

Le.1

4th class

Introduction to Orthodontics

Definition of orthodontics:

Orthodontics is the branch of dentistry concerned with facial growth, development of the dentition and occlusion; diagnosis, interception and treatment of occlusal anomalies.

'Ortho' means correction of irregularity and 'dontics' means teeth, so "orthodontics means correcting irregularities of teeth.

Occlusion: Any position or relationship in which the upper and the lower teeth come together.

There are three types of occlusion:

1. **Ideal occlusion:** is a theoretical concept of an ideal arrangement of the teeth within the dental arches, combined with an ideal inter-arch relationship, which concentrate optimal esthetic, function and stability of the supporting structures, but it is almost never found in nature. However, it provides a standard by which other occlusions can be judged.
2. **Normal occlusion:** that occlusion, which satisfies the requirement of esthetic and function, but in which there are minor irregularities of individual teeth.
3. **Malocclusion:** is an irregularity in the occlusion beyond the accepted range of normal.

However, there is a wide range of variation between individuals and races. The fact that an individual has a malocclusion is not itself a justification for treatment. Only if it is certain that the patient will benefit,

esthetically or functionally, and only if he is suitable and willing to undergo treatment should orthodontic intervention be considered.

Andrews six key of normal occlusion:

1 Molar relationship: Class I molar relationship.

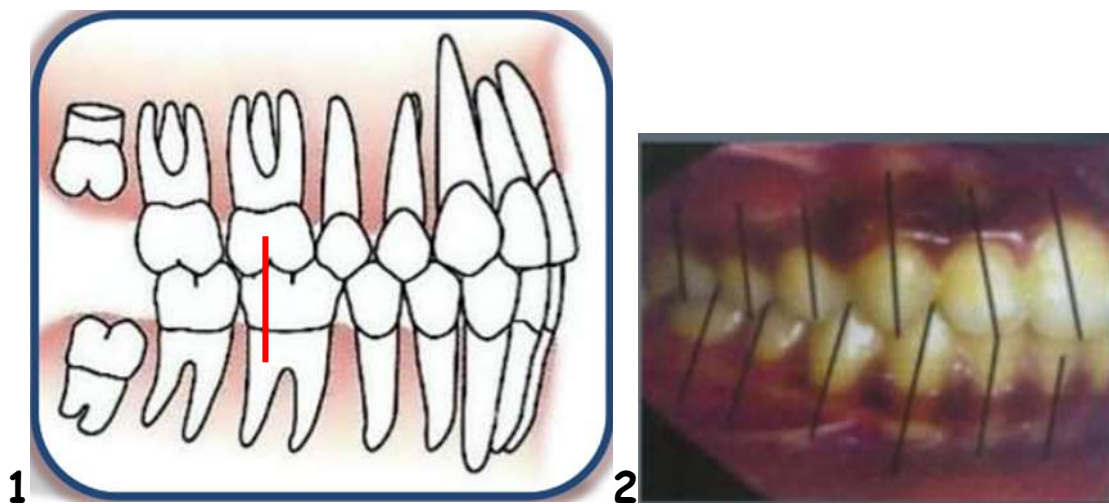
2 Crown angulation or mesio-distal tip: the gingival portion of the long axis of each tooth crown is distal to the occlusal portion of that axis. The degree of tip varies with each tooth type.

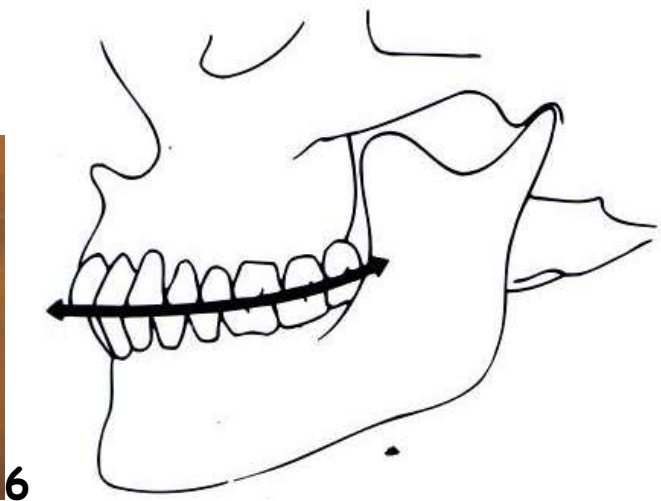
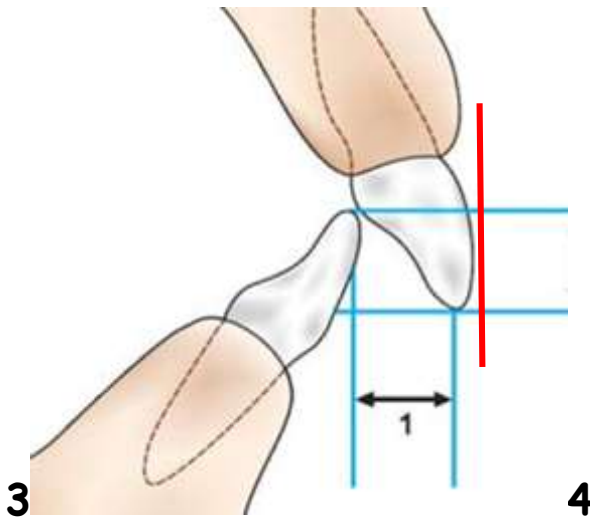
3 Crown inclination: for the upper incisor teeth the occlusal portion of the crown labial surfaces labial to the gingival portion. In all other crowns, the occlusal portion of the labial or buccal surface is lingual to the gingival portion.

4 Rotation: An absence of rotation of individual teeth.

5 Spacing: There should be absence of any spacing within the dental arches.

6 Occlusal plane: A flat or only slightly curved occlusal plane.





The aims of orthodontic treatment:

Improve the following:

1. **Dental health**

a-Dental caries: Malalignment of the teeth may reduce the potential for natural teeth-cleansing and increase the risk of decay.

b-Periodontal disease: Irregular teeth reduce effective brushing, in addition to that, crowding may force one or more teeth to be squeezed buccally or lingually out of their investing bone reducing the periodontal support (anterior cross bite).



c-Trauma to anterior teeth: Researches have shown that overjet more than 3mm had more than double the risk of traumatic injury.



d-Impacted teeth: unerupted teeth may effect normal position and health of adjacent teeth in addition to the loss of function of the impacted tooth itself.

2. **Function:**

a-masticatory function patient with open bite, markedly increased overjet (CII) or reversed over jet (CIII) often complain difficulties with eating, particularly incising the food.



b-Speech: crowding may has little effect on normal speech.

c-TMJ: elimination of premature contacts which give rise to mandibular displacements and may cause later muscle or joint pain.



3. **Esthetic**: orthodontic treatment should increase the overall esthetic appearance.

Risk of orthodontic treatment:

1-Root resorption: excessive orthodontic force may lead to un-accepted amount of root resorption and hence devitalization of affected tooth or teeth.

2- Pulpal injury: Excessive orthodontic force may lead to pulpal injury and death, especially for the teeth with a history of trauma.

3-Demineralization: may occur during fixed orthodontic treatment as a result of plaque accumulation in case of uncooperative patient.

4-Soft tissue damage: traumatic ulceration may occur, especially in fixed orthodontic treatment.

5- Loss of periodontal support: caused by poor oral hygiene during orthodontic treatment.

Definitions of common orthodontic's terms

Overjet: It is the horizontal distance between the upper and lower incisors in occlusion, measured at the tip of the upper incisor (Fig.1)

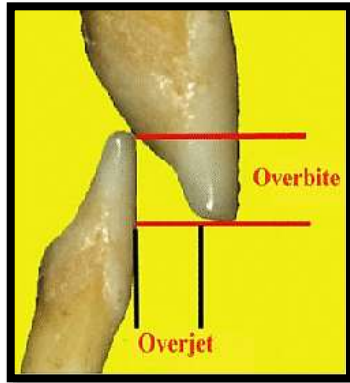


Figure: 1



It is of four types:

1. Excessive overjet: it is increased overjet being more than 4mm (Fig.2)
2. Normal overjet: it is 2-4mm(Fig.3 a).
3. Edge to edge occlusion: it is occlusion of the upper and lower incisal edges, with 0mm overjet(Fig.3 b).
4. Reversed overjet: it is decreased overjet being less than 0mm. (Fig.3c)

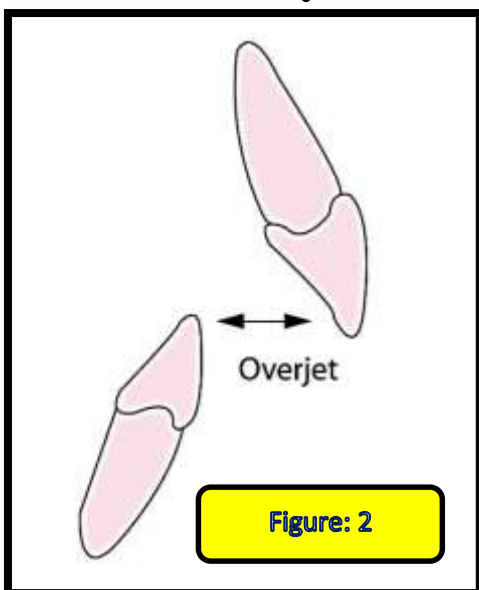


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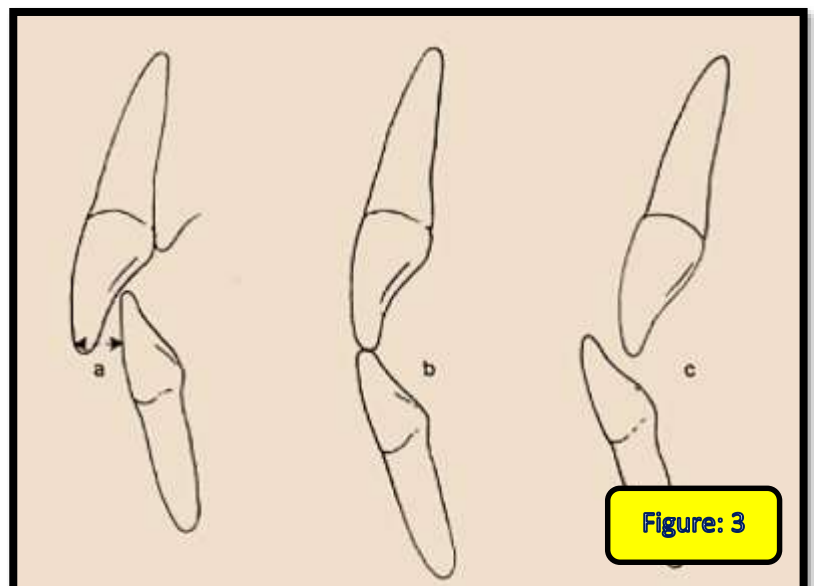
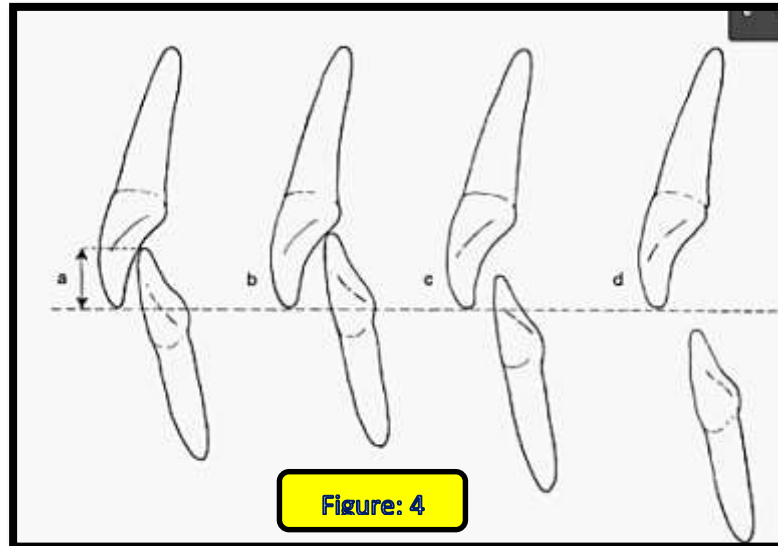


Figure: 3

Overbite: It is the vertical distance between the tips of the upper and lower incisors in occlusion (fig. 1). It is of four general types:



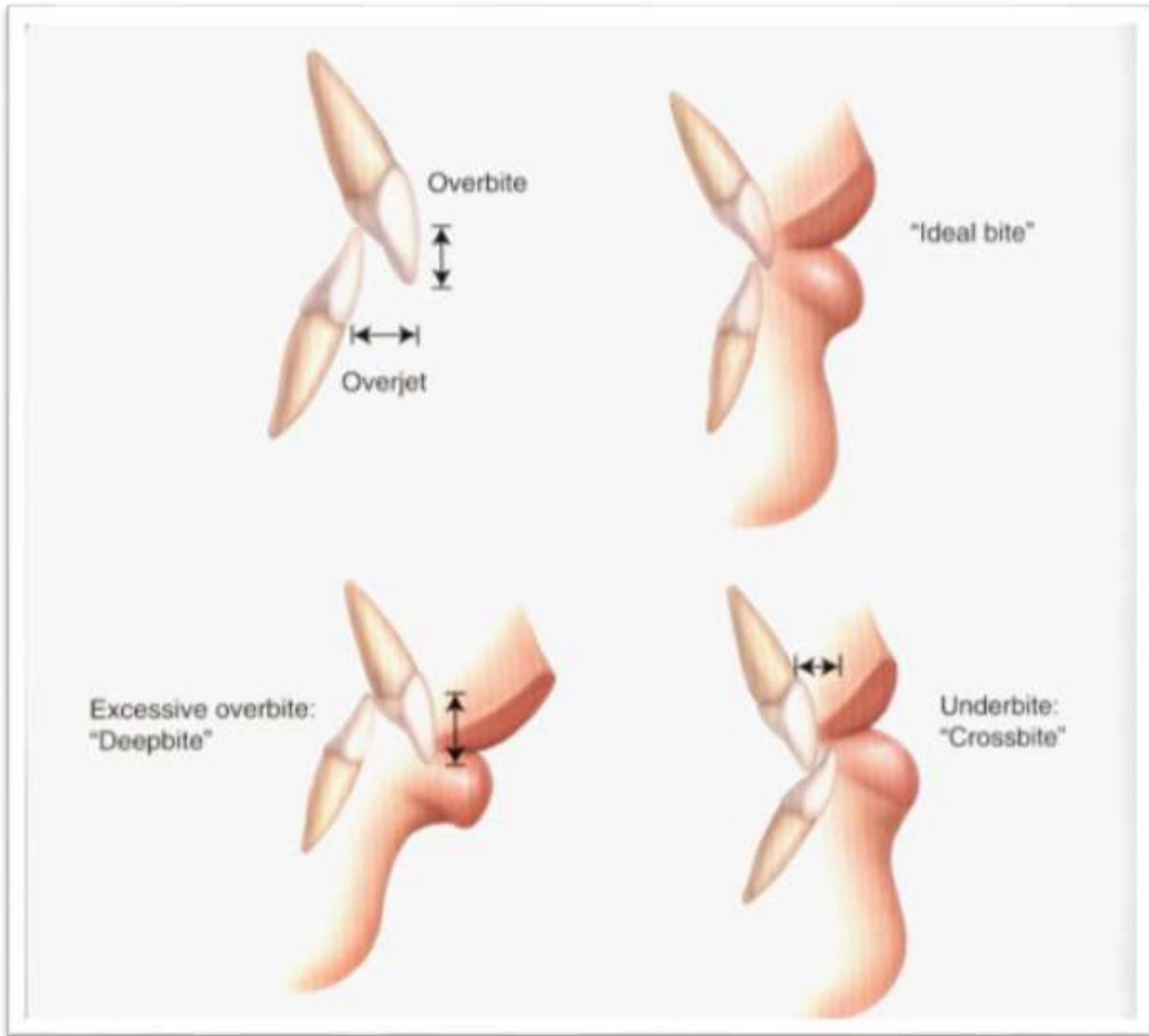
1. **Normal overbite**: it is 1-3mm (Fig.4 a).
2. **Anterior open bite**: it is decreased overbite with absence of overlap between opposing incisors being less than 0mm (4-d).
3. **Edge to edge occlusion**: it is occlusion of the upper and lower incisal edges with 0mm overjet (Fig.3 b).
4. **Deep overbite**: it is increased overbite being more than 3mm. It may be
 - A. **Incomplete overbite**: when the overbite more than 3mm and the lower incisal edge does not touch any opposing tissue.



B. **Complete overbite:** it's more than 3mm , but when the lower incisal edge occludes with the palatal soft tissue or the palatal aspects of the opposing upper incisors, it's either:

1. **Traumatic:** when the upper incisors are proclined and the lower incisors cause trauma of the palatal soft tissue (especially the incisive area)
2. **Bitraumatic:** when the upper incisors are retroclined and the lower incisors cause trauma of the palatal soft tissue and the upper incisors cause trauma of the lower labial soft tissue.





Cross bite:

It is a discrepancy in the buccolingual or labiolingual relationship of the upper and lower teeth which could involve single tooth or segmental crossbite which involve more than one tooth. Its generally of two types according to their location in the arch:

1- **Anterior crossbite:** involve one or more incisor or canine **may** be associated with displacement of the mandible (functional cross bite).

2- **Posterior crossbite:** involve one or more premolar or molar, its of two types named according **to the position of the mandibular teeth.**

a-Buccal cross bite: In which the buccal cusp of a mandibular tooth lies buccal to the maximum height of the buccal cusp of an opposing maxillary tooth.

b-Lingual cross bite(sissor bite): In which the buccal cusp of the mandibular tooth lies lingual to the maximum height of the lingual cusp of an opposing maxillary tooth.

According to the side:

The crossbite may be bilateral crossbite or unilateral, The unilateral cross bite either true or false:

True unilateral cross bite: due to unilateral maxillary arch constriction.

False unilateral posterior cross bite: associated with lateral mandibular displacement to the right or left during closure

from the rest position to the maximum interdigitation, usually noticed by mid line shift in the direction of mandibular displacement.

Space discrepancy: It is the difference between the space needed in dental arch and the available space in that arch and is either crowding or spacing caused by an altered tooth / tissue ratio.

Space discrepancy (crowding or spacing) may be mild, moderate or severe. It may be localized to the anterior or posterior region or may affect the entire arch.

Crowding: is the lack of space in the dental arch associated with rotation or displacement of teeth.

Spacing: is the presence of extra space in the dental arch associated with spaces between the teeth, and if present in the midline called 'a median Diastema'.

Midline shift:It is the lack of coincidence between the lower and upper dental midline. A midline shift of 0.5mm may be considered as normal.

Proclination: labial inclination or tipping of the anterior teeth.

Retroclination: lingual inclination or tipping of anterior teeth.

Displacement: Abnormal position of the tooth(crown and root)in the dental arch.

Rotation:Type of malocclusion involve movement of the tooth around its long axis. Its of to types:

1-mild (less than 90): Can be treated easily by removable orthodontic appliance using couple force system.

2-Sever (more than 90): must be treated by fixed orthodontic appliance only

Transposition: Switching in the position of nighboring teeth, usually a canine and the nighboring incisor or premolar.

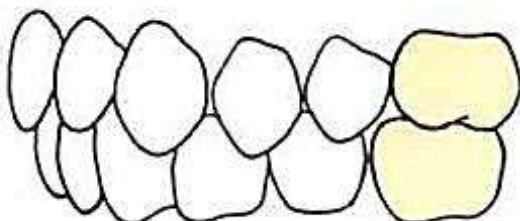
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Classification of malocclusion (Angle's classification)

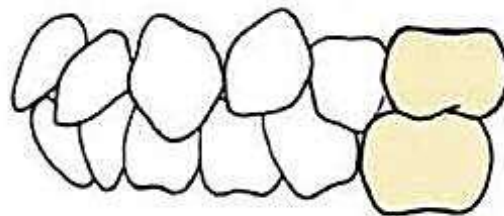
There are several types of classifications of malocclusion:

1-Molar Classification:

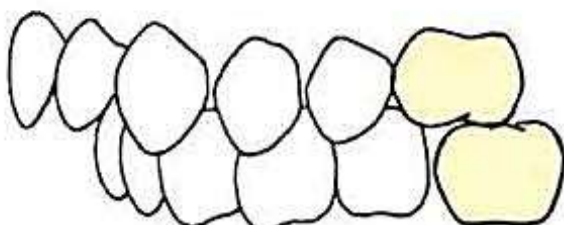
1. Class I relation: the mesiobuccal cusp of the maxillary first permanent molar occludes with the mesiobuccal developmental groove of the mandibular first permanent molar.
2. Class II relation: the tip of the mesiobuccal cusp of the maxillary first permanent molar lies, at least half a cusp anterior to the mesiobuccal developmental groove of the mandibular first permanent molar.
3. Class III relation: the tip of the mesiobuccal cusp of the maxillary first permanent molar lie at least half a cusp posterior to the mesiobuccal developmental groove of the mandibular first permanent molar.



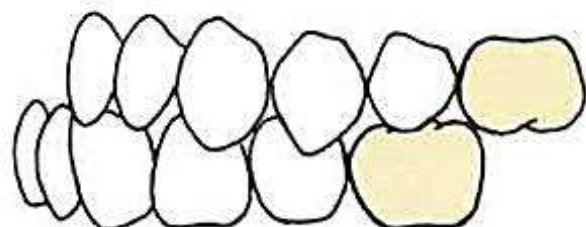
Normal occlusion



Class I malocclusion



Class II malocclusion



Class III malocclusion

2-Canine classification

Class I relation: The cusp tip of maxillary permanent canine occludes with the embrasure between the mandibular permanent first premolar and canine.



Class II relation:

The cusp tip of maxillary permanent canine lie at least half cusp anterior to the embrasure between the mandibular permanent canine and first premolar.



Class III relation:

The cusp tip of maxillary permanent canine lie at least half a cusp posterior to the embrasure between the mandibular permanent first premolar and canine.

3-Incisor classification

Class I relation: The lower incisors touch with or lie immediately below the cingulum platur (middle part of palatal surface) of maxillary incisors.

Class II relation: The mandibular incisor edge lies posterior to the cingulum platur of the maxillary incisors. There are two divisions:

Class II division I: There is an increase in the over jet with proclination of the maxillary incisors.

Class II division II: The maxillary incisors are retroclined, the overjet usually minimal, but may be increased.



Class III Relation: The mandibular incisors edges lie anterior to the cingulum platur of the maxillary incisors. The overjet reduced or reversed.



Classification of malocclusion (Angle's classification):

***Class I occlusion:** Normal anteroposterior relationship of the maxillary and mandibular dental arches.

***Class I malocclusion (neurooclussion):** Normal CI molar relationship, but with malocclusion like crowded, spaced or rotated teeth.

***Class II malocclusion (distocclusion):** The mandibular arch being retruded in relation to the maxillary dental arch. This was either:

Division 1: with proclined maxillary central incisors and increased overjet.

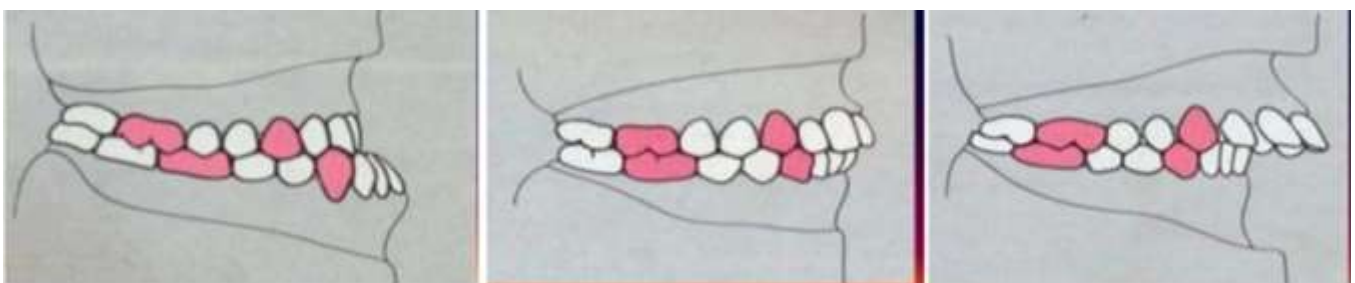
Division 2: with retroclined maxillary central incisors and normal overjet.

***Class III occlusion (mesioclussion):**

The mandibular arch being protruded in relation to the maxillary dental arch. This was either:

Postural: associated with forward mandibular displacement, or

True: not associated with forward mandibular displacement



Class III malocclusion

Class I malocclusion

Class II malocclusion

Important Notes

1-Angle used Roman numerals I, II, III to designate the main classes and Arabic numerals 1,2 denote the divisions of the classification

2-when talking about the angle's classification we talk about the first permanent molar relation (some time this relation not symmetrical on both sides).

3-Subdivisions (left or right) used for unilateral deviation, it indicates the side that deviate from a Class I molar relationship, e.g. Class III malocclusion subdivision left, mean that the left side is class III malocclusion while the right side is class I.

4-When there's missing first permanent molar so we shift to another classification, which is the canine classification. If there's no canine, impacted canine or severely malposed canine, we shift to another classification which is the incisor classification.

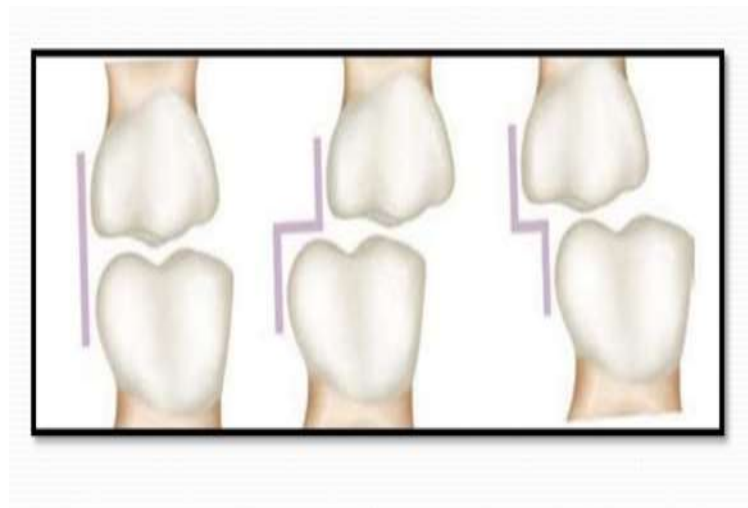
Primary and mixed dentition relationship (Terminal plane relationship);

In the primary and early mixed dentition the occlusal relationship is different than those in the permanent dentition include:

1- Flush terminal plane relationship: which is the normal relationship with the distal surfaces of the upper and lower second primary molars at the same plane.

2- Distal step relationship: in which the mandible is relatively posterior to the maxilla and the distal surface of the lower primary second molar is distal to that of the upper primary second molar.

3- Mesial step relationship: in which the mandible is relatively anterior to the maxilla and the distal surface of the lower primary second molar is mesial to that of the upper primary second molar.



Le.5

Etiology of malocclusion

The final form of the occlusion and position of the teeth exhibits a wide range of variation. The main factors responsible for producing this variation can be divided into two groups, the first group containing major factors which have a general effect on the occlusion and which play a part in the development of every occlusion, and the second group containing more localized factors, which do not appear in everyone, but which nevertheless may be the main factor in producing a malocclusion in an individual. The factors can be grouped as follows:

1. General factors affecting the occlusal development

- a. *Skeletal factors*: The size, shape and relative positions of the upper and lower jaws.
- b. *Muscle factors*: The form and function of the muscles which surround the teeth, i.e. the muscles of the lips, cheeks and tongue.
- c. *Dental factors*: The size of the dentition in relation to the size of the jaws.

2. Local factors affecting the occlusal development

- a. Anomalies of teeth' number
- b. Supernumerary teeth

- c. Missing teeth (congenital absence or loss due to accidents, caries, etc.).
- d. Anomalies of tooth size
- e. Anomalies of tooth shape
- f. Abnormal labial frenum
- g. Premature loss of teeth
- h. Prolonged retention of primary teeth
- i. Delayed eruption of permanent teeth
- j. Abnormal eruptive path
- k. Ankylosis
- l. Dental caries
- m. Improper dental restorations.

The general factors will always be present, producing ideal occlusion or some occlusal variation and usually the three major factors are interrelated. Thus the muscles are attached to the jaws, and variation in jaw position may produce variation in muscle action. The local factors may be present in isolation or in combination, and may be superimposed on the adverse effect of one or more of the general factors, adding further complications to the occlusion of the teeth.

Skeletal factors affecting occlusal development

Any pathological condition affecting growth of the jaws is likely to have a marked effect on the occlusion of the teeth. Inherited and

acquired congenital malformation, trauma or infection during the growing years can all affect jaw growth(fig.1,2)

(fig.1) Mandibulofacial dysostosis is an autosomal dominant inherited syndrome consisting of micrognathia, and hypoplastic zygomatic arches and others.



(fig. 2) A 10-year-old girl. The 3D image demonstrates hypoplastic zygomas with downward sloping orbits and atresia of the external auditory canals.

The mandible is also hypoplastic with a concave inferior border.



As the teeth are set in the jaws, the relationship of the jaws to each other will have a large influence on the relationship of the dental arches. Jaw relationship can be considered in three headings:

1. Jaws in relation to the cranial base.
2. Jaws in relation to each other.
3. Alveolar bone in relation to basal bone.

1. Jaws in relation to cranial base

The jaws are part of the total structure of the head, and it is possible for each jaw to vary in its positional relationship to other structures of the head. Such variation can exist in all three planes, sagittal, lateral and vertical, but is usually greatest in the sagittal and vertical planes. It is usual in orthodontic diagnosis to relate the jaw positions to the anterior cranial base, and each jaw can vary independently in its relationship to the cranial base.

2. Jaws in relation to each other

The relationship of the jaws to each other can also vary in all three planes of space, and variation in any plane can affect the occlusion of the teeth. The *anterio-posterior* positional relationship of the basal parts of the upper and lower jaws to each other, with the teeth in occlusion, is known as the *skeletal relationship* or the skeletal pattern. A classification of the skeletal relationship is in common use, namely:

1. Skeletal Class I: in which the jaws are in their ideal antero-posterior relationship in occlusion. Fig 3.A
2. Skeletal Class II: in which the lower jaw in occlusion is positioned further back in relation to the upper jaw than in skeletal Class I. Fig.3.B
3. Skeletal Class 3—in which the lower jaw in occlusion is positioned further forward than in skeletal Class I. Fig 3.C

There is, of course, a range of severity of skeletal Class II and Class III.

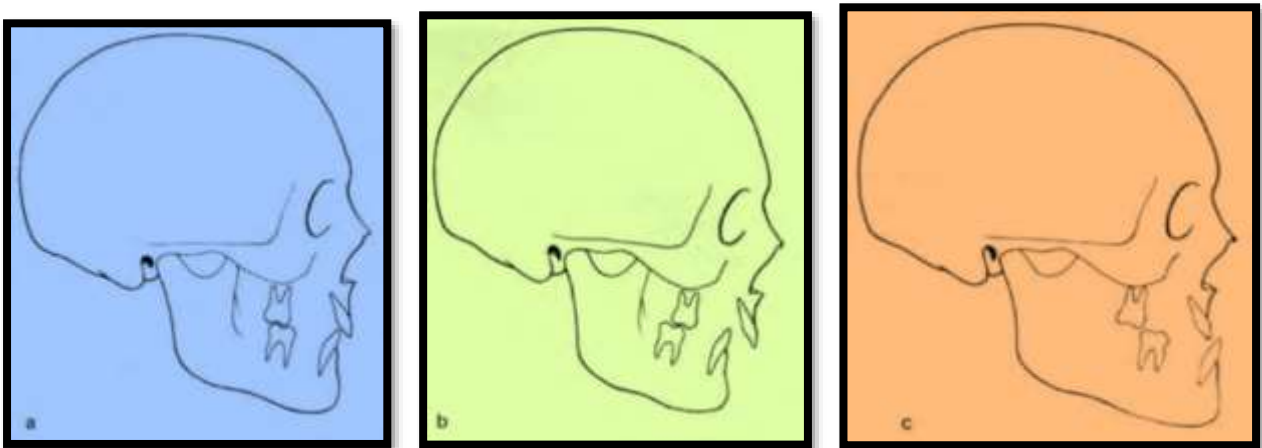


Figure 3 a, b and c

Variation in the skeletal relationship can be brought about by:

1. Variation in size of the jaws.
2. Variation in position of the jaws in relation to the cranial base.

Thus, if one jaw is excessively small or large in relation to the other in antero-posterior dimension the development of skeletal

Class II or Class III relationship may result (Fig. 4). Furthermore, if one jaw is set further back or further forward than the other in relation to the cranial base, again a skeletal Class II or Class III relationship may result. The relative sizes of the jaws in lateral dimension also have an effect on the occlusion of the teeth.

Ideally the jaws match in size, so that the occlusion of the buccal teeth in transverse relation is correct. Occasionally, one jaw is wider than the other to such extent that the occlusion of the teeth is affected, giving a buccal cross bite if the lower jaw is wider (Fig.5 A & B), or lingual cross bite if the lower teeth occlude lingual to the upper teeth (Fig. 6).

The vertical relationship of the upper and lower jaws also affects the occlusion. The effect is most clearly seen with variation in the shape of the lower jaw at the gonial angle. The mandible with a high gonial angle tends to produce a longer vertical dimension of the face and in severe cases an anterior open bite. Conversely, the mandible with a low gonial angle tends to produce a shorter vertical dimension of the face.

Fig. 4. Variation in the size of either jaw can affect the skeletal relationship. Skeletal Class 3 resulting from a small upper jaw or from a large lower jaw.

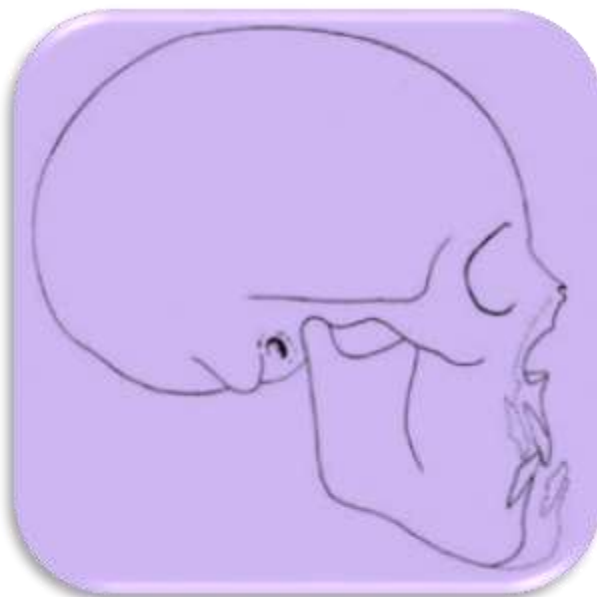


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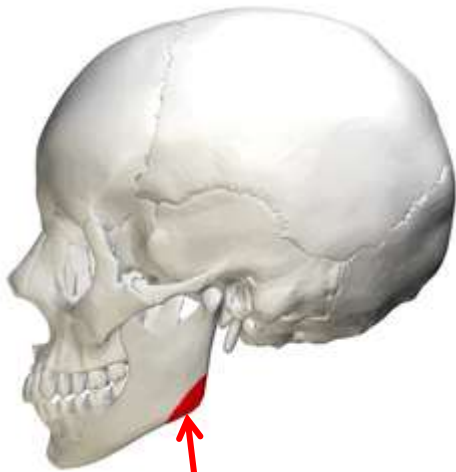
A. Unilateral Buccal crossbite

B. Bilateral Buccal crossbite



Figure 6

Sissor (lingual) crossbite



Gonial angle



Mandible with a high gonial angle

3. Alveolar bone in relation to basal bone

1. The term 'skeletal relationship' refers to the basal bone of the jaws. Although the alveolar bone is supported by the basal bone, the relationship between the upper and lower alveolar bones is not necessarily the same as that between the upper and lower basal bones.
2. The alveolar bone supports the teeth, and will therefore match tooth position rather than basal bone position. Nevertheless, the basal bone provides the base, and the alveolar bone relationships, and the tooth relationships, can only differ from the basal relationships within a limited range. This is a very important factor in orthodontic treatment.
3. The reason for the possibility of difference between alveolar and basal relationships is that tooth position is not governed entirely by jaw position. The teeth, during eruption, to be tilted away from their correct inclinations. Alveolar bone grows to support the tilted teeth, and therefore may be slightly different in position from the basal bone. However, the teeth cannot be moved completely away from the basal bone during eruption. Therefore, it is the basal bone relationships which are most important in occlusal development.