Physiological Consideration of Tooth Form & Function

Geometric Concept of Crown Outline

In general all aspects of each tooth crown - except the incisal or occlusal aspects - may be outlined schematically within one of three geometric figures; a triangle, a trapezoid or rhomboid.

Facial and lingual aspects of all teeth
The outline of these surfaces may be outlined by a trapezoids of various dimensions (Fig 1). The shortest of the uneven sides of the trapezoid represent the bases of the crown at the cervices. While the longest of the uneven side represent the incisal or occlusal surfaces and form the approximate point at which the opposing teeth come together when the jaws are closed. This arrangement and design brings out the following fundamentals of form:

- Create interproximal spaces to accommodate the interproximal gingival.
- Create a space between the roots of the adjacent teeth which allow enough space for bone and supporting structures required to hold up the gingival tissue to normal level and to provide sufficient circulation of blood to region.
- Provides a contact area between adjacent teeth which help to protect the interproximal gingiva.
- The arrangement of teeth tends to prevent elongation of the antagonists as each tooth has two antagonists in the opposing arch except lower central and upper third molar.

Mesial and Distal Surfaces

A. Anterior teeth
These aspects may be included within a triangle, the base of which is represented by the cervical portion of the crown and the apex by the incisal ridge (Fig 2). This design provides:

- A wide base to the crown for maximum strength.
- A tapering outline labially and lingually, narrowing to a relatively thin ridge (incisal ridge) which facilitate cutting and penetration through food materials.

B. Maxillary posterior teeth
The outline of these aspects can be included within a trapezoid with the longest uneven side representing the cervical part of the crown (Fig. 3). The design provides the following fundamentals:

- Since the occlusal surface is constricted, the tooth can be forced into food material more easily.
- If the occlusal surfaces were as wide as the bases of the crowns excessive masticatory forces would be transmitted to the roots.
- The form helps self-cleaning of the teeth.

C. Mandibular posterior teeth
These surfaces are somewhat rhomboidal in outline (Fig. 3). The occlusal surfaces are constricted as compared to the bases. The rhomboidal design provides the following fundamentals:

- The crown is inclined lingually which allow proper intercuspation.
- Keep the axis of the crown and root of the teeth of both jaws together.
- Prevent clash of the opposing cusps with one another.

Fig. 57. Outline of labial and lingual surfaces of all teeth is trapezoid. Lower central incisor (Left), lower canine (Middle) and lower first molar (Right).

Fig. 58. Outline of mesial and distal surfaces of anterior teeth are triangular.

Fig. 59 The outline of the proximal surfaces of upper posterior teeth is trapezoidal (A upper, B & D upper), while that of lower posterior teeth is rhomboidal with lingual inclination (A lower, C and D
The teeth have a specific shape, with fundamental curvatures which play an essential role in maintenance of the teeth in the dental arch, preventing diseases, damage, bacterial invasion and calculus building. Also they disperse the excessive occlusal trauma and biting forces and protecting the periodontium and therefore increasing the life span of the tooth within the dental arch. Table I list direct and indirect tooth form characteristics that are successful in protecting and preserving the teeth.

**Proximal contact areas**
The contact areas are located on the mesial and distal surfaces of each tooth. The contacts between the adjacent teeth are not just a point but rather flattened area which are narrow on the anterior teeth and wide on the posterior teeth. (Fig. 4)

The proximal (mesial or distal) contact areas of the teeth are situated in a way that the food debris is prevented from packing between them.

The actual proximal contact areas touch each other so that the surfaces are not large enough to create a build up of excessive amounts of bacteria or food debris, but large enough to effective barrier and prevent food from packing between teeth. Proper contact areas help the following:

- Stabilize the dental arches by anchorage between the adjacent teeth.
- Prevent food impaction between teeth.
- Resistance to teeth displacement.

**Interproximal spaces**
These are V-shaped spaces between the teeth, formed by the proximal surfaces and their contact areas. The space is wider cervically than occlusally and filled with gingival tissues. (Fig. 5)

When gingival recession occurs between the teeth, the interdental papilla and bone no longer fill the entire spaces, accordingly a void exist cervical to the contact area which is termed "cervical embrasure". It occurs frequently as a pathological consequence of periodontal or orthodontic causes and offer a place in which bacteria and food debris can accumulate. Table II list the functions of the interproximal spaces.

**Embrasures (Spillways)**
These are spaces between the teeth surrounding the contact areas (Fig. 6). They widen out from the contact area in all direction. The names of the embrasures are facial (labial or buccal), lingual, incisal or occlusal. There are also cervical or gingival embrasures but only when the interproximal space is not occupied by gingiva or bone. Table III lists the functions of the embrasures.

**Curvature of the cervical line**
The curvature of the cervical line on the mesial and distal surfaces depends on the height of the contact area above the crown cervix as well as the diameter of the crown labiolingually or buccolingually.

The periodontal attachment follows the cervical line and connects the gingiva and the cementum. The periodontal ligament attaches the cementum to the bone.

The anterior teeth are narrow labiolingually, accordingly the curvature of the cervical line is high to provide more anchorage and bony support. The posterior teeth on the other hand are wider buccolingually and have more bony support and therefore need not to have this raised portion of bone.

The maxillary anterior teeth show greater amount of curvature of the cervical line. The more anterior the tooth the more the curvature. The mandibular anterior teeth...
show less curvature (about 1 mm) than in the maxillary anterior teeth.

**Contours of the facial and lingual surfaces**
The degree of these contours vary from tooth to tooth but the following concepts should be considered:

- The location of the buccal contour of anterior and posterior teeth is at the cervical third of the crown.
- The lingual height of contour of the anterior teeth is at the cervical third of the crown (the cingulum)
- The lingual height of contour of posterior teeth is at the middle third.
- The average degree of curvature found on most facial contours is approximately 0.5 mm, and some what less lingually on the anterior teeth.
- The average degree of curvature on the lingual aspects of maxillary posterior teeth is about 0.5 mm, while on the mandibular posterior teeth it is about 1 mm.

**Functions of having the right degree of surface contour are shown in table IV.**

If the curvature is absent or too slight, gingival recession will occur. And if the curvature is too high the gingiva will be over protected and food material will pack around the gingival area and result in gingival inflammation.

In young individuals most of the curvatures lie beneath the gingival crest. However, in old persons the cervical line may be visible and may be just under the gingival crest due to the gradual gingival recession and the curvature becomes exposed.

**Self-cleaning qualities of the teeth**
The smoothness of the enamel which covers the crown of the teeth helps food substance to slip off the crown and aids in the prevention of periodontal diseases by stimulating and cleaning the gingival tissues.

It is evident that teeth reflects their function as well as their cleaning ability. The premolars are shaped in such a way to deflect food to the occlusal surface where it is ground by cusps.

Pits and fissure provide a method of dissipating the extreme occlusal force that result from interdigititation of cusps during the process of grinding of food. These little pits and fissures act as a spillways on the occlusal surface of the tooth.

Generally speaking when tooth is well formed histologically and morphologically, properly arranged in the dental arch, has normal relation to the opposing tooth and adjacent tooth, it is considered a self-cleaning tooth.

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<td>2. Size and location of interproximal space</td>
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<td>3. Curvature of the cervical line</td>
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<td>4. Labial, buccal and lingual contours of the crown</td>
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| Indirect Characteristics                                  |
| 1. Crown root ratio                                       |
| 2. Cusp form                                              |
| 3. Angulation of the root in the dental arch              |

**Size and location of interproximal space**

**Curvature of the cervical line**

**Labial, buccal and lingual contours of the crown**

**The Mandible**

The mandible is the strongest bone of the facial skeleton. It is a U-shaped bone composed of a body and two rami. Figures 5-7 shows the anatomical landmarks of the outer and inner surface of the mandibular body and rami.

**Age changes of the mandible**

To study the changes which occur on the human mandible over age we divide the age periods into: at birth, after birth (childhood), adult period and old age.

**At birth**
- At birth the size of the mandible is very small and body is formed of two separate halves connected by fibrous tissues at the symphysis menti. (Fig. 10 A)
- The body of the mandible contains the developing deciduous teeth in their crypts.
- The mandibular canal runs near the lower border of the mandible.
- The mental foramen opens below the crypt of the lower deciduous first molar near the lower border.
The coronoid process is higher than the level of the condyle. The angle between the body and ramus is obtuse (about 170°).

**Childhood**
- The two halves become united at the symphysis from below upwards and become fully united at the end of the first year.
- The height of the body increase by bone deposition on the inferior border and beginning of development of the alveolar process.
- The mandibular canal runs above the level of the mylohyoid line.
- Mental foramen positioned on a higher level and below the deciduous first molar. (Fig. 10 B)
- The sigmoid notch become more deeper.
- The mandibular angle is reduced by the growth of the ramus and become 140°.

**Adult period**
- The mandible reaches maximum size by complete eruption of the permanent teeth and formation of the alveolar process.
- The mental protuberance is well developed to give the characteristic chin appearance.
- The mandibular canal runs nearly parallel to the mylohyoid line. (Fig. 10 C)
- The mental foramen opens midway between the upper and lower borders of the body of the mandible and between the apices of the lower first and second premolars.
- The condyle is at a higher level than the coronoid process.
- The sigmoid notch is much deeper.
- The angle of the mandible diminishes till it reaches 110°-130°.

**Old age**
- The mandible is reduced in size after loss of teeth and resorption of the alveolar process.
- The mandibular canal and the mental foramen are closer to the upper border of the body of the mandible. (Fig. 10 D)
- The condylar head is bent backward till it become at a lower level than the coronoid process. This is due to loss of teeth and the continuous trial of the individual to bring the upper and lower jaws near to each other during mastication.
- The sigmoid notch is shallower than in adult life.
- The angle of the mandible increase to 140° and the ramus assume an oblique direction.

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Fig. 65. The mandible: lateral view (upper), medial view (middle) and superior view (lower).
15. Mental protuberance, 16. Mental tubercle
17. Gnathion - the lowest medial point of jaw
20. Digastric fossa, 21. Mental spine
22. Mylohyoid line, 23. Mandibular torus
24. Sublingual fovea 25. Submandibular fovea
27. Alveolar bone 28. Dental alveoli
29. Intervalveolar septa 30. Interradicular septa
31. Alveolar juga - prominence on the external surface of bone caused by roots of the teeth.

Fig. 66. Morphological age changes of the mandible. At birth (upper), at childhood (next to upper), at adulthood (next to lower) and at old age (lower).
**Dento-Osseous Structures**

The osseous structures that support the teeth are the maxilla and the mandible. The maxilla consists of two bones, right and left maxillas sutured together at the midline. Both maxillas are joined to the base of the skull. The mandible, on the other hand, has no osseous union with the skull and is movable. (Fig. 11 and 12)

Each jaw, maxilla and mandible, is formed of alveolar process and basal bone. The alveolar process is that portion of the bone which surrounds the roots of the teeth and give them their osseous support.

The **alveoli (Teeth Sockets)**

These cavities are formed by the facial and lingual bony plates of the alveolar process and by connecting septa of bone placed between the two plates. The form and depth of each alveolus is regulated by the form and length of the root it supports.

**MAXILLARY ALVEOLI**

**Central incisor**
The periphery of the alveolus is regular and rounded and its interior is evenly cone shaped.

**Lateral incisor**
It is generally cone shaped but it is narrower mesiodistally than labiolingually. It is smaller in cross section but deeper than the alveolus of the central incisor. Sometimes it is curved distally at its upper end.

**Canine**
It is much larger and deeper than that of the incisors. The periphery is oval with the labial width greater than the lingual. The socket is flattened mesially and somewhat concave distally. The labial plate of bone is very thin over the canine eminence. Generally the facial cortical plate of bone over the anterior teeth is thin.

**First premolar**
The alveolus is kidney shaped with the cavity partially divided by a spine of bone which fits in the mesial developmental groove of the root.

If the root is bifurcated as is often the case, the terminal portion of the cavity is separated into buccal and lingual alveoli. The socket is flattened distally and wider buccolingually than mesiodistally.

**Second premolar**
It is also kidney shaped but the curvatures are the reverse of the first premolar alveolus. The septal spine is located at the distal side instead of the mesial. The tooth usually has one broad root with blunt end but occasionally bifurcated at the apical third.

**First molar**
There are three distinct alveoli widely separated. The lingual (palatal) one is the largest and is round, regular and deep. It extends palatally having a lingual plate over it which is very thin.

The mesiobuccal and distobuccal alveoli has no special characteristics except that the buccal plates are thin. The mesiobuccal alveolus is broad buccolingually with the mesial and distal walls flattened. The distobuccal alveolus on the other hand, is rounded and more conical.

**Second molar**
The alveoli are closer together as the roots of this tooth are not as divergent as those of the first molar.

**Third molar**
It is similar to that of second molar except that it is somewhat smaller in all dimensions. Usually the roots are fused. The inter-radicular septum changes accordingly, if the roots are fused a septal spine will appear in the alveolus at the point of fusion of the roots.
MANDIBULAR ALVEOLI

Central incisor
The periphery of the alveolus often dips down labially and linguually making an interdental spine out of the interdental septum separating the alveoli of the mandibular central incisors. The alveolus is flattened on its mesial surface and is somewhat concave distally to accommodate the developmental groove on the root.

Lateral incisor
Similar to that of central incisor with two variations; the socket is larger, deeper and its periphery does not dip down on the lingual but may dip more on the labial. (Fig 12)

Canine
It larger, oval and deeper to accommodate the root of the tooth. The mesial and distal walls are irregular to accommodate developmental grooves on the root. The lingual plate is stronger and much heavier than over the alveoli of the incisors, but the labial plate is thin.

First and second premolars
Are similar in outline, which is smooth and rounded although greater buccolingually than mesiodistally. The alveolus of the second premolar is larger than that of the first premolar. The buccal plate is relatively thin but the lingual is heavy.

First molar
The socket is divided by an interradicular septum which is thick and regular. The alveolus of the mesial root is kidney shaped, much wider buccolingually than mesiodistally and constricted in the center to accommodate the developmental grooves found mesially and distally on the mesial root. The alveolus of the distal root is evenly oval with no constriction, confirming to the rounded shape of the distal root.

Second molar
May be divided into two alveoli as that of the first molar or it may appear as one compartment near the periphery of the alveolus, but divides into two compartments in the deeper portion.

Third molar
Usually the socket of the third molar is irregular in outline. It is much narrower toward the distal than the mesial aspect. In addition it may have interradicular septa or septal spine to accommodate the irregularity of the root.

The Arrangement of Teeth

DENTAL ARCH FORM
The teeth are arranged in the maxilla and the mandible in such a way to produce a curved arch which may be a U-shaped, square or tapered.

Parabolic curve
The shape of the arch from the facial aspect of the teeth is described as being a parabolic curve. The curve is divided into three segments; anterior, middle and posterior.

- The anterior segment is presented by a curved line includes the anterior teeth and ending at the labial ridge of the canine.
- The middle segment is represented by a straight line including the distal portion of the canines, the premolars and the buccal ridge of the mesiobuccal cusp of the first molar.
- The posterior segment is represented by a straight line passing along the buccal cusps of the first, second and third molars.

The line describing the segments of the curve will overlap slightly at the canines and the first molar regions. This arrangement indicates that the canines and first molars serve as anchor supports for both upper and lower arches. The arc segments of upper and lower arches are not similar, they differ in three details:

- The anterior segment of the mandibular arch is smaller than that of the maxillary arch.
- The middle segment of the mandibular arch extends distally to the distobuccal cusp of the first molar, while the maxillary one ends at the mesiobuccal cusp of the first molar.
- The posterior segment of the upper arch may be inclined palatally instead of being parallel to the median plane.

These differences between upper and lower dental arches allows the following:
TOOTH MORPHOLOGY & PHYSIOLOGY

- Extension of the direction of the mandibular movement.
- Protection of the checks, lips and tongue from being clipped during closure of the teeth.
- Avoiding the clashing of the incisal edges and cusps of molars during function.

**Bonwill Triangle**
The mandible was described as being adapted to a 4 inch equilateral triangle. The angles of the triangle are placed at the centers of each of the condyles and at the mesial contact area of the mandibular incisors. In fact the measurement of 4 inches cannot be emphasized arbitrarily, but the Bonwill’s theory did emphasize bilateral symmetry of the mandibular arch.

**COMPENSATING CURVATURE OF THE DENTAL ARCHES**
The occlusal surfaces of dental arch do not follow a flat plane. The mandibular arch conforms generally to one or more curved planes which appear concave, while the opposing maxillary arch conforms to a curvature which appear convex. When the two arches are brought together in centric occlusion, this curved planes become identical.

**Curve of Spee**
This curve is seen within the sagittal plane when the upper and lower dental arches are observed from a point opposing to the first molars. The incisal ridges of the anterior teeth and the buccal cusps of the posterior teeth follow a curve that end at the anterior surface of the condyles.

**Curve of Wilson**
In the coronal plane, the occlusal surfaces of the posterior teeth conform to a curved plane. The crowns of the mandibular teeth must incline to the lingual, while the crowns of the maxillary teeth must incline toward the buccal to conform to the curve. The curve is deeper posteriorly so that the inclination of the molars is greater than the premolars. Because of this inclination the buccal cusps of the lower molars and the lingual cusps of the upper molars appear to be longer. The importance of this curve is to complement the paths of the mandibular condyle during movements.

**Sphere of Monson**
It is a three dimensional curvature of the occlusal plane, which is the combination of the curve of Spee and the curve of Wilson. The mandibular arch was originally described as adapting itself to a curved surface of a sphere 4 inches radius with the center of the sphere at the glabella. However, the arbitrary 4 inches measurement was refuted because the radius of the sphere varies considerably in different individuals. The mandibular teeth are the one that establish compensating curvatures, and the maxillary teeth have to adapt themselves to the mandibular teeth.

**COMPENSATING CURVATURE OF THE INDIVIDUAL TEETH - CURVED TOOTH AXIS**
The axis of the teeth are not at right angle to their occlusal surfaces, accordingly the force in occlusion do not act upon the tooth in straight lines. If this is not true the arches would not be stable very long because the forces brought to the tooth units would be tangent to their axes at any time the teeth of the two arches were separated. A resistant food bolus between the teeth will exert pressure unfavorable to stabilization of the teeth. In addition it is impossible to adapt teeth with straight axes to curved occlusal planes. Accordingly the long axes of the teeth are all curved. These axial curvature tend to be parallel with each other in centric occlusion and during jaw opening regardless the extent of the opening. Importance of curved tooth axis are listed in table V.

**Angulation of individual teeth in relation to various planes**
Each tooth is positioned in the dental arch with an angle that best withstand the forces applied to it during function. The axial inclination is also essential for proper occlusal and incisal function of teeth.

<table>
<thead>
<tr>
<th>Table XXVI. Importance of curved tooth axes.</th>
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<tr>
<td>Stabilize each tooth in its location in the dental arch</td>
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<tr>
<td>Enables teeth to withstand the occlusal forces to establish occlusal balance.</td>
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<tr>
<td>Allow mandibular teeth to strike maxillary teeth with mesial inclination of force thus promote the tendency of the molars to drift mesially with age.</td>
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**Facio-Lingual inclination**
Section through the jaws with the teeth in centric occlusion show the mesial aspect of each tooth in both arches reflect the facio-lingual inclination of the teeth as follows:
- The incisors are placed with their axes at about 60° to the horizontal plane. The axes of the maxillary incisors form an acute angle with the axes of mandibular incisors.
- The canines are placed with their axes forming less acute angles with the horizontal plane.
The maxillary premolars are placed with their roots slightly inclined lingual as well as the mandibular first premolar, while the mandibular second premolar the roots is inclined buccally. The maxillary molars display great lingual inclination of their roots, while the roots of the mandibular molars exhibit great buccal inclination. This provides parallelism of the maxillary and mandibular molars axes.

Prolongation of the line bisecting the lower first molar tends to pass between the buccal and lingual roots of the maxillary first molar.

Prolongation of the lines bisecting the mandibular second and third molars tend to bisect the lingual roots of maxillary second and third molars.

**Mesiodistal inclination**
The teeth also has mesiodistal axial inclinations in relation to horizontal and vertical planes. The degree of inclination is not great but it is readily seen that the long axes of the teeth is never at right angles to horizontal plane. From the labial and buccal aspect the axial inclination appear as follows:

- The maxillary anterior teeth are placed with their long axes making less than right angle with the horizontal plane with an average of 80°. This arrangement makes the crowns of the teeth point medially while their root point distally. (Fig. 20, upper)

- The mandibular incisors are nearly straight or with slight mesial root inclination, while the canines have slight distal inclination. (Fig. 20, lower)

- The premolars and molars either mandibular or maxillary exhibit moderate to great distal root inclination.

The functional importance of axial inclination of teeth are shown in table VI.

**FUNCTIONAL FORMS OF TEETH AT THEIR INCISAL AND OCCLUSAL THIRDS**
The incisal and occlusal thirds of the teeth crowns present convex or concave surfaces at all contacting occlusal areas, this includes cusps, ridges, fossa, sulci and embrasures. In other words there are no flat plans on the incisal and occlusal surfaces of any tooth unless they are created by wear or accident.

The elevation of crowns in the dental arch interlock with depressions of crowns of the opposing arch during centric occlusion. This is termed self-occluding design of tooth crown.

The lingual surface of the maxillary incisors present concave areas where convex portion of the mandibular incisors come into occlusal contact.

Cusps of the posterior teeth will contact the sides of the sulci that are formed by the convexities that point into the developmental grooves.

In centric occlusion the teeth seem to intercuspated closely, but escapement spaces are found between the occluding surfaces. These spaces are minute when the teeth are in maximum contact and become larger as the teeth come out of occlusion but preserve some degree of occlusal contact.

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<td><strong>Facio-Lingual inclination</strong></td>
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<tr>
<td>☀ Protection of soft tissues by avoiding their biting</td>
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<tr>
<td>☀ Adequate physiologic space for tongue movement during function</td>
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<tr>
<td>☀ Proper occlusal and incisal function</td>
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**The mesiodistal inclination**

- favor the stabilization of the contact relationship of the teeth.
Occlusion

Occlusion is the term used to describe the contact of teeth in opposing dental arches when the jaws are closed "Static Occlusal relation" and during various jaw movements "Dynamic Occlusal Relationship". During jaw movements the two mandibular condyles under go the following possible movements:

- Bilateral symmetrical movements
- Opening and closing (elevation and depression of the mandible)
- Forward movements (protrusion of the mandible)
- Backward movement (retrusion of the mandible)

Bilateral asymmetrical movements:
- Right and left lateral movement where one condyle acts a a bivot while the other moves.

Occlusion is also defined as that situation created when the mandibular teeth come in contact with maxillary teeth in functional relations. There are groups of functional relations presented by the mandibular movements. These are centric occlusion, protrusive occlusion, retractive occlusion and lateral occlusal relation. However, an ideal occlusion should fulfill the following criteria:

1. Evenly distribute the masticatory force over the teeth in both arches during function.
2. Helps to bring symmetry of facial bones, muscles and good appearance.
3. Promote good pronunciation of letters during speech.

Development of occlusion

Occlusion develops in childhood as the primary teeth erupt. At this time oral motor behavior develops and masticatory skills are acquired.

Occlusal of the erupting permanent teeth is then dependant on that of the primary teeth as they are being shed. Improper occlusion leads to undue occlusal stresses placed on teeth resulting in occlusal disharmony which eventually leads to changes in the periodontium and weakening of the masticatory apparatus.

Interrelated factors are involved in the development of occlusion. These are:

- Dental arch form and alignment of teeth.
- The associated musculature.
- The neuromuscular pattern developed with mastication.
- The development and function of the temporomandibular joint.

Classification of Occlusion

Ideal tooth relationships were described in the early 1900s by Edward H. Angle. In centric occlusion there are three relationship that can exist between the arches. He classified ideal occlusion as class I centric occlusion and defined it based on the relationship between the maxillary and mandibular permanent first molars.

A. Class I occlusal relation (normal relation)

The permanent maxillary first molar is slightly posterior to the permanent mandibular first molar. The mesiobuccal cusp of maxillary first molar is directly in line with the mesiobuccal groove of the mandibular first molar.

B. Class II occlusion relation

The buccal groove of the mandibular first molar is posterior to the mesiobuccal cusp of the maxillary first molar.

C. Class III occlusion relation

The buccal groove of the mandibular first molar is more anterior than normal to the mesiobuccal cusp of the maxillary first molar.

Key of occlusion

The key to the intercuspal relationship of the teeth in the centric occlusal position is described as the relative position of the maxillary and mandibular first permanent molars. The permanent first molars are considered the key for occlusion for the following causes:

- They are the first penanent teeth to develop and erupt in the oral cavity.
- They are guided during eruption by the presence of the second deciduous molars.
- They are the largest teeth in the dental arch.
- Their eruption is not disturbed since they have no deciduous predecessors.
- The maxillary first molars are preferred, as the erupt in the maxilla which is fixed to the skull.

I. CENTRIC OCCLUSION

Centric occlusion is defined as the relation of the upper and lower teeth when they are in maximum intercuspatation. The central occlusion position is the start and the terminal position of all physiologic mandibular movements. In class I centric occlusion teeth in the opposing arches show different relationships.

Opposing teeth

Each tooth in the dental arch occludes with two teeth in the opposing arch, except the mandibular central incisor and maxillary third molar (Fig. 24). These serve to:

- Equalize the forces of contact in occlusion, thereby distributing the work.
- It preserves the integrity of the dental arch in case of loosing a tooth, since the second antagonist prevents the elongation and displacement of the opposing tooth.

Vertical alignment of teeth

The longitudinal axis of each maxillary tooth is slightly distal to the corresponding mandibular tooth so that:

- The tip of the mesiobuccal cusp of the maxillary first molar is aligned directly over the mesiobuccal groove of the mandibular first molar i.e. the key factor in definition of class I occlusion.
- The distal surface of maxillary first molar is posterior to that of the mandibular first molar.

Relationship of anterior teeth

The maxillary anterior teeth overlap the mandibular anterior teeth both horizontal and vertical. (Fig. 25)
the incisors: following describe the contact relation of the lower ones in contact occlusion. The upper incisors have a labial relation to lateral incisors are free of contact. All the The incisal ridge of the upper central and Incisors

A. Anterior Teeth

occlusion.

Figures 81 to 82 demonstrate the contact relationship of permanent teeth in centric occlusion. (right)

B. Premolars

Upper first premolar

• The buccal cusp is free of contact and is located in the buccal embrasure between the lower second and first premolars.

• The lingual cusp is in contact with the distal triangular fossa of the lower second premolar. In three cusp type lower second premolar it contacts the distal slope of the distolinguinal cusp.

• The mesial outline lies directly above the buccal cusp of the lower second premolar.

• The distal outline is above the mesiobuccal cusp of the lower first molar.

• The lingual cusp is short and free of contact and lies below the lingual embrasure between the upper canine and first premolar.

Lower second premolar

• The buccal cusp is mainly below the occlusal embrasure of the upper first and second premolars. It contacts the mesial marginal ridge of the upper second premolar.

• The lingual cusp is free of contact and lies in the lingual embrasure of the two upper premolars.

• In the three-cusp type, the mesiolingual cusp is free of contact, and the distal slope of the distolinguinal cusp strikes the lingual cusp of the upper second premolars.

Fig. 81. Class I centric occlusal relationship of upper and lower teeth.

Fig. 82. Horizontal (black arrow) and vertical (white arrow) overlap (left) and Mesial view of upper and lower first molars with maximum intercuspation during centric occlusion. (right)
C. Molars
The maxillary molars bear a distobuccal relation to the mandibular molars, their mesiodistal dimensions are smaller, while their buccolingual dimensions are greater than lower molars.

The occlusal slopes of the buccal cusps of maxillary teeth contact the occlusal third of the buccal cusps of the lower teeth.

Upper first molar
- The mesiobuccal cusp rests on the mesiobuccal sulcus of the lower first molar.
- The distobuccal cusp rests in the embrasure of the lower first and second molars.
- The mesiolingual cusp lies in the central fossa of the lower first molar.
- The distolingual cusp contacts the mesial marginal ridge of the lower second molar.

Upper second molar
- The mesiobuccal cusp rests in the buccal sulcus of lower second molar.
- The distolingual cusp lies in the embrasure of the lower second and third molar.
- The mesiolingual cusp rests in the central fossa of the lower second molar.
- The distolingual cusp strikes the distal cusp ridge of the distolingual cusp of the lower second molar.

Upper third molar
- The triangular ridge of the mesiobuccal cusp rest in the buccal sulcus of the lower third molar.
- The distobuccal cusp may be free, or contacts through its triangular ridge the lower third molar on the distal slope of its distobuccal cusp.
- The mesiolingual cusp rests in the central fossa of he lower third molar.
- If it has a distolingual cusp, it strikes the lower third molar on its distal marginal ridge.
- Its distal outline is in the same line with the distal outline of the lower third molar.

Lower first molar
- The mesiobuccal cusp contacts the distal marginal ridge of the upper second premolar and the mesial marginal ridge of the upper first molar.
- The distobuccal cusp rests in the central fossa buccal to the central pit of the upper first molar.
- The distal cusp rests in the distal triangular fossa of the upper first molar.
- The mesiolingual cusp is free of contact and is located in the lingual embrasure between the upper second premolar and the first molar.
- The distolingual cusp is free and is located immediately lingual to the lingual developmental groove of the upper first molar.

Lower second molar
- The mesiobuccal cusp contacts the marginal ridge of the upper first and second molars.
- The distobuccal cusp is centered in the central fossa of the upper second molar.
- The mesiolingual cusp is free of contact and is located in the lingual embrasure of the upper first and second molars.
- The distolingual cusp is free of contact and is located just lingual to the lingual groove of the upper second molar.

Lower third molar
- The mesiobuccal cusp contacts the mesial triangular fossa of the upper third molar.
- The distobuccal cusp rests in the central fossa of the upper third molar slightly distal to the central pit.
- The mesiolingual cusp is free of contact and is located in the lingual embrasure of the upper second and third molars.
- The distolingual cusp is free of contact and is located just lingual to the lingual groove of the upper second molar.

Centric occlusal relation of the deciduous teeth
The normal occlusion of the deciduous teeth is established at the age of three years as follows:
- The mesial outline of the upper and lower central incisors are in line with each other at the midline.
- The upper central incisors have a labial position to the lower incisors which strike the upper teeth lingually above the level of the incisal ridge.
The upper central incisor occludes with the lower central incisor and the mesial third of the lower lateral incisor.

The upper lateral incisor occludes with the distal two-thirds of the lower lateral incisor and the portion of the lower canine which is mesial to the tip of its cusp.

The upper canine occludes with the portion of the lower canine distal to the cusp tip and the portion mesial to the tip of the mesiobuccal cusp of the lower first molar (about one third of the molar).

The upper first molar occludes with the distal two-thirds of the lower first molar and the mesial portion of the lower second molar represented by the mesial marginal ridge and the mesial triangular fossa.

The upper second molar occludes with the remainder of the lower second molar. The distal surface of the upper molar projects slightly over the distal portion of the lower second molar (distal step).

II. PROTRUSIVE OCCLUSAL RELATION
When the mandible moves from centric occlusion, the only teeth that should touch are the anterior. The mandibular four incisors should glide across the maxillary four incisors. The canines may touch slightly. No posterior teeth should come in contact during the protrusive movement.

Occlusal cycle of the anterior teeth
This cycle occurs during the protrusive movement in the following steps:

Starting from centric occlusion position, the mandible moves downward to free the cusps.

The mandible moves forward for biting by the anterior teeth, while the balancing side at the posterior teeth.

Then the mandible moves backward and upward to centric occlusion.

This alternating protrusion to working and back to centric is called “Occlusal cycle of anterior teeth”.

III. RETRUSIVE OCCLUSAL RELATION
The mandibular teeth show posterior relation to centric occlusion with the maxillary arch. Actually retrusion is very limited and not performed during mastication. It is a reference mandibular movement used by dentists.

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IV. LATERAL OCCLUSAL RELATION
In lateral occlusal relation, the mandible moves toward the right or left side until the canines on that side are in cusp to cusp relationship.

The side to which the mandible moves is referred to as the working side while the other side is referred to as the non-working side. On artificial teeth this non-working side is referred to as the balancing side.

Occlusal cycle of posterior teeth
This cycle occurs during the lateral movement of the mandible which starts from the centric occlusion and ends also in centric occlusion as follows:

1. From centric occlusion the mandible moves downward to free the cusps.
2. The mandible moves to lateral side, e.g. right side. This is the working side while the left side is the non-working side.
3. In the working side the buccal cusps of the maxillary and mandibular teeth are in contact.
4. In the non-working side, the lingual cusps of the maxillary teeth come in contact with the buccal cusps of the mandibular teeth.
5. Then the mandible moves back to centric occlusion.

Forms of malocclusion
There are three common forms of malocclusion which are crowding, anterior open bite and cross bite.

Crowding of teeth
Crowding is the term used to describe the condition where the teeth are markedly out of the line of the dental arch. Usually this condition is due to disproportion between the size of the arch and the size of the teeth.

Anterior open bite
This condition occurs when there is no incisors contact and no incisor overbite. It may be caused by thumb sucking habit, abnormal swallowing pattern or skeletal abnormalities.

Cross bite
This is a transverse abnormality of the dental arches where there is an asymmetrical bite. The condition may be unilateral or bilateral. The condition is usually related to discrepancies in width of the dental bases and may involve displacement of the mandible to one side to obtain maximum intercuspation. In this condition the mandibular teeth have facial relation to maxillary teeth. There are two main forms of cross bite:

1. Anterior cross bite which is usually associated with class III occlusal relation, or it may be due to improper faciolingual inclination of the whole segment of an individual tooth.
2. Posterior cross bite which is usually related to discrepancies in width of the dental base and may involve displacement of the mandible to one side. This condition can be unilateral or bilateral.