ORTHODONTICS

Lec: 6 Dr. Baraa Al Rubai B.D.S, M. Sc.(orthodontics)

4th stage

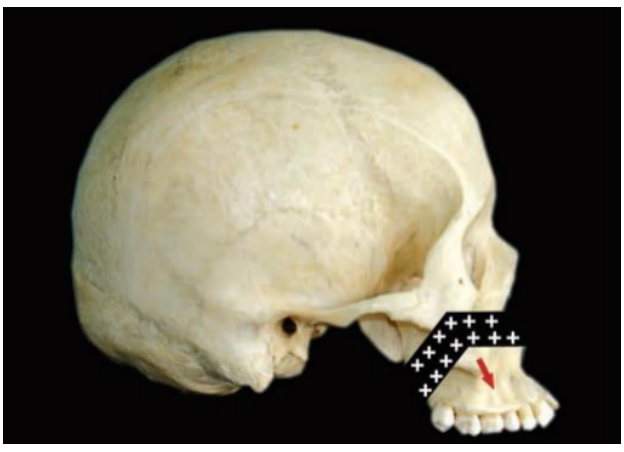
Growth and development 3

C. THE NASOMAXILLARY COMPLEX

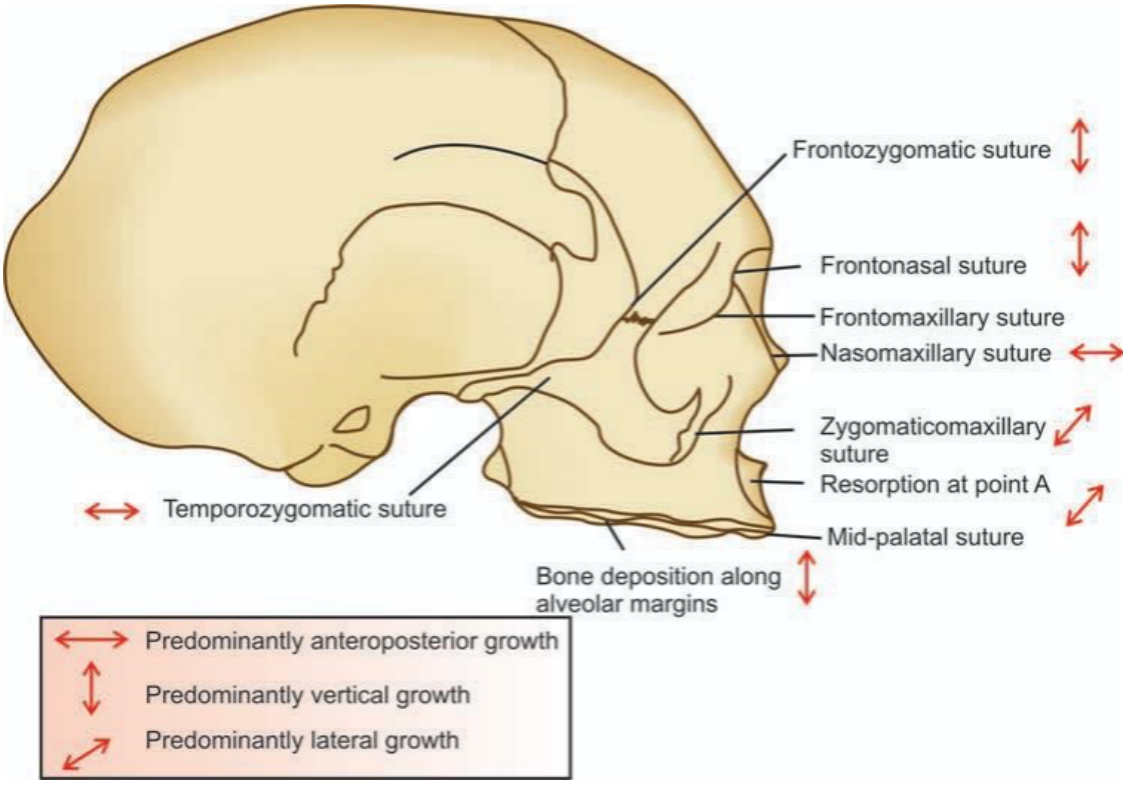
The growth of the cranium and facial skeleton progress at different rates (Scammon). By differential growth, the face literally emerges from beneath the cranium. The upper face, under the influence of cranial base inclination, moves upwards and forwards; the lower face moves downwards and forwards on an 'expanding V".

Since the maxillary complex is attached to the cranial base, there is a strong influence of the latter on the former. Although, there is no sharp line of demarcation between cranium and maxillary growth gradients, yet the position of the maxilla is dependent upon the growth at spheno-occipital and spheno-ethmoidal synchondroses. Hence, while discussing the growth of nasomaxillary complex, we must investigate two aspects.

1. The shift in the position of the maxillary complex.
2. The enlargement of the complex itself.



That both these issues are interrelated and concomitant. Enlow and Bang apply the principle of "area relocation" to the complex and multidirectional growth movements. As the dynamic process continues, "specific local areas come to occupy new actual positions in succession, as the entire bone enlarges. These growth shifts and changes involve corresponding and sequential remodeling adjustments to maintain the same shape, relative positions and constant proportions of each individual area in the maxilla as a whole". Moss described these as translocation and transposition respectively. The maxilla develops entirely by intramembranous ossification. Sutural connective tissue proliferations, ossification, surface apposition, resorption and translation are the mechanisms for maxillary growth. The maxilla is related to the cranium at least partially by the frontomaxillary suture, the zygomaticomaxillary suture, zygomaticotemporal suture and pterygopalatine suture. Weinmann and Sicher have pointed out that these sutures are all oblique and parallel with each other. Thus, growth in these areas would serve to move the maxilla downward and forward (or the cranium upward and backward).

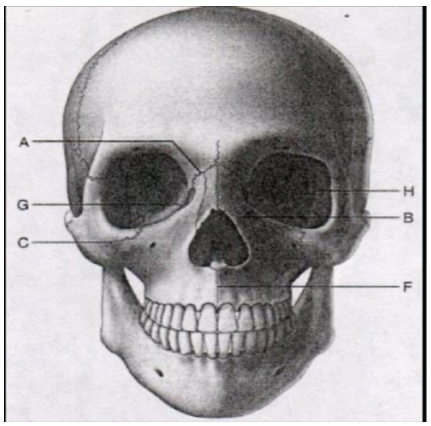


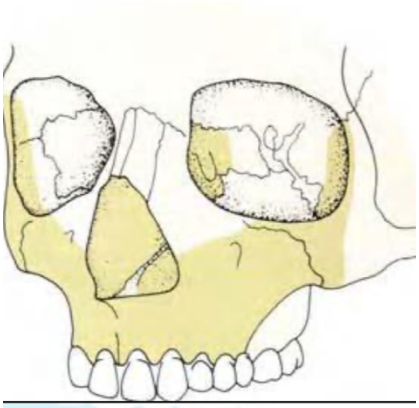
The maxilla

The maxilla develops post-natally entirely by intra-membranous ossification. Since there is no cartilage replacement, growth occurs into two ways: sutural growth and surface remodeling which can be described as:

A- Transversal growth

By apposition of bone at the sagittal sutures such as inter nasal suture, intermaxillary suture, interpalatine suture, their activity decrease at the end of the first year but they continue forming osteal tissue for a long period. Also, appositionof bone at the external aspect of the maxilla on both sides at the premolar regions by surface remodeling.

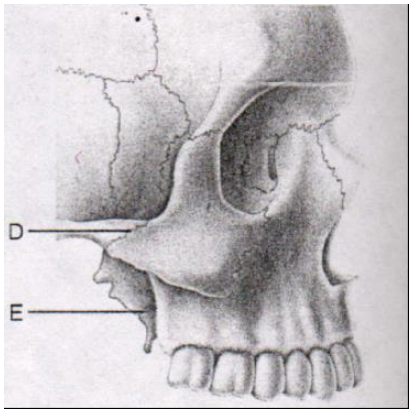


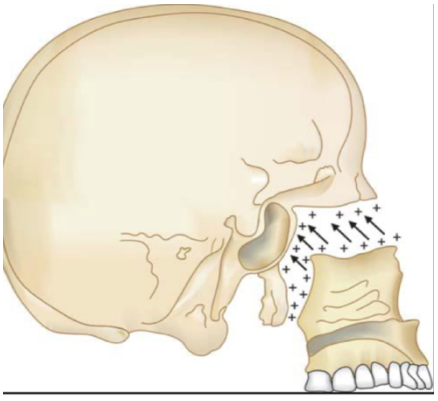


B- Vertical and antero-posterior growth

This is accomplished in two ways:

Apposition of bone at the sutures that connect the maxilla to the cranium and cranial base such as tempro-zygomatic suture, maxillo-zygomatic suture, pterygo-palatine suture and fronto-maxillary suture, these are parallel to each other, and they orient the direction of the facial growth downward and forward.



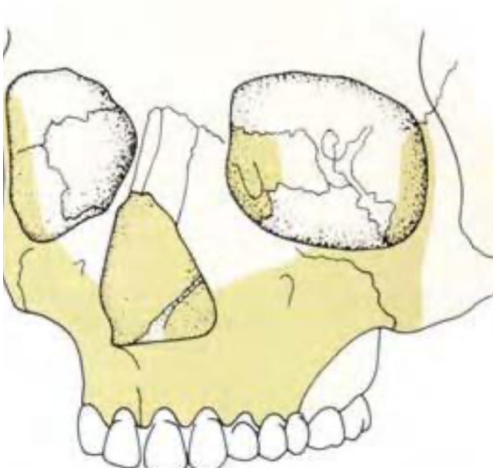


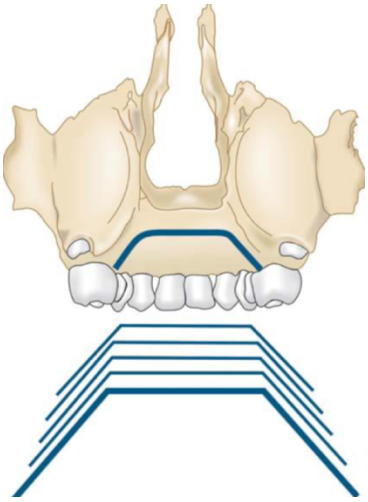
Surface remodeling which occurs by:

1- Vertical growth included:

- Alveolar process: the formation of alveolar process starts about the 4th month of intrauterine life their growth is by apposition of bone on three aspects (inferior, internal, external) in posterior region and on two aspects (internal, inferior) in the anterior region.

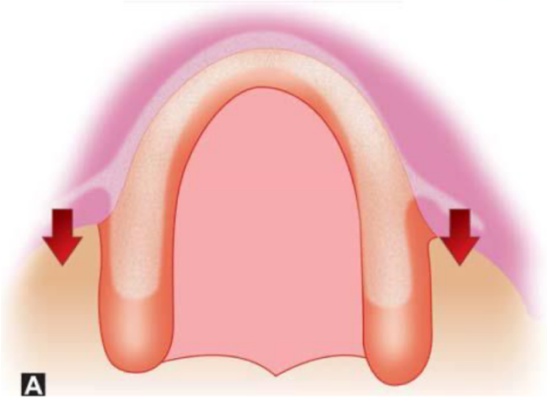
- Palate: there will be resorption on the superior aspect (nasal) and apposition on the inferior aspect (oral) which will bring the palate downward.





2- Antero-posterior growth occurs by:

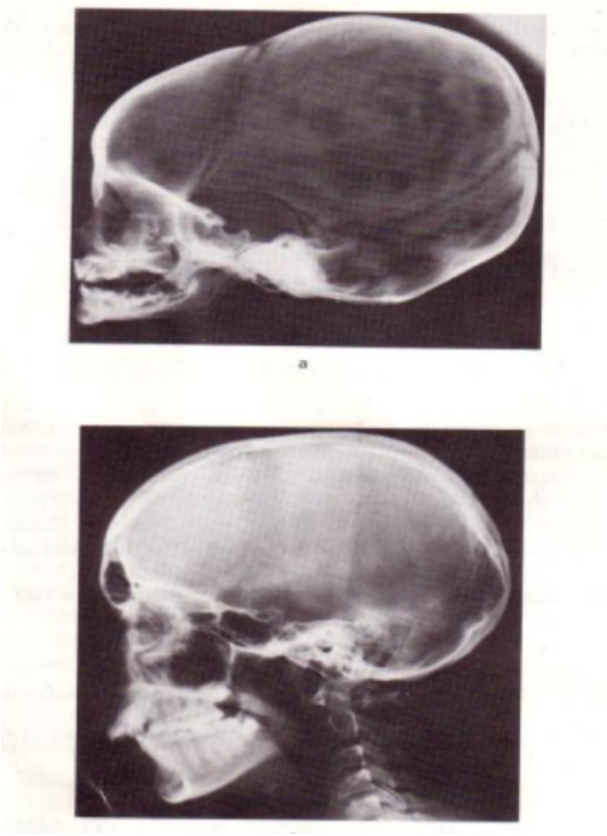
- Anterior alveolar growth, resorption in the vestibular part and apposition on the inferior and palatal part.
- An apposition on the posterior aspect of the horizontal part of the palate.
- Development of the tuberosity.



Postnatal growth of the maxilla follows a growth pattern that is thought to be intermediate between a neural and a somatic growth pattern, but closure to the neural pattern; therefore, after the age of 7 years, growth of the maxillary complex slows. Hence, orthodontic interventions to advance the maxilla, for example, with protraction headgear in Class III cases, are reported to be more successful before the age of 10 when the sutures around the maxillae are more amenable to displacement. While interventions to expand the maxilla by rapid maxillary expansion are reported to be more successful before the age of 16 and progressive bony fusion of the mid-palatal suture. Maxillary growth slows to adult levels on average at about 15 years in girls and rather later, at about 17 years, in boys.

Maxillary sinus

As the sinus has the volume of small peas, 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.



The Mandible

The mandible is a bone of membranous origin but there are secondary cartilages that develop in it. At birth the mandible consists of two hemimandible separatedby sympheseal suture. The condylar cartilage will persist for long time but the coronoid cartilage and the cartilage of the angle of the mandible will disappear early and play no role in the mandibular growth. The sympheseal suture will disappear at two years of age. The condylar cartilage will contribute in the vertical and antero-posterior growth. The increase in size is due to apposition and resorption phenomena.

Transversal growth

After the first year, the sympheseal cartilage does not play any more role in the growth, only the apposition and resorption phenomena continue to manifest but they stop early, only the alveolar borders show thickening which accommodate the roots of the permanent teeth, in fact the increase in transverse dimension of the mandible results from its vertical growth because of its divergence toward the posterior, the transversal growth is therefore sensitive in the posterior part, particularly at the condyles which are more away from each other following the transversal growth of the cranial base.

Antero-posterior growth

1- Ramus of the mandible: it results in important apposition on its posterior border and resorption on the anterior border but less rapid than the apposition in a way that the ramus will move backward and become thicker.

2- Body of the mandible: the resorption of the anterior border of the ramus will increase the antero-posterior dimension of the body of the mandible.

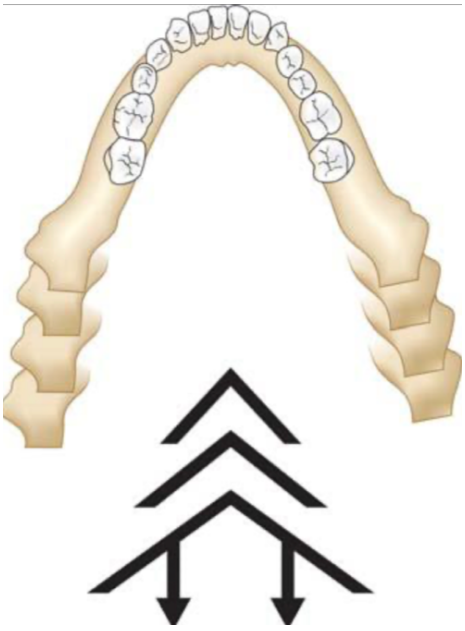
So, the inferior part of the ramus is therefore incorporated progressively in the body also an osteal apposition occurs during the first year of life particularly at the mental symphysis.

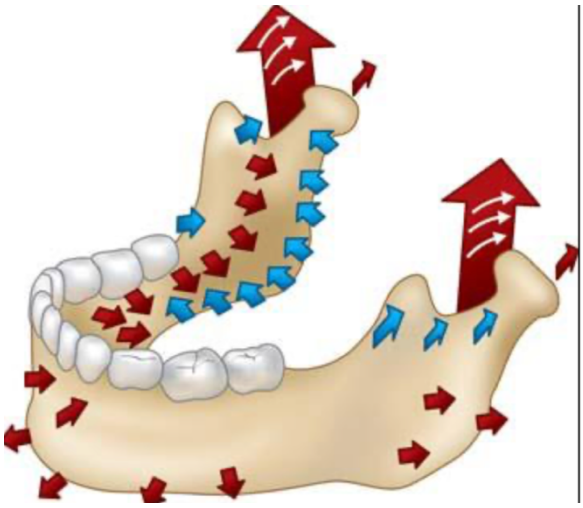
Vertical growth

1- Ramus of the mandible: at birth the ramus is very short, its size depending on the activity of the condylar cartilage that determines the vertical dimension at the same time as the total length of the mandible.

2- Body of the mandible: the vertical growth of the ramus will move away the body of the mandible from the maxilla in the space that is liberated there through the development of the alveolar process by osteal apposition jointly with the phenomena of teeth eruption. Little apposition during the first year occurs at the inferior border of the body of mandible.

Postnatal growth of the mandible follows a pattern intermediate between a neural and somatic pattern, although it follows the somatic pattern more closely than does the growth of the maxilla. Growth occurs at a steady rate of 2–3 mm per year in length of the body of the mandible until puberty when growth rates double. Mandibular growth slows to adult levels at around 17 years in girls and around 19 years in boys, although it may continue for longer.





Soft tissue growth

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

Growth of the lips

The lips trail behind the growth of the jaws before 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.

Lip thickness reaches its maximum during adolescence, then decreases to the point that in their 20s and 30s, some women consider loss of lip thickness a problem and seek treatment to increase it.

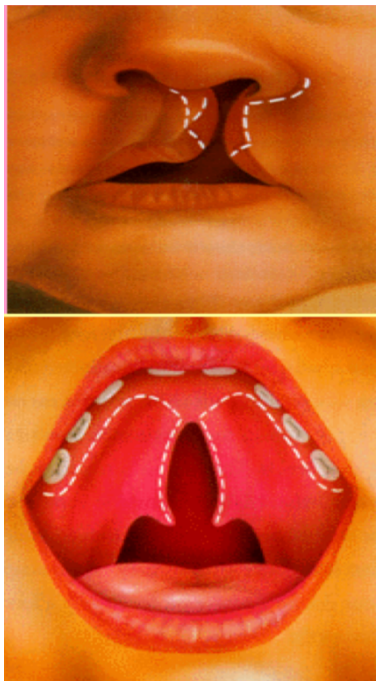
Growth of the nose

Growth of the nasal bone is complete at about age 10. 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.

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 animportant point in determining how much lip support should be provided by the teeth at the time orthodontic treatment typically ends in late adolescence. Changes in the facial soft tissues with aging, which also must be taken into consideration in planning orthodontic treatment.

Cleft lip and palate

It is the most common craniofacial anomaly, caused by failure of fusion between certain embryological processes during facial morphogenesis. 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 with each other or with primary palate 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 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 may be congenitally missing or malformed, and many atypically shaped supernumerary teeth may be present in the area of the cleft.

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 clefting 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.

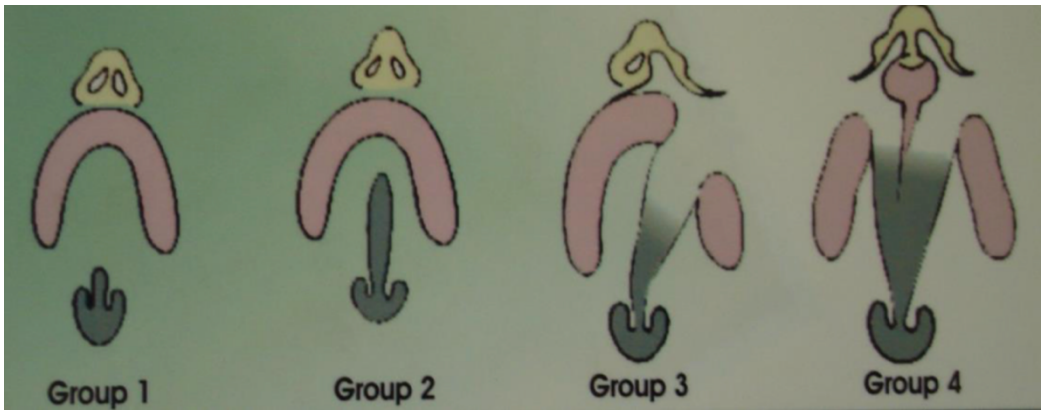
Cleft palate can be classified according to its severity as follows:

Class I: Cleft of soft palate (uvula)

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

Class III: Complete unilateral cleft palate

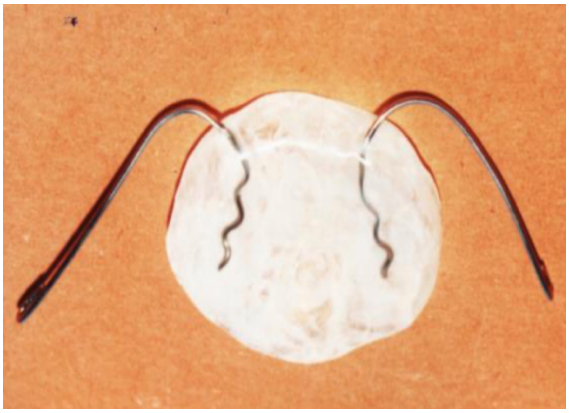
Class IV: Complete bilateral cleft palate



Treatment

Treatment of cleft lip and palate must be started as soon as possible after birth because of its physiological effect on the infant since it interferes with the natural feeding process, and its psychological trauma to the parents, this treatment of patients with cleft lip and / or palate is along and involved process, requiring

many stages of intervention by many different specialists, forming a cleft lip and palate team.



The involvement of the team, orthodontist starts a few days after the baby was born, with presurgical infant orthopedic treatment if applicable, (construction of baby feeding plate which assists the infant to suck and swallow the milk properly). Baby feeding plate is a piece of acrylic that disconnect between the oral and nasal cavities which are opened to each other through the cleft palate. This plate has advantage to help the two pieces of the palate to approximate toward each other (orthopedic movement).

Repair of the lip usually is performed within the first three months after birth, and the palate subsequently is repaired within the first year. The scar tissue created from these and other surgical procedures is considered responsible for variable degrees of maxillary growth inhibition which is commonly seen during subsequent growth. When the cleft involves the alveolar process, a bone graft may be necessary to restore the alveolar anatomy. Alveolar bone grafting usually is performed prior to the eruption of the permanent maxillary canine on the side of the cleft.

Phase I of orthodontic treatment, in preparation for the alveolar bone graft, may consist of expansion of the constricted maxilla and correction of any cross bites. Following alveolar bone grafting, and when the patient is in the permanent dentition, phase II of orthodontic treatment is performed to idealize the occlusion, or if a severe skeletal discrepancy is present, to prepare the arches for orthodontic surgery.