.
Protrusive functional occlusion

It includes eccentric contacts that occur when the mandible moves forward. Ideally the six mandibular anterior teeth contact along the lingual inclines of the maxillary anterior teeth while the posterior disocclude.
Non-functional occlusion

They are tooth contacts that occur in the segment away from which the mandible moves. For example if the mandible is moved to the left side, contact occur on right side.
Based on relationship of first permanent molar

- The angulation of upper first permanent molar – the key to functional occlusion.
  - They are biggest teeth and their anchorage is strongest
  - Their local position in the occlusal arch supports the main masticatory function
  - They influence the vertical dimension of upper and lower jaw, the occlusal height and esthetic proportions
  - They are the first erupting teeth of permanent dentition
  - The anamolies in dental positioning are mostly due to more prominent disloacted positions of the crown of upper permanent molar to normal.
Class I: Neutro Occlusion

Mesiobuccal cusps of the upper first permanent molar occludes with the mesiobuccal groove of the lower first permanent molar. This is called the key of occlusion.

Class II: Disto Occlusion

Condition in which the mandibular first Permanent molar is placed posterior in relation to the normal class I condition

- Division I
- Division II

Class III: Mesio Occlusion

Condition in which the mandibular first Permanent molar is placed anterior in relation to the normal class I condition.
Based on the Organisation

Canine guided (or) protected occlusion – during lateral movements only working side canine comes into contact with the other. This result in disclusion of all posterior teeth

- The canine has a good crown root ratio capable of tolerating high occlusal forces
- The canine root has a greater surface area than adjacent teeth. Providing greater proprioception.
- The shape of the palatal surface of the upper canine is concave and is suitable for guiding lateral movement.
**Mutually Protected**: Posterior teeth prevent excessive contact of the anterior teeth in maximum intercuspation. Anterior teeth disengage the posterior teeth in all mandibular excursive movements.

**Group Function**: During the lateral movement the buccal cusp of the posterior teeth on the working side are in contact.
**Cusp to fossa occlusion**: Supporting cusp occluding into fossa. This produces an interdigitation of the cusps and fossa of one teeth with the fossa of only one opposing tooth. This is tooth-to-one-tooth relation.

**Cusp to embrasure / Marginal ridge occlusion**: Occlusion of one supporting cusps into a fossa and the occlusion of another cusp of the same tooth into the embrasure area of two opposing teeth. This is a tooth-to-two-teeth relation.
SIX KEYS TO NORMAL OCCLUSION

LAWRENCE F. ANDREWS (1972)

- collection of 120 models of teeth with naturally excellent occlusion

Criteria for selection

1. Had never undergone ortho treatment
2. Were straight & pleasing in appearance
3. Had a bite which looked generally correct
4. In his judgement, would not benefit from ortho treatment

Andrews LF (1972). The six keys to normal occlusion. 
ANDREWS SIX KEYS OF OCCLUSION

1. MOLAR RELATIONSHIP
2. CROWN ANGULATION
3. CROWN INCLINATION
4. ROTATIONS
5. TIGHT CONTACTS
6. OCCLUSAL PLANE
Molar relation

Corresponds with the mesiodistal relationship of upper first permanent molars of Angle (1899) with addition that the distal surface of the disto buccal cusp of the upper first permanent molar should made contact and occluded with the mesial surface of the mesio buccal cusp of the lower second molar.
The closure the distal surface of buccal surface of distobuccal cusp of upper first permanent molar approaches the mesial surfaces of the M-B cusp of lower second molar, the better the opportunity for normal occlusion.
Crown angulation (Tip)

The gingival portion of the long axis of each crown should be distal to the incisal portion.

The degree of crown tip is the angle between the of long axis of the crown to a line perpendicular to the occlusal plane.
A ‘plus’ reading when the gingival portion of the long axis of crown is distal to the incisal portion.

A ‘minus’ reading is when the gingival portion of the long axis of crown is mesial to the incisal portion.
Crown inclination (Torque)

Refers to the buccolingual inclination of the long axis of crown, not to the long axis of entire tooth.

*Determined by resulting angle between a line perpendicular to the occlusal plane and a line that is tangent to the middle of the labial or buccal clinical crown.*
Crown inclination of teeth

A ‘plus’ reading is given if the gingival portion of the tangent line is lingual to the incisal portion.

A ‘minus’ reading is recorded when the gingival portion of the tangent line is labial to the incisal portion.
Most maxillary incisors have a positive inclination; mandibular incisors have a slightly negative inclination.

All posterior teeth have lingual crown inclination (negative inclination)
Absence of rotations

- Arch should be devoid of any rotated tooth.
- A rotated molar occupies more mesiodistal space.
- A rotated incisor occupies less space.
Tight contacts

In absence of abnormalities such as genuine tooth size discrepancies, contact point should be tight.

It should be free of spacing.
Occlusal plane

An excessive curve of Spee restrict the amount of space available for the upper teeth results in crowding.

A flat curve of Spee is most receptive for normal occlusion. (the mandibular curve of Spee should not be deeper than 1.5mm)
A reverse curve of spee creates excessive space in upper jaw.
Works by Roth (1981) had then added some functional keys to the previous six keys to normal occlusion by Andrew:

a) Centric relationship and centric occlusion should be coincident.

b) In protrusion, the incisors should disclude the posterior teeth, with the guidance provided by the lower incisal edges passing along the palatal contour of the upper incisors.
c) In lateral excursions of the mandible, the canine should guide the working side whilst all other teeth on that and the other side are discluded.

d) When the teeth are in centric occlusion, there should be even bilateral contacts in the buccal segments.
Key VII – Correct tooth size

Bennett and McLaughlin in 1993 gave seventh key to normal occlusion. I.e. the upper and lower tooth size should be correct
ABO criteria for ideal occlusion

A set of criteria was developed in 1998 by the directors of The American Board of Orthodontic (ABO) for objectively evaluating the dental casts and panoramic radiographs.
Alignment.

Attention is paid to the incisal edges and lingual surfaces of the maxillary anterior teeth and the incisal edges and labioincisal surfaces of the mandibular anterior teeth. The mesiodistal central grooves of the maxillary premolars and molars are used to assess the adequacy of alignment, as are the buccal cusps of the mandibular premolars and molars.
Marginal Ridges

Marginal ridges of adjacent teeth should be at the same level or within 0.5 mm of the same level. Radiographically, the cemento enamel junctions should be at the same relative height, resulting in a flat bone level between adjacent teeth.
Buccolingual inclination

The buccolingual inclination of the maxillary and mandibular posterior teeth is assessed by using a flat surface that is extended between the occlusal surfaces of the right and left posterior teeth. There should not be a significant difference between the heights of the buccal and lingual cusps of the maxillary and mandibular premolars and molars, with all cusps within 1 mm of the straight edge.
Occlusal relationship

The mesiobuccal cusp of the maxillary first molar must coincide within 1 mm of the buccal groove of the mandibular first molar. In addition, the buccal cusps of the maxillary molars, premolars, and canines must align within 1 mm of the interproximal embrasures of the mandibular posterior teeth.
Occlusal contacts

Maximum intercusption should be established between the buccal cusps of the mandibular posterior teeth and the lingual cusps of the maxillary posterior teeth. Each functional cusp should be in contact with the opposing arch
Overjet

Posteriorly, the mandibular buccal cusps and the maxillary lingual cusps are used to determine proper position within the fossa of the opposing arch. Anteriorly, the mandibular incisal edges should lightly contact the lingual surfaces of the maxillary anterior teeth.
Interproximal contacts

All spaces within the dental arches should be closed.
Root angulation

Generally, the roots of the maxillary and mandibular teeth should be parallel to each other and the perpendicular to the occlusal plane, as viewed in the panoramic radiograph. If roots are properly angulated, sufficient bone will be present between adjacent roots, an important consideration in periodontal health.
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Thank You