## Facial soft tissue growth

An important concept is that the growth of the facial soft tissues does not perfectly parallel the growth of the underlying hard tissues.

## Growth of the Lips

The lips trail behind the growth of the jaws prior to adolescence, then undergo a growth spurt to catch up. Because lip height is relatively short during the mixed dentition years, lip separation at rest (often termed lip incompetence) is maximal during childhood and decreases during adolescence (Fig.1). Because the lips move downward relative to the lips and teeth during adolescence (and continue to do so as the face ages), what looks like too much display of gingiva prior to and in adolescence can look perfectly normal in a young adult. Lip thickness reaches its maximum during adolescence, then decreases (Fig. 2) to the point that in their 20s and 30s, some women consider loss of lip thickness a problem and seek treatment to increase it.

• Fig. 1 Growth of the lips trails behind growth of the facial skeleton until puberty, then catches up and tends to exceed skeletal growth thereafter. As a result, lip separation and exposure of the maxillary incisors is maximal before adolescence and decreases during adolescence and early adult life. (A) Age 11-9, prior to puberty. (B) Age 14-8, after the adolescent growth spurt. (C) Age 16-11. (D) Age 18-6.

• Fig. 2 Lip thickness increases during the adolescent growth spurt, then decreases (and therefore is maximal at surprisingly early ages). For some girls, loss of lip thickness is perceived as a problem by their early 20s. (A) Age 11-9, prior to puberty. (B) Age 14-8, after the adolescent growth spurt. (C) Age 16-11. (D) Age 18-6.


## Growth of the Nose

Growth of the nasal bone is complete at about age of 10 years. Growth thereafter is only of the nasal cartilage and soft tissues, both of which undergo a considerable adolescent spurt. The result is that the nose becomes much more prominent at adolescence, especially in boys (Fig. 3). The lips are framed by the nose above and chin below, both of which become more prominent with adolescent and post-adolescent growth while the lips do not, so the relative prominence of the lips decreases. This can become an important point in determining how much lip support should be provided by the teeth at the time orthodontic treatment typically ends in late adolescence.

Fig. 3 The nasal bone grows up until about age 10, but after age 10, growth of the nose is largely in the cartilaginous and soft tissue portions. Especially in boys, the nose becomes much more prominent as growth continues after the adolescent growth spurt (and this process continues into the adult years). (A) Age 4-9. (B) Age 12-4. (C) Age 14-8. (D) Age 17-8.


## Maxillary sinus

As the sinus has the volume of small peas at birth, the eruption of deciduous teeth will modify its volume and it increases in size with the eruption of the 1st molar, about 8 years it has a pyramidal form that will lengthen after the eruption of the canine and the last molar (fig. 4).

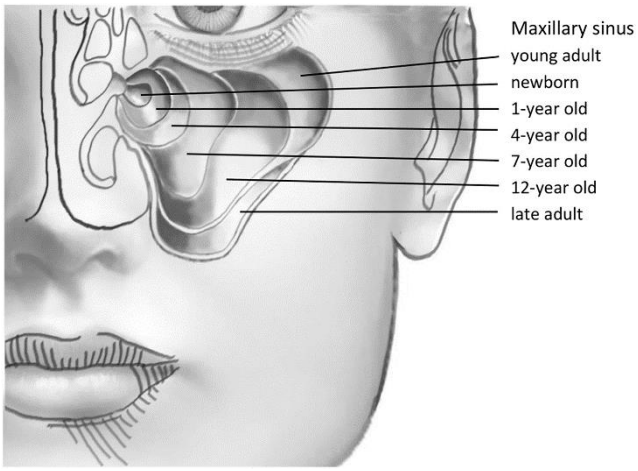



Fig. 4: Development of maxillary sinus

## Development of palate

The palate begins to develop early in the 6" week, but the process is not completed until 12" week. The most critical period during palatal development is the end of the 6th week and the beginning of the 9th week.

The entire palate develops from (fig. 5):

1- The primary palate (premaxilla): is the triangular-shaped part of the palate anterior to the ‘incisive foramen. Its origin is the deep portion of the inter- maxillary segment which developed from the frontonasal process, which arises from the fusion of the two medial nasal prominences.

2- The secondary palate: give rises to the hard and soft palate posterior to the incisive foramen. It arises from paired lateral palatine shelves of the maxilla. These shelves are oriented in a superior-inferior plane with the tongue interposed. Later they become elongated and the tongue becomes smaller and moves inferiorly. This allows the shelves to orient horizontally, to approach one another, and to fuse in to midline. Later on these lateral palatal shelves fuse with the primary palate and nasal septum. Cleft palate results if the lateral palatal shelves failed to fuse with each other, with the nasal septum, or with the primary palate.

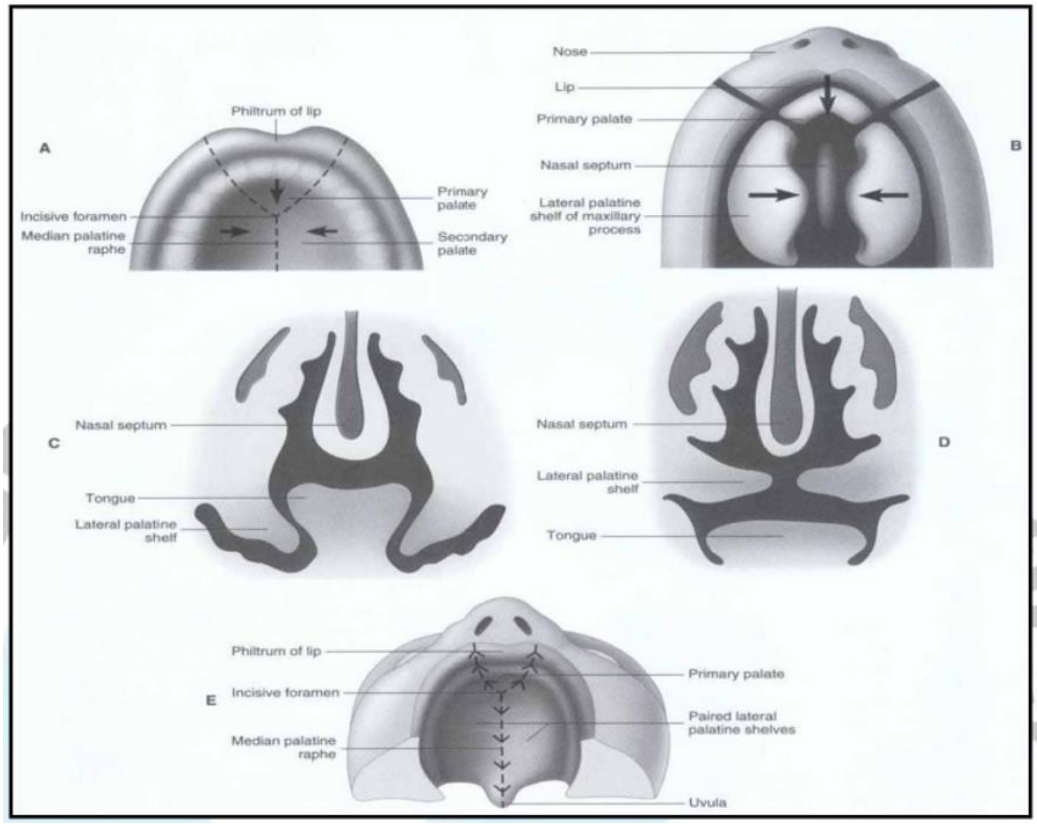



Fig. 5; Development of palate

## Cleft lip and palate:

The most common craniofacial anomaly, caused by failure of fusion between certain embryological processes during facial morphogenesis (fig. 6). Failure of fusion between the medial and lateral nasal and the maxillary processes results in **a cleft of the lip and/or alveolar process.**

Failure of fusion between the lateral palatine processes results in **a cleft of the palate.**

The etiology of cleft lip and palate is thought to be multifactorial. Genetic is implicated in 20%-30%of the patients. Environmental factors that have been shown in experimental animals to result in clefting include nutritional deficiencies, radiation, several drugs, hypoxia, viruses, and vitamin excesses or deficiencies.

In case of complete or bilateral clefts of the lip, alveolus and palate, the maxillary arch typically is collapsed in the transverse direction, especially in the area of the cleft. The maxillary permanent lateral

incisors at the line of cleft may be congenitally missing or malformed, and many atypically shaped supernumerary teeth may be present in the area of the cleft.

Fig. 6; Cleft lip and palate

**Classification:**

A cleft can be complete or incomplete, and it can occur unilaterally or bilaterally. A useful classification divides the anatomy into primary and secondary palates. An individual thus may have cleft of the primary palate, the secondary palate, or both.

**Cleft lip**: is classified either unilateral or bilateral and it could be minor cleft of the lip (small notch in the upper lip) or increase in the severity to complete cleft of the upper lip or continue to reach the nostril or to the internal angle of the eye, mostly unilateral, sometimes cleft lip may include cleft of the alveolar ridge.

**Cleft palate:** the fusion of the palatal components that form the palate usually start from the anterior aspect and continue posteriorly so that cleft palate could happen at any site through this process of fusion.

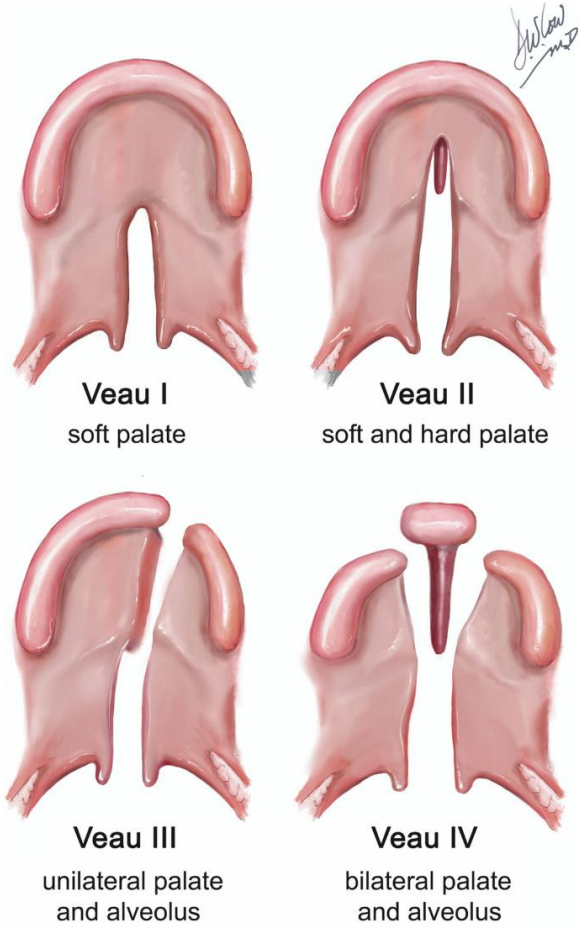
Cleft palate can be classified according to its severity as follows (Fig. 7):

Class I : Cleft of soft palate (uvula)

Class Il : Cleft of the secondary palate ( median palatine cleft )

Class Ill: Complete unilateral cleft palate

Class IV: Complete bilateral cleft palate




## Facial growth and the occlusion

The alveolar bone is highly adaptable, depending for its existence and location on the presence and position of the teeth: remove a tooth and the associated alveolar process resorbs, move a tooth into the same area make the bone remodels.

## Dento-alveolar compensation

Because the upper and lower teeth erupt into the 'neutral zone' of muscle balance between lips, cheeks and tongue they tend to be guided towards one another to establish an occlusion and to compensate for any transverse or antero-posterior mal-relationships of jaws. Variations in vertical jaw relationships are compensated, to a greater or lesser degree, on eruption of the teeth and growth of the alveolar processes. Where the skeletal mal-relationships are too severe, the dento-alveolar compensation described above may not be sufficient to

establish a normal occlusion and so crossbite, open bite and antero-posterior arch mal-relationships may develop. Therefore, mal-occlusion often will be less severe than might have been expected from the jaw mal-relationship by this compensation (see Figure 8).
(So compensation occurs dento-alveolarly by the effect of soft tissue in response to jaws mal-relation to decrease its severity)

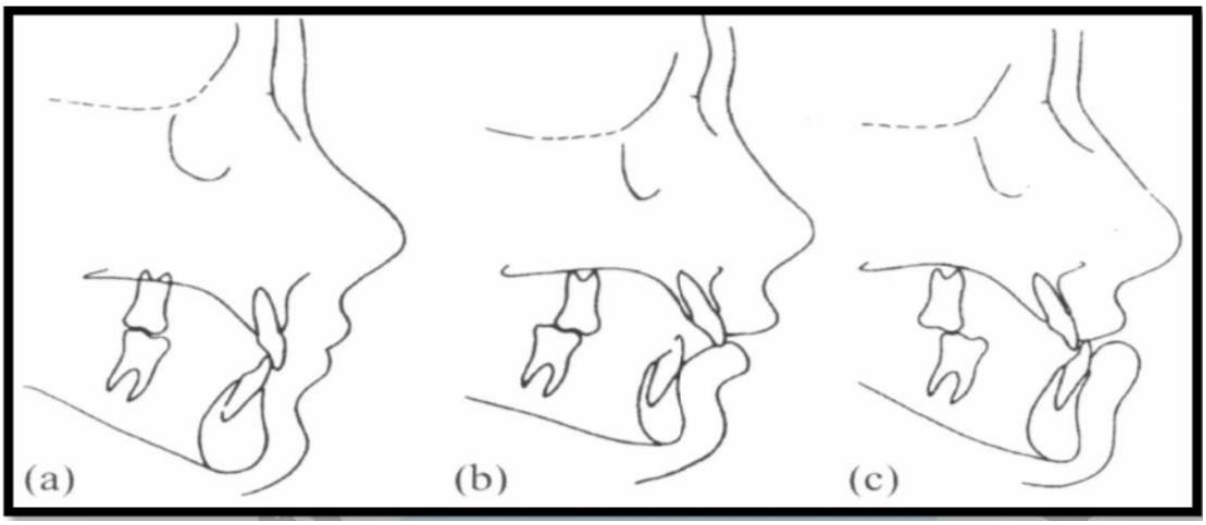



Fig. 8 skeletal patterns: (a) Class I (b) Class II (c) Class III

Dento-alveolar compensation is not always advantageous: in some cases of mandibular retrusion, for example, compensation occurs by retroclination of the upper incisors (fig. 9). This type of incisor relationship is usually associated with a deep overbite and may, when associated with poor oral hygiene, be traumatic as well as being unsightly.

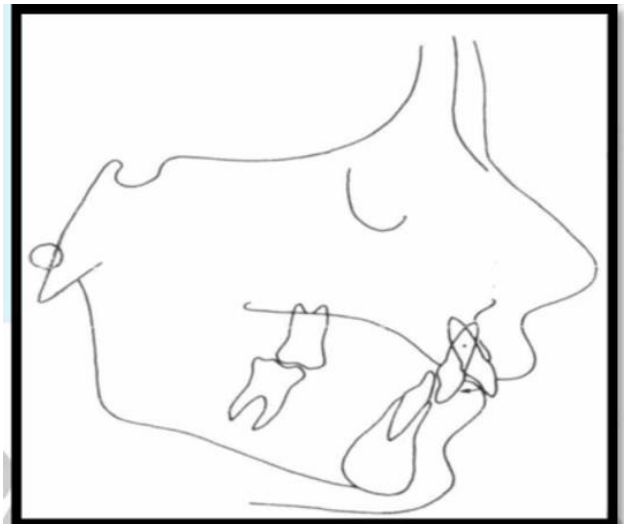


Fig. 9 ; Retroclination of the upper incisors as Dento-alveolar compensation

## Dento-alveolar adaptation

As the face grows, the intermaxillary space increases in height and the anteroposterior jaw relationship may change. As a result of vertical growth of the alveolar processes, occlusal contacts, and the soft tissue environment of the teeth, so the existing occlusion tends to be maintained. Dentoalveolar adaptation is a dynamic process (occurs as a result to normal growth in normal jaws relation).

Dento-alveolar adaptation is greatest vertically, in response to vertical growth of the intermaxillary space. Little change in transverse jaw relationships occurs with growth. Where changes in antero-posterior jaw relationships occur there will usually be corresponding dento-alveolar adaptation. Most commonly mandible grows forwards slightly more than the maxilla, so the upper incisors expected to procline whilst the lower incisors retrocline. The proclination of the upper incisors does not produce spacing in the same upper arch because the upper buccal segments come forwards by a comparable amount. Retroclination of the lower incisors usually results in crowding (late lower incisor crowding in young adults).

## Growth rotations:

Research by Björk shows that the direction of facial growth is curved, giving a rotational effect. Growth rotations are most obvious and have their greatest impact on the mandible (particularly in vertical dimension) while their effects on the maxilla are small.

Mandibular growth rotations result from the interplay of growth of a number of structures which determines the ratio of the posterior to anterior facial heights.

The posterior facial height is affected by the followings:

- The direction of the mandibular growth at the condyles.
- The vertical growth at the spheno-occipital synchondrosis.

The anterior facial height is affected by;

- The eruption of the teeth.
- The vertical growth of the soft tissues including the masticatory musculature.

## Types of growth rotations:

a-The rotation of either jaw is considered "forward" or “ anterior” and given a negative sign if there is more growth posteriorly than anteriorly (clockwise rotation) bringing the chin forward and upward(tendency to skeletal deepbite).

b-The rotation is "backward" or “ posterior ” and given a positive direction if it lengthens anterior facial dimensions more than posterior ones, bringing the chin downward and backward (counter clockwise rotation).(tendency to skeletal openbite)

c- Average rotation: A mild forward rotation which produces a well-balanced facial appearance.

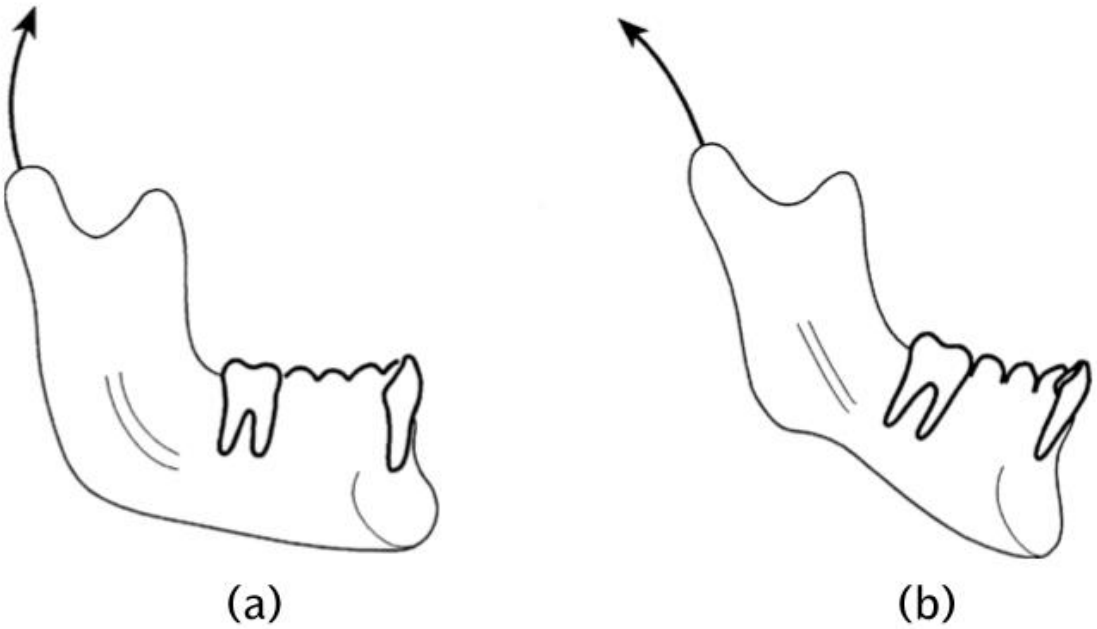



Fig. 10 Direction of condylar growth and mandibular growth rotations: (a) forward rotation; (b) backward rotation

Forward growth rotations are more common than backward rotations with the average being a mild forward rotation which produces a-well balanced facial appearance. A marked forward growth rotation tends to reduce anterior vertical facial proportions and increased overbite (deepbite).while backward rotation will tend to increase anterior vertical facial proportions and reduced overbite (anterior openbite).

Growth rotation not only affect vertical dimension but also affect anterio- posterior relation of the facial skeleton. For example, correction of classll malocclusion will be helped by a forward rotation as there will be forward growth of the mandible, but made more difficult by a backward rotation as there will be backward growth of the mandible increasing the skeltal class Il so myofunctional appliance is contraindicated in case of class Il div.1 when the rotation of the mandible is backward. (Backward rotation usually is un favourable).

## Devlopmental Anomalies:

1-Supernumerary teeth: Extra teeth in the dental arch.

2-Congenitally missing teeth: Reduce no. of teeth in the dental arch. (Lower second premolar; Upper lateral incisor and wisdom teeth).

3-Cleft lip-and /or palate.