Lec 1

Orthodontics: Is that branch of dentistry concerned with facial growth; development of the dentitions and occlusion; diagnosis; interception and treatment of occlusal anomalies. Orthodontics" is derived from the Greek orthos ("correct", "straight") and -odont- ("tooth").

According to British society of orthodontics (1922) "Orthodontics includes the study of growth & development of the jaws & face particularly, & the body generally as influencing the position of the teeth; the study of action & reaction of internal & external influences on the development & the prevention & correction of arrested & perverted development.

According to American Board of orthodontics "Orthodontics is that specific area of dental practice that has as its responsibility the study and supervision of the growth and the development of the dentition and its related anatomical structures from birth to dental maturity, including all preventive and corrective procedures of dental irregularities requiring the repositioning of teeth by functional or mechanical means to establish normal occlusion and pleasing facial contours".

In 1911 Noyes defined orthodontics as "The study of the relation of the teeth to the development of the face and correction of arrested and perverted development ".

In 1907 Angle stated that the objective of the science of orthodontics is "The correction of malocclusion of the teeth".

Aims & objectives of orthodontic treatment: Aims & objectives of orthodontic treatment have been summarized by Jackson as the Jackson's Triad.

1. Functional Efficiency.
2. Structural Balance.
3. Esthetic Harmony.

Functional Efficiency Many malocclusions affect normal functioning of the stomatognathic system. The orthodontic treatment should thus aim at improving the functioning of the orofacial apparatus.

Structural Balance The oro-facial region consists of the dentoalveolar system, the skeletal tissue and the soft tissue including musculature. Stable orthodontic treatment is best achieved by maintaining a balance between these three tissue systems.

Esthetic Harmony By far the most common reason for seeking orthodontic care is to improve the appearance of the teeth & face. Many malocclusions are associated with unsighty appearance of teeth & can thus affect the individual's self-image, wellbeing & success in society. Thus, the orthodontic treatment should aim at improving the esthetics of the individual.

Orthodontics can improve the following:

1- Dental health:
   a- Dental caries: Mal-alignment of the teeth may reduce the potential for natural teeth –cleansing and increase the risk of decay.
   b- Periodental 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 periodontal support and finally traumatic occlusion may lead to increase loss of periodontal support (e.g.: anterior crossbite).
   c- Trauma to anterior teeth: Researches have shown that overjet more than 3 mm had more than double the risk of traumatic injury.
   d- Impacted teeth: Impacted (unerupted) tooth may affect normal position and health of adjacent teeth in addition to the loss of function of the impacted tooth itself.

2- Function:
   a- Masticatory function: Patients with open bites; markedly increased overjet (Class II) or reversed overjet (Class III) often complain difficulties with eating, particularly incising food.
   b- Speech: Crowding may have little effect on normal speech.
   c- Tempro-mandibular joint: There is no clear association between malocclusion and the TMJ.
3- Psychosocial -wellbeing: Unattractive dento-facial appearance does have a negative effect on expectations of teachers and employers.

Scope of orthodontic treatment:

1. Alteration in tooth position.

2. Alteration in skeletal pattern.

3. Alteration in soft tissue pattern.

Definitions:

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

Ideal Occlusion: A theoretical concept of an ideal arrangement of the teeth within the dental arches, combined with an ideal inter-arch relationship, which concentrates optimal esthetic, function, and stability of the dentition and supporting structures. But it is almost never found in nature.

Normal occlusion: That occlusion which satisfies the requirements of function and esthetic but in which there are minor irregularities of individual teeth.

6 keys of normal occlusion:

1: Molar relation: The distal surface of the distobuccal cusps of the upper first permanent molar made contact and occluded with the mesial surface of the mesiobuccal cusps of the lower second molar, the mesiobuccal cusp of the upper first permanent molar fell within the groove between the mesial and middle cusps of the lower first permanent molar. (The canines and premolars enjoyed a cusp-embrasure relationship).

2: Crown angulation "The mesiodistal tip", The term angulation refers to angulation (or tip) of the long axis of the crown not to angulation of the long axis of the entire tooth. The gingival portion of the long axis of each crown was distal to the incisal portion varying with the individual tooth type, the long axis of the crown for all teeth except molars is identified to be the mid developmental of ridge which is the most prominent part and center most vertical portion of the labial or buccal surface of the crown.

The long axis of the molar crown is identified by the dominant vertical groove on the buccal surface of the crown.

3: Crown inclination (Labiolingual or buccolingual inclination):
Crown inclination refers to the labiolingual or buccolingual inclination of the long axis of the crown not to the inclination of the long axis of entire tooth. The inclination of all the crowns has a consistent scheme:

a- Anterior teeth (Central and lateral incisors)
The labial inclination of upper and lower anterior crown is sufficient to resist over eruption of anterior teeth and sufficient also to allow proper distal positioning of the contact points of the upper teeth in their relationship to the lower teeth, permitting proper occlusion of the posterior teeth.

b-Upper posterior teeth (Canines through molars)
A palatal crown inclination existed in the upper posterior crown was a constant and similar from the canines through the second premolar and was slightly more pronounced in the molars.

c-Lower posterior teeth (Canines through molars)
The lingual crown inclination in the lower posterior teeth progressively increases from the canine through the second molar.

4: Rotation: There are no undesirable rotations**.** Rotated molar and bicuspid occupy more space than normal while rotated incisors occupies less space than normal

5: Spaces: there were no spaces with tight contact point.

6: Occlusal planes: the plane of occlusion varied from generally flat to a slight curve of spee (which measured from most prominent cusp of lower second molar to the lower central incisor), no curve deeper than 1.5 mm is accepted from a stand point of occlusal stability.

Recently the authors believe that the correct crown diameter represents the seventh key to normal occlusion this key (the seventh key) had to be present in Andrews non-orthodontic normal study models.

Malocclusion

Defined as any deviation from the normal or ideal occlusion.

Risks of orthodontic treatments:

1- Root resorption: During 2- years of fixed orthodontic treatment it is inevitable to find 1mm of root resorption, however the use of excessive orthodontic force may lead to un-accepted amount of root resorption and hence devitalization of affected tooth or teeth.
2- Loss of periodontal support: Caused by poor oral hygiene during orthodontic treatment.
3- Demineralization: May occur during fixed orthodontic treatment specially, as a result of plaque accumulations in case of un-cooperative patient (poor oral hygiene).
4- Soft tissue damage: Traumatic ulceration may occur specially in fixed orthodontic treatment.
5- Pulpal injury: Excessive orthodontic force may lead to pulp injury and death especially for the teeth with a history of trauma.

Orthodontic definitions:

Incisal overjet: The horizontal distance between the upper and lower incisors in occlusion, measured at the tip of the upper incisor (Fig. 1).
It is dependent on the inclination of the incisor teeth and the antero-posterior relationship of the dental arches. In most people, there is a positive overjet, i.e. the upper incisor is in front of the lower incisor in occlusion (normally 2-4 mm), but the overjet may be reversed (in case of Class III), or edge-to-edge (Fig. 1).

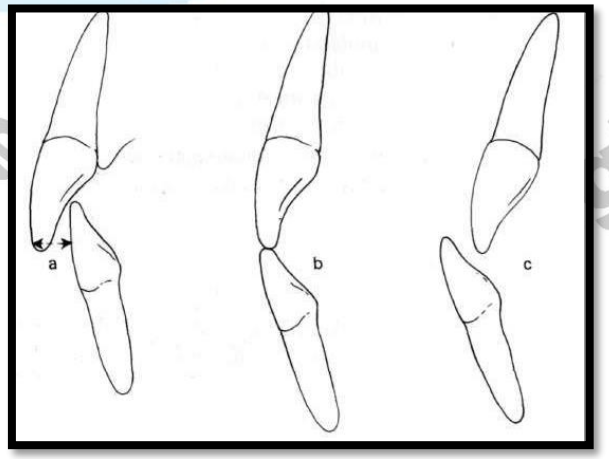


Fig. 1: Incisal overjet: (a) The ideal overjet relationship, (b) Edge to edge incisal position,
(c) Reversed overjet.

Incisal overbite: The overbite is the vertical distance between the tips of the upper and lower incisors in occlusion (Fig.2).

It is governed by the degree of vertical development of the anterior dento-alveolar segments. Ideally, the lower incisors contact the middle third of the palatal surface of the upper incisors in occlusion (2-4 mm), but there may be excessive overbite (deepbite), or there may be no incisal contact, in which case the overbite is described as *incomplete overbite* when the lower incisors are above the level of the upper incisal edges, or *anterior open bite,* when the lower incisors are below the level of the upper incisal edges in occlusion.

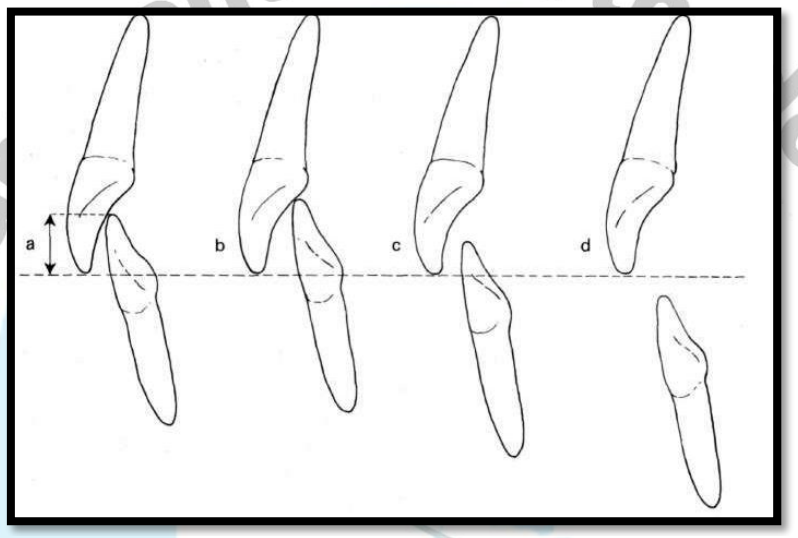


Fig.2: Incisal overbite: (a) Ideal overbite relationship, (b) Excessive incisal overbite (deepbite), (c) Incomplete overbite, (d) Anterior open bite.

Lect.2

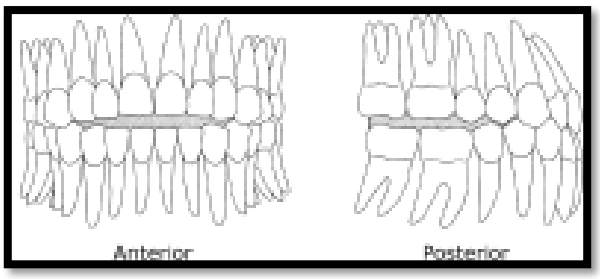
Orthodontic Definition

Open bite (Negative overbite):

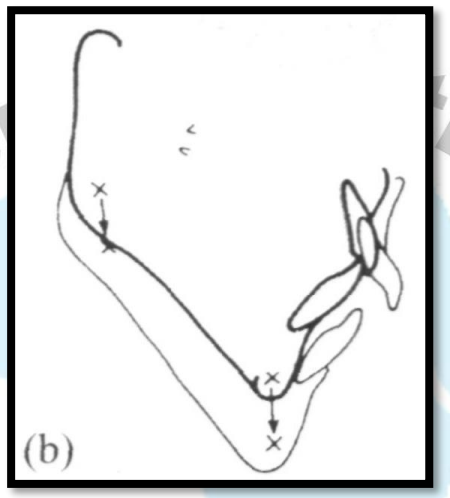
Inherited, developmental or acquired malocclusion, whereby no vertical overlap exists between maxillary and mandibular anterior teeth (anterior open bite), or no vertical contact is exhibited between maxillary and mandibular posterior teeth (posterior open bite).

Subdivided to:

1- Dental open bite: A localized openbite that involves only a few teeth due to a digit-sucking habit or other local factors.
2- Skeletal open bite: Caused by divergence of the skeletal mandibular or / and maxillary planes leading to increased facial height as in case of posterior rotational growth of the mandible (Fig. b).



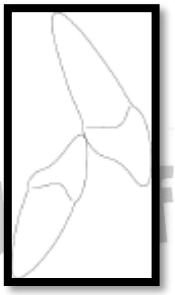
a-Anterior and posterior dental openbite



b-Posterior rotational growth of the mandible

Deep bite (Excessive overbite): Type of malocclusion in which the vertical overlap of the anterior teeth is increased beyond the ideal relationship (more than the normal range which is 2-4 mm); it is frequently associated with decreased vertical facial dimensions, subdivided into;

1- None traumatic deepbite: In which the deepbite still associated with teeth–teeth relation.



2- Traumatic deepbite: in which the deepbite associated with the Impingement of the mandibular incisors in the mucosa palatal to the maxillary incisors commonly is seen in malocclusions with extremely deep bite as in sever Class II malocclusion.

3- Bi-traumatic deepbite: usually seen in some Class II, Division 2 malocclusions with minimal overjet, the retroclined maxillary incisors may impinge in the keratinized

tissue labial to the mandibular incisors, causing gingival recession at the same time there is a trauma to palatal mucosa caused by lower incisors.

Buccal overjet:

The distance between the buccal surfaces of the maxillary posterior teeth and the buccal surfaces of their mandibular antagonists. An unofficial term sometimes used to indicate whether or not there is a tendency for a posterior crossbite.

Crossbite:

An abnormal relationship of one or more teeth to one or more teeth of the opposing arch, in the buccolingual or labiolingual direction. A crossbite can be dental or skeletal in etiology. [Note: The appropriate type of crossbite can be specified by identifying the teeth or jaws that deviate the most from their ideal position (e.g. when a crossbite is mainly due to a narrow maxillary arch the correct term is "maxillary posterior lingual crossbite" as opposed to "mandibular posterior buccal crossbite" which indicates wider mandibular arch).

Classification of crossbite:

Based on Location

1. ANTERIOR CROSS BITE:

- According to no. of teeth involved:
  A. Single tooth Cross bite. B. Segmental Cross bite.

2. POSTERIOR CROSS BITE:

- According to no. of teeth involved:
  A. Single tooth Cross bite. B. Segmental Cross bite.
- According to side involved:
  A. Unilateral. B. Bilateral.
- According to extent:
  A. Single posture Cross bite. B. Buccal Non-occlusion (Scissor bite).
  C. Lingual Non-occlusion (Buccal crossbite).

Based on the Etiologic Factor

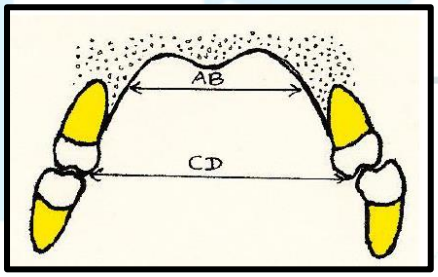
1. Skeletal crossbite.
2. Dental crossbite.
3. Functional crossbite.

Anterior crossbite: If the one or more of the lower incisors are in front of the upper incisors, the condition is called reverse overjet or anterior crossbite.

Posterior crossbite: A crossbite due to buccal displacement of the affected posterior tooth (or group of teeth) from its (their) ideal position relative to its (their) antagonist(s). Subdivided into:

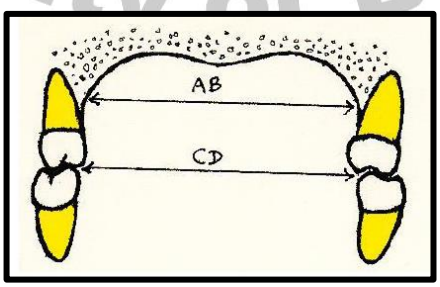
1- Unilateral posterior: Affect only one side of the dental arch, and can be either:
a-True unilateral posterior crossbite: Caused by the asymmetry present in the dental arch and usually does not associated with deviation of the mandible.
b- False unilateral posterior crossbite: caused by narrowing of the maxilla or widening of the mandible leading to cusp –cusp relation then the patient tries to get maximum intercuspation by deviation of the mandible to one side leading to unilateral crossbite.
2- Bilateral posterior crossbite: Caused by sever maxillary collapse or/ and mandibular widening, there is no mandibular deviation during closure.

Skeletal crossbite: It is a crossbite with a skeletal basis (constricted maxilla and/or wide mandible).



Palatal arch width (AB) is inadequate and quiet less than dental arch width (CD)

Dental crossbite: It is caused by distortion of the dental arch where the jaws are of normal proportions.



Palatal arch width (AB) is adequate and nearly equal to dental arch width (CD)

Functional crossbite (False): It is a crossbite due to a functional shift of the mandible, it should be treated early if recognized, because if uncorrected, true crossbite may result by modification of growth.

Scissors-bite:

Situation in which several adjacent posterior teeth overlap vertically in habitual occlusion with their antagonists, without contact of their occlusal surfaces. The deviation of the affected teeth from their ideal position could occur either in maxillary buccal or mandibular lingual direction, where mandibular dentition are completely contained within the maxillary dentition in habitual occlusion.

Spacing of the dentition: A dental arch with spacing of more than accepted range (2 mm or more), it is either:

a- Localized: Localized in one position like median Diasthema that caused by abnormal frenal attachment.

b- Generalized: Affect the whole dental arch mostly caused by abnormal soft tissue function like tongue thrust.

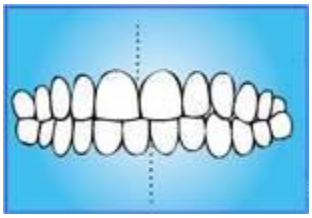
Crowding of the dentition: A dental arch with crowding of more than accepted rang (2 mm or more), either caused by local factor like early extraction of deciduous teeth or general factor like collapsed maxillary arch that lead to crowding of the whole arch.

Imbrication: The overlapping of incisors and canines in the same arch, usually due to crowding.

Midline shift (deviation): Occurs when the upper and lower dental midline are not coinciding, and subdivided into:

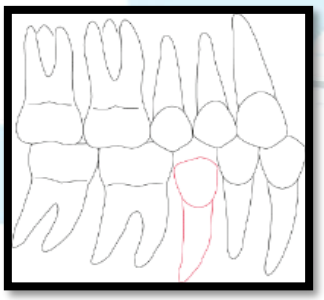
1- Associated with mandibular deviation during closure as in case of premature occlusal contact.

2- Not associated with mandibular deviation during closure as in case of unilateral missing of the teeth or crowding.



Midline shift may be due to shift of upper or lower teeth or some time may both of them and it is very important to determine that during diagnosis and treatment planning specially to choose a tooth or teeth to be extracted, in addition to that it is important to differentiate between midline shift of the dentition and the face because we may see one of them or some time both of them.
Midline shift of the face mostly caused by abnormal skeletal factor (like unilateral hyperplasia of the mandible) or deviation of the nose.
Midline shift of the dentition mostly associated with unilateral extraction or congenital missing or impaction of a tooth.

Infraposition (Infraocclusion):
A situation in which a tooth or group of teeth is positioned below the occlusal plane; commonly due to a deleterious habit or to ankylosis.



Overeruption (Supraeruption, Supraposition, Supraocclusion):
The situation whereby an unopposed or non-occluding tooth extends beyond the occlusal plane.

Dental retrusion:

Posterior position of a tooth or group of teeth but keeping their long axis with normal inclination.

Dental retroclination:

Posterior positioning of a tooth or group of teeth but their long axis are tipped labio-lingually.

[Note: A tooth can be retrusive without being retroclined, if it is positioned too far posteriorly but has a normal inclination.]

Dental proclination:

Anterior positioning of a tooth or group of teeth but their long axis are tipped labially.

Dental protrusion:

Anterior positioning of a tooth or group of teeth but keeping their long axis with normal inclination.

Impaction of teeth:

Occurs when eruption is completely blocked by other teeth due to crowding, it tends to affect the last teeth to erupt in each segment (as in case of canine).

Rotation of teeth:

A type of malocclusion in which there is a rotation of a tooth about its long axis, most evident when viewing the tooth from an occlusal perspective mostly, caused by crowding and sub divided into:

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

Displacement of tooth:

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

Overlapping of teeth:

Abnormal position of the crown of the tooth in the dental arch while there is normal position of root in the jaw.

Lec 3

Classification of malocclusion

Angle classification

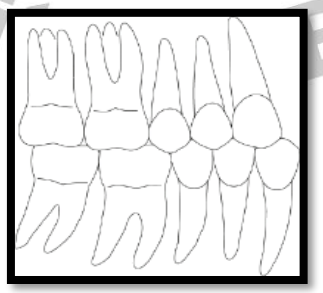
A classification of malocclusion introduced by E. H. Angle, based on the anteroposterior relationship of the maxillary and mandibular first permanent molars. Angle's assumption when formulating this classification was that the maxillary first permanent molar always is in the physiologically correct position and the variability comes from the mandible.

Angle's classification, which is still widely popular, only can serve as a framework, as it does not take into account many other important relationships in the anteroposterior (e.g. overjet, canine relationship), transverse (e.g. buccolingual crossbites), or vertical (e.g. overbite) planes of space. It also does not identify intra-arch problems, such as crowding, spacing, rotations, missing or impacted teeth.

Angle's classification subdivided into:

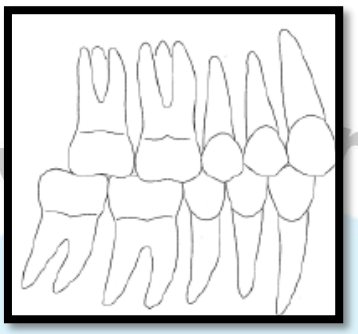
• Class I malocclusion (Neutroclusion)

A malocclusion in which the buccal groove of the mandibular first permanent molar occludes with the mesiobuccal cusp of the maxillary first permanent molar. The term "Class I" is sometimes used incorrectly as a synonym for normal occlusion, although in reality, it only signifies a normal relationship of maxillary and mandibular first molars in the sagittal plane.



•Class II malocclusion (Distoclusion, Postnormal occlusion):

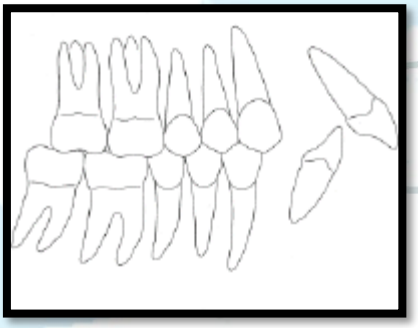
A malocclusion in which the buccal groove of the mandibular first permanent molar occludes posterior (distal by at least half cusp) to the mesiobuccal cusp of the maxillary first permanent molar. The severity of the deviation from the Class I molar relationship usually is indicated in fractions (or multiples) of the mesiodistal width of a premolar crown ("cusp" or "unit").



Subdivided into:

• Class II malocclusion, Division 1:

A Class II malocclusion with proclined maxillary incisors, resulting in an increased overjet with normal or mostly deepbite.



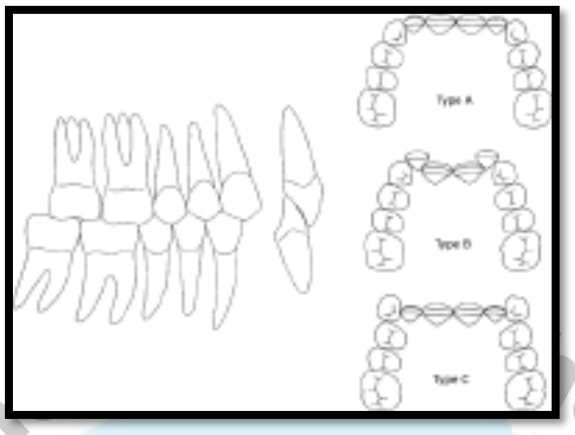
• Class II malocclusion, Division 2:

A Class II malocclusion typically with the maxillary central incisors tipped palatally, a short anterior lower face height, an excessive overbite and normal or decreasing overjet. Three types of Class II Division 2 malocclusion can be distinguished, based on differences in the spatial conditions in the maxillary dental arch:

Type A: The four maxillary permanent incisors are tipped palatally, without the occurrence of crowding.

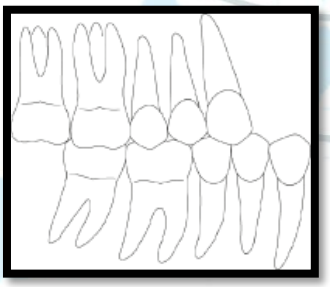
Type B: The maxillary central incisors are tipped palatally and the maxillary laterals are tipped labially.

Type C: The four maxillary permanent incisors are tipped palatally, with the canines labially positioned.



• Class III malocclusion (Mesioclusion, Prenormal occlusion):

A malocclusion in which the buccal groove of the mandibular first permanent molar occludes anterior (mesial by at least half cusp) to the mesiobuccal cusp of the maxillary first permanent molar. The same conventions as described before are used to indicate the severity of deviation from a Class I molar relationship.



Important notes:

1-Usually when we talk about angles classification we talk about first permanent molar relation (and some time we notice that this relation not symmetrical in both side).

2- When there is missing of the first permanent molar or there is drifting as a result of an early loss of deciduous molars so we shift to another classification which is canine classification ,and if there is no canine or impacted canine or severly malposed canine so we shift to another classification which is incisor classification.

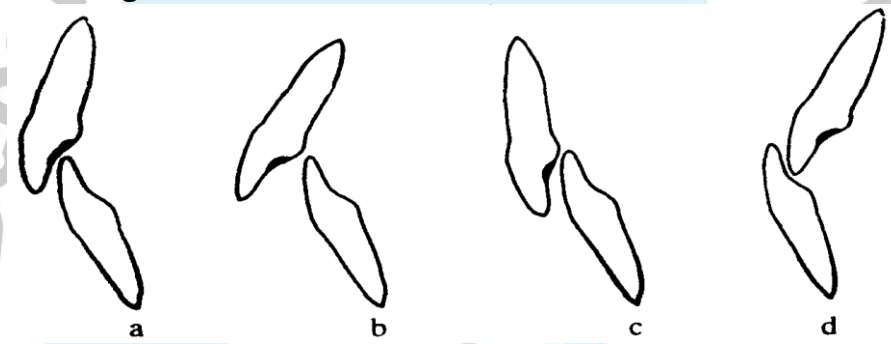
Canine classification:

Class I: It is a normal canine relation, when the tip of the upper canines located in the embrasure area between lower canine and first premolar

(or the mesial slope of the upper canine coincide with the distal slop of lower canine) in occlusion.
Class II: Abnormal canine relation in which the lower canine will be more backward from normal canine relation in occlusion.
Class III: Abnormal canine relation, when the lower canine will be more forward than from normal canine relation.

Incisor classification

The incisor relationship does not always match the buccal segment relationship. Since much of orthodontic treatment is focused on the correction of incisor malrelationships, it is helpful to have a classification of incisor relationships. The terms used are the same but this is not Angle's classification, although it is a derivation.
In clinical practice the incisor classification is usually found to be more useful than Angle's classification.



Incisor classification: (a) Class 1: (b) Class II Division 1: (c) Class II Division 2; (d) Class III.

Class I. The lower incisor edges occlude with or lie immediately below the cingulum plateau (middle part of the palatal surface) of the upper central incisors (a).

Class II. The lower incisor edges lie posterior to the cingulum plateau of the upper incisors.
There are two divisions to Class II malocclusion:
Division 1. The upper central incisors are proclined or of average inclination, with an increased overjet (b).
Division 2. The upper central incisors are retroclined (less than 105° to the maxillary plane). The overjet is usually of an average amount but may be increased (c),o.b mostly increased(deep bite)

Class III. The lower incisor edges lie anterior to the cingulum plateau of the upper incisors (d). The overjet may be either reduced or reversed.

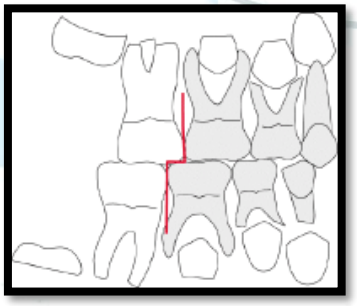
Classification of deciduous teeth: Depend on the relation between terminal plane present in the maxillary and mandibular deciduous posterior teeth.

Terminal plane:

The distal proximal surface of the maxillary and mandibular second deciduous molars (being the distal terminal plane of the deciduous dentition). The relationship between the maxillary and mandibular terminal planes in the early mixed dentition is thought to determine, to a degree, the eventual relationship between the (at the time still unerupted) maxillary and mandibular first permanent molars.

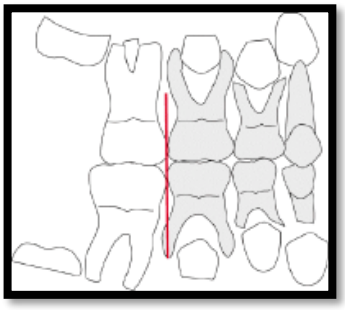
Distal step:

A situation in which the terminal plane of the mandibular second deciduous molar is situated posteriorly to that of the maxillary second deciduous molar. This situation is thought to be predisposing to, but not necessarily predictive of, a Class II relationship of the (at the time, still unerupted) first permanent molars.



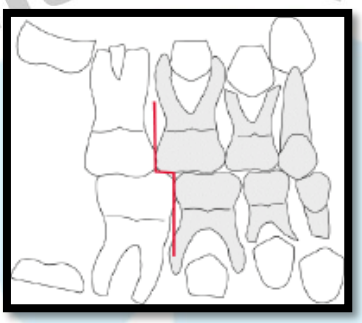
• Flush terminal plane

An end-to-end relationship between the distal proximal surfaces of the maxillary and mandibular second deciduous molars, usually leading to a Class I or Class II relationship between the (at the time, still unerupted) maxillary and mandibular first permanent molars.



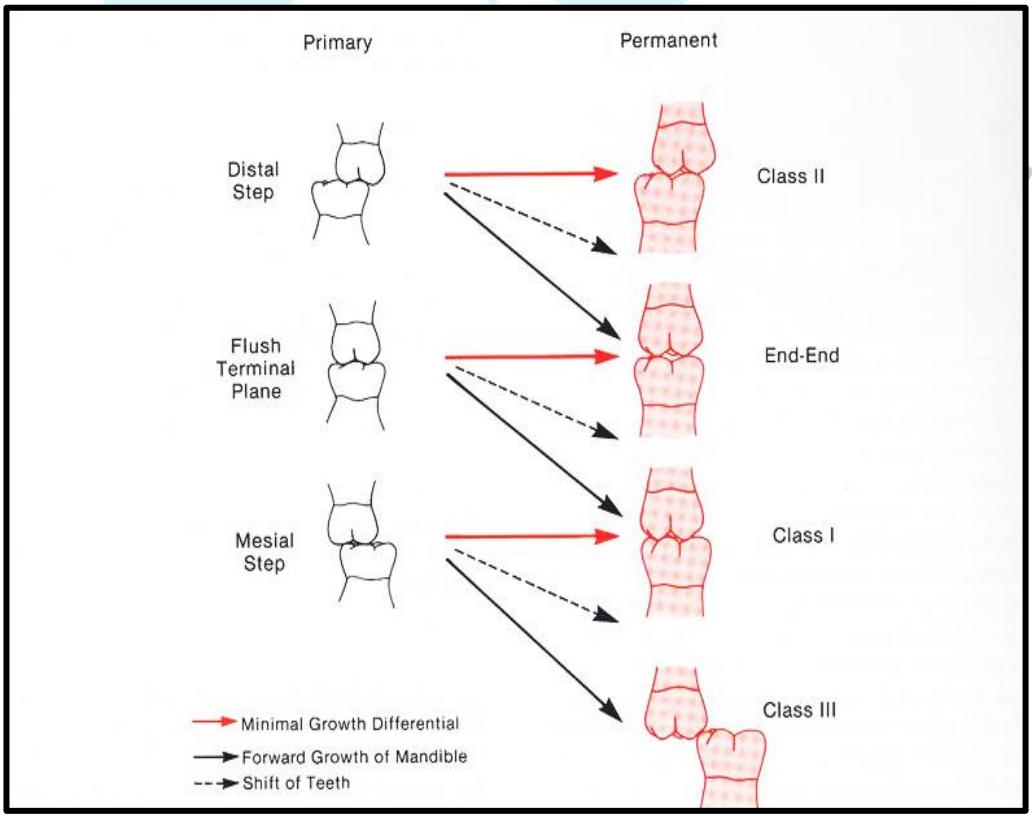
• Mesial step:

A situation in which the terminal plane of the mandibular second deciduous molar is situated anteriorly to that of the maxillary second deciduous molar. Depending on the severity of the mesial step, this relationship is thought to predispose to (but is, strictly speaking, not predictive of) either a Class I or a Class III relationship of the (at the time, still unerupted) maxillary and mandibular first permanent molars.



Clinical implications and variations:

The first permanent molars may erupt into one of the following occlusal relationships



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