23 Cleft Lip and Alveolus

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Overview

Introduction

An isolated cleft lip is a relatively uncommon entity among the spectrum of the cleft-affected population. Cleft lip and alveolus occurred unilaterally (20%) and bilaterally (5%) among all the clefts in the US population.[1] Its clinical presentation may vary from microform to complete unilateral cleft of the lip that may extend into the alveolus and dental arch. The alveolus is a component of the primary palate and alveolar cleft results from maldevelopment of the frontonasal prominence.[2] Cleft of alveolus may have different severity patterns with no cleft of the alveolus or a little or a sizeable bony gap. Further, cleft lip and cleft alveolus have been subclassified based on the severity of cleft using the embryonic approach: (A) early embryonic period (4 to 7 weeks postconception) and (B) late embryonic period (7 to 12 weeks postconception). The early embryonic period defects are essentially fusion defects and are clinically seen as: (1) complete cleft lip, (2) complete cleft alveolus (extending to the incisive foramen), and (3) incomplete cleft alveolus (if the lip is normal or has a complete cleft). The late embryonic defects are due to disturbances in differentiation. These appear as: (1) Incomplete cleft lip, (2) submucous cleft lip, (3) hypoplastic lip, (4) incomplete cleft alveolus (if the lip has an incomplete/submucous cleft), (5) submucous cleft alveolus, and (6) hypoplastic alveolus.[3] Generally, alveolar clefts are located between the incisor and canine region (**Fig. 23.1**).

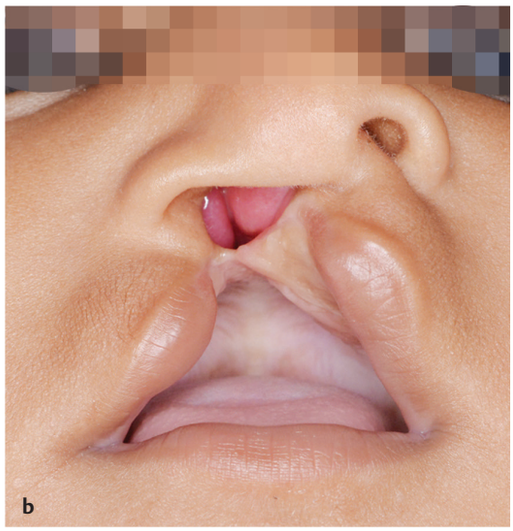
Features of Cleft Lip and Alveolus

The alveolar defect has a definite adverse effect on nasal symmetry particularly in unilateral cases. Even after an excellent primary correction, some residual asymmetry of the nasal base and nares persists. The residual deformity may also be present as a nasoalveolar fistula located at the cleft site visible only with a careful examination of the lip vestibule (**Fig. 23.2**). The persistent nasolabial fistula will allow chronic nasal regurgitation, which leads to chronic inflammation and nasal discharge.[2]

Orthodontic Considerations

The continued growth of the maxilla in the operated cleft lip and alveolus patients usually follows an average growth in transverse, vertical, and sagittal dimensions.[4] The dental anomalies in the cleft of the lip show a proportional trend according to cleft severity. The common dental anomalies in cleft lip and alveolus are the absence of cleft side lateral incisor, microdontia, and a supernumerary tooth.[5] The central incisors may present with hypoplastic or malformed enamel (**Fig. 23.3**). The maxillary lateral incisor is usually placed on the cleft's distal margin in the bony alveolus.

The benefits of cleft alveolar repair, are both aesthetic and functional (**Table 23.1**). Orthodontic aspects of cleft lip and alveolus are no different than treating a case of malocclusion with moderate crowding. The central incisor may be rotated and can be aligned if sufficient bone is available. The patient may present with a single tooth crossbite in the maxillary arch adjacent to the cleft site due to deficient bone. In such a situation, the teeth in crossbite can be tipped labially using a removable appliance. More severe forms may require comprehensive orthodontic treatment with or without bone graft. In large defects of the alveolus, comprehensive orthodontics could be integrated with an intraoral distraction device.



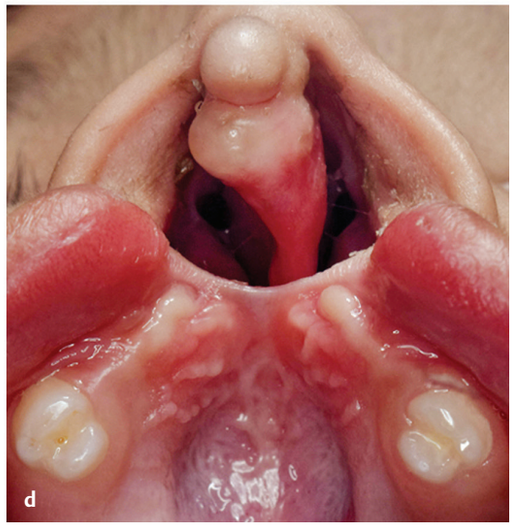


Fig. 23.1 Unoperated cleft of lip and alveolus. **(a, b)** Unilateral cleft lip and alveolus (*arrow*). **(c, d)** Bilateral cleft lip and alveolus. The nasal deformity can be seen in unilateral cleft lip and palate (UCLP) cases **(a, b)** on the affected side. Note the arrow pointing to Simonart's band **(a)**. Whereas in the bilateral cases, mostly the features are symmetrical.

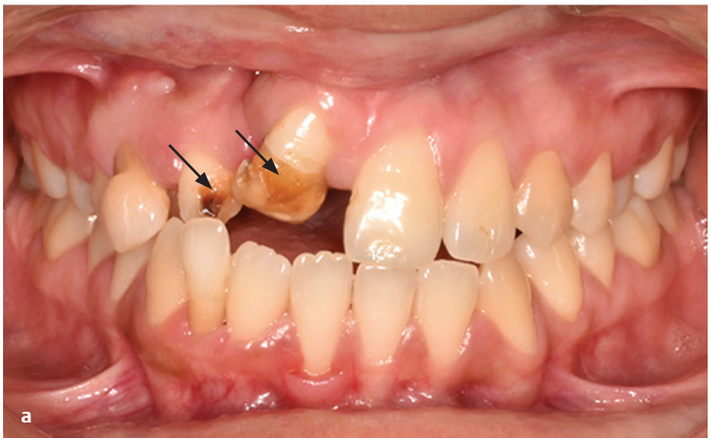


Fig. 23.2 **(a)** A patient with cleft lip and alveolus shows hypoplastic upper right central and lateral incisors and distally tipped crown into the cleft defect (*arrows*). **(b)** There is also a prealveolar fistula, which can be seen when the lip is lifted upward (*white arrow*). Asymptomatic fistula can be missed without diligent clinical examination.

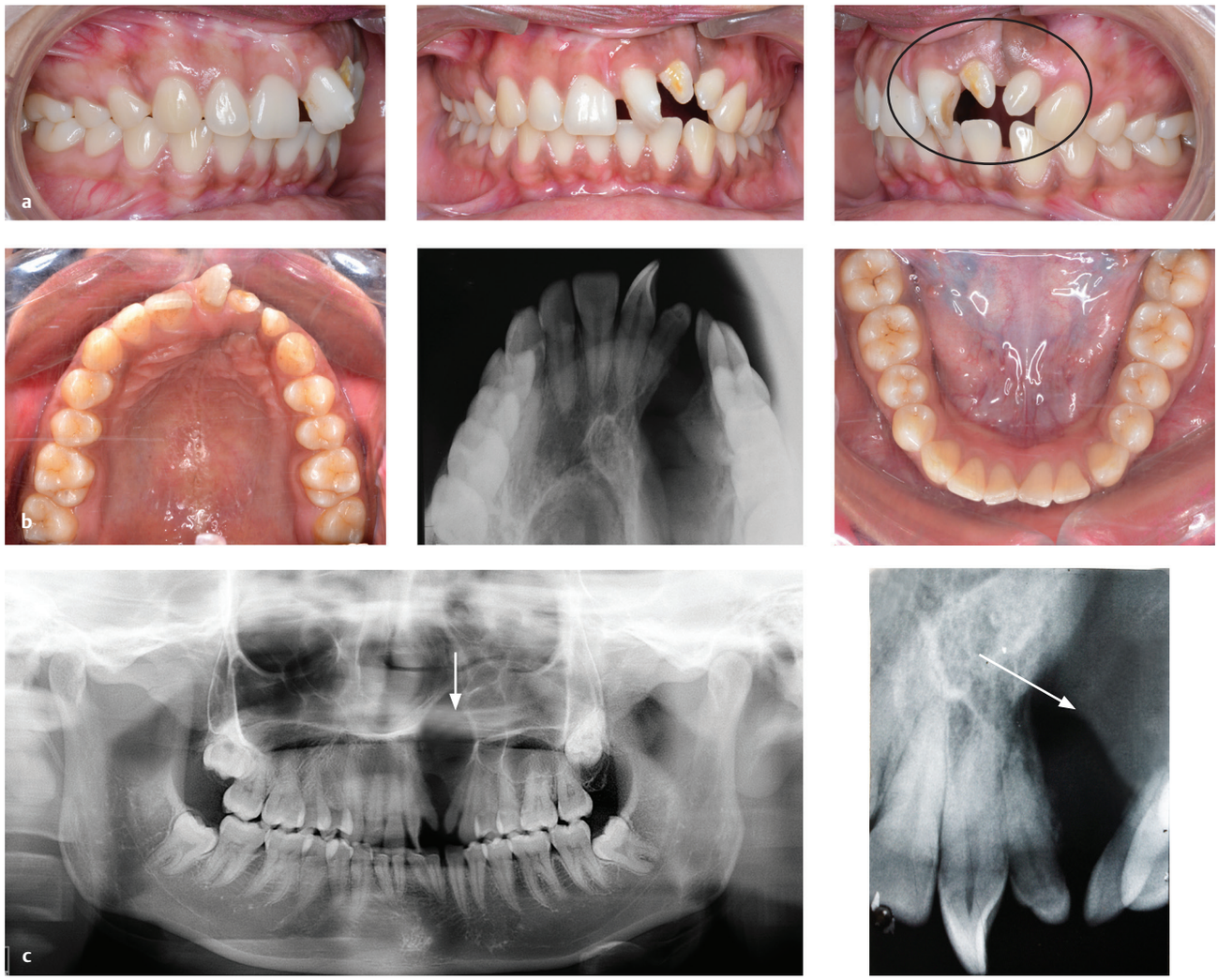


Fig. 23.3 The comprehensive treatment planning should include evaluating root form and alveolar bone around the cleft region. Occlusion of an adult patient with operated cleft lip and alveolus with no history of orthodontic treatment. **(a)** Buccal occlusion and dental arch forms are normal, but for cleft site dental malformations (*circle*). **(b)** Maxillary arch shows a rotated left central incisor and rudimentary microdontic cleft side lateral incisor with slender root. The mandibular arch shows mild crowding. **(c)** Orthopantomogram (OPG) and intraoral periapical (IOPA) X-rays are showing a large bony cleft defect (*arrows*) which requires secondary alveolar bone graft (SABG).

Table 23.1 Functional and aesthetic benefits of alveolar repair[2]

Functional	Aesthetic
Closure of nasolabial fistula	▪ Augmentation of the pyriform region
Establish the continuity and a stable maxillary dental arch	▪ Improved alar base support and asymmetry
Improved periodontal support of teeth adjacent to the cleft site	▪ Anatomical dental arch form and scope for normal appearance of dentition
Allowance for the eruption of teeth into the cleft site	
Enable orthodontic tooth movement	
Facilitates oral hygiene	
Improvement in speech	

■ Early Orthodontics

Early orthodontics aims to correct an anterior crossbite, which can be attained with conventional removable appliance having provision for Z spring. Alternatively, a slow expansion screw and buccal occlusal bite block that allows labial jumping of the teeth in crossbite can be used. A single or twin or more Z springs are fabricated, one for each tooth in the crossbite. The Z spring is made of a 23-gauge stainless-steel spring hard wire or 0.016″ AJ Wilcock wire. The spring is activated by opening the helix, and the free end of the spring should be placed parallel to the occlusal plane. Good retention of the appliance is critical since the springs tend to bounce back in the active state, dislodging the appliance. The spring(s) is activated

once every 3 weeks. Expansion screw with split Hawley appliance designed for the protraction of maxillary teeth is used in a schedule of slow expansion. The usual recommendation is one-quarter turn expansion/3–6 days. Patients are followed up every 3 weeks.

The anterior crossbite can also be corrected using fixed appliances, popularly called "2 × 4 appliance." This kind of appliance is effective, particularly when the teeth are rotated and palatally placed. Crossbite correction leading to attainment of normal overbite is self-retaining and does not require further retention appliance. However, the patient should be regularly followed up to evaluate for the development of any underlying skeletal malocclusion.

The evaluation of root morphology, bone support, rotation, and proximity of teeth with alveolar cleft is important in designing the appliance. The appliance design, biomechanics, and activation should not jeopardize the integrity of root bone support. These principles and clinical management are represented in **Case study 1** (**Fig. 23.4**).

■ Comprehensive Orthodontics

Comprehensive orthodontics in cleft lip and alveolus children would require a full arch fixed appliance treatment mostly as a nonextraction approach. The buccal occlusion in treated cleft lip and alveolus children is normal, and the treatment approach is essentially focused on alignment and aesthetic restoration of anterior maxillary dentition. Two major factors would influence treatment planning.

1. Presence of dental anomalies:
    - Space management to be considered for malformed incisors and missing or microdontic lateral incisor.

Case Studies

Case study 1 Orthodontic correction of an anterior crossbite in mixed dentition stage.

History
A 10-year-old young girl reported for orthodontic treatment. History revealed that the patient was born with a unilateral cleft lip and alveolus on the right side in a family with no previous presence of cleft and no significant medical history. The patient had undergone primary lip repair at the age of 1 year with no subsequent surgeries.
Clinical examination
The patient showed a convex facial profile with proportionate facial dimensions. The nasal tip was rounded, and the columellar length on the right side was smaller. On the cleft side, the nasal floor was lowered. There was a scar on the upper lip and a fair symmetry of cupid's bow and vermilion. The upper and lower lips were well balanced. There was no centric relation-centric occlusion (CR-CO) discrepancy or a functional shift (**Fig. 23.4a**).
The child was in a mixed dentition stage. The upper central incisors were rotated and retroclined. There was a mild anterior crossbite. Clinically, both upper lateral incisors were absent. The molars were in Class I relationship bilaterally. Mild crowding was present in the lower anterior region. The oral hygiene was satisfactory except for mild gingivitis in the lower anterior region.
Radiographic and cephalometric findings
The occlusal X-ray of the maxilla showed no other dental anomalies except congenital absence of the maxillary right lateral incisor. The most significant and foremost consideration was the presence of an alveolar cleft and insufficient alveolar bone support on the distal aspect of the right maxillary central incisor. This tooth showed a delayed root formation relative to the contralateral incisor. The cephalometric observations were those of a vertical growth tendency of the mandible, retroclined upper incisors, and proclined lower incisors (**Fig. 23.4a**).
Treatment approach
The most critical and immediate orthodontic considerations were the correction of anterior crossbite without disturbing the mesiodistal inclination of the cleft-side central incisor. The treatment objectives included restraining the growth of the mandible with orthopaedic appliance till completion of pubertal spurt. The skeletal growth modification is aimed to avoid the need for future orthognathic surgery or lessen the severity of the skeletal maxilla–mandibular discrepancy. Alveolar bone graft at an appropriate age was suggested and review for orthodontic space closure for the missing maxillary lateral incisor.
Treatment progress
A Hawley's type of removable appliance with two Z springs and a buccal platform was considered an appropriate appliance. The Z springs were fabricated with 0.018″ AJ Wilcock wire. The appliance was discontinued once the anterior crossbite was corrected. The child was advised to wear a chin cup appliance delivering a force of 400 g/side for 12 hours per day. A passive lower translingual arch appliance was provided to prevent loss of arch length. The patient is under review for secondary alveolar bone graft (SABG) and further comprehensive orthodontics at an appropriate age (**Fig. 23.4b, c**).

Fig. 23.4 A case of unilateral cleft lip and alveolus (UCLA) right side. **(a)** Pretreatment records: **(i)** Extraoral photographs showing competent lips with secondary lip and nose deformities. **(ii, iii)** Intraoral photographs showing mixed dentition and negative overjet and missing right upper lateral incisor. The maxillary occlusal view showing deficient alveolar bone at the cleft site. **(iv)** Profile photograph and lateral cephalogram showing Class I skeletal base and vertical growth pattern. *(Continued)*

Fig. 23.4 *(Continued)* **(b)** Phase I treatment stages: **(i)** Construction of Z spring appliance along with posterior bite plate. The intraoral photograph is showing the appliance in situ. **(ii, iii)** After correction of anterior crossbite by proclination of the upper incisor. A passive lingual arch is provided in the lower arch **(iv)** with chin cup, to restrain mandibular growth. *(Continued)*

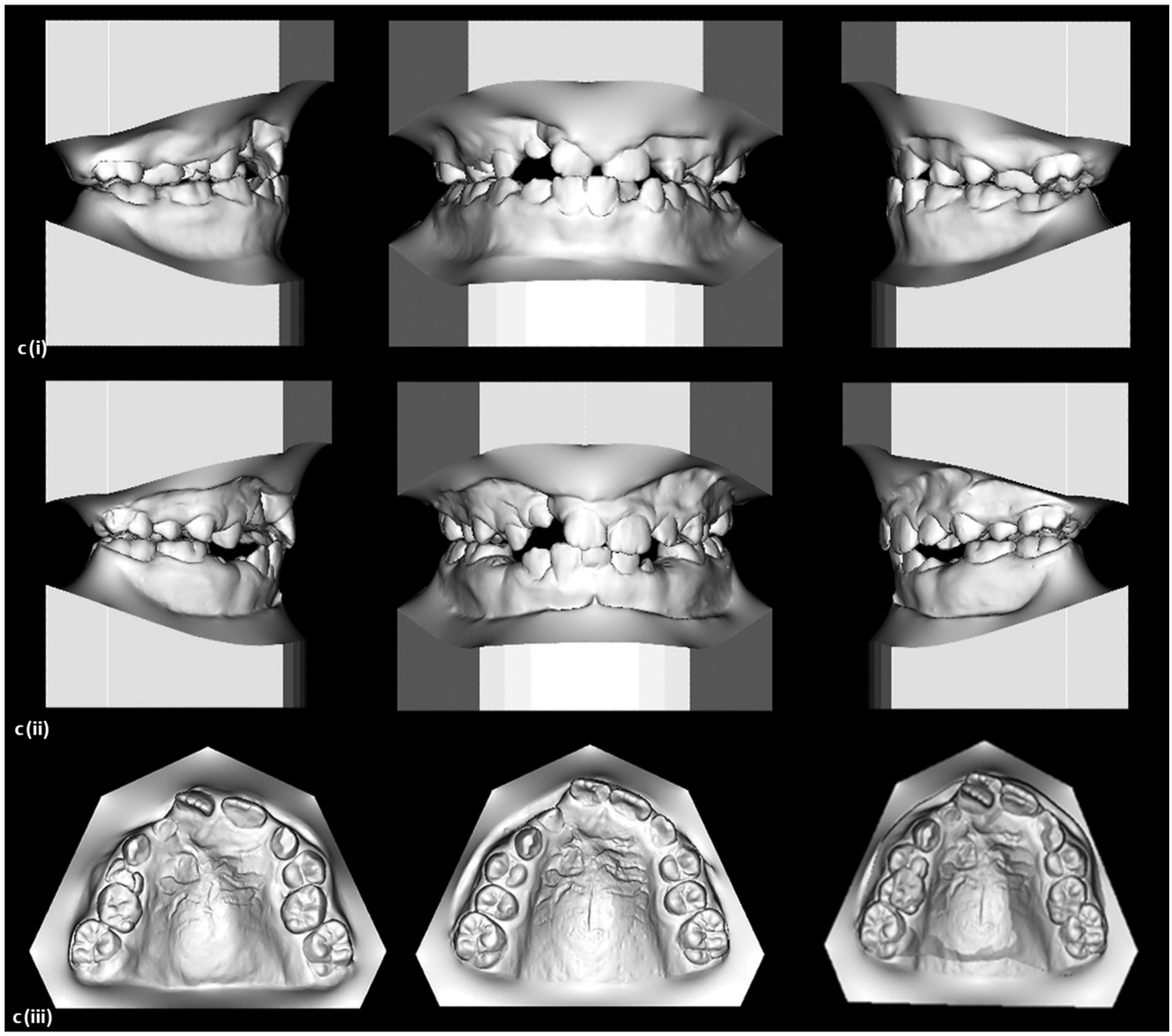


Fig. 23.4 *(Continued)* **(c) (i)** Pretreatment study model. **(ii)** Study models after crossbite ccorrection. **(iii)** Pre- and post crossbite correction maxillary models with three-dimensional model superimposition.

2. Biomechanics for teeth in close proximity to alveolar cleft:
    - Management without secondary alveolar bone graft (SABG).
    - Management with SABG.

Another important consideration will be issues of bond failure on hypoplastic teeth. A major consideration in treatment planning will include a detailed review of the morphology of crowns of the teeth and whether these are suitable for bonding with conventional method or would require a modification in the bonding technique and/or attachment. A microdontic or rudimentary crown is of insufficient width to accommodate conventional bracket size. In such situations, a single siamese bracket may be used.

The intraoral periapical (IOPA) X-rays are useful in evaluating root morphology, size, and proximity with alveolar cleft. IOPA X-ray is more reliable and has the least distortion compared to orthopantomogram (OPG), which may show significant blurring and magnification for midline dental structures.

Several considerations like crown morphology, root morphology and length, and patient's willingness to accept a prosthesis or a restored tooth will influence the decision to retain or extract a microdontic tooth. **Case study 2** (**Fig. 23.5**) represents biomechanics and treatment steps

Case study 2 Management of a unilateral cleft lip and alveolus patient with hypoplastic and microdontic incisors without alveolar bone graft (ABG).

History

A boy with unilateral cleft lip and alveolus was born to a mother who had a complete unilateral cleft lip and palate (UCLP). His mother was a UCLP patient and earlier treated by the author. The boy had undergone primary lip repair at the age of 5 months with no subsequent surgeries. During early mixed dentition, his orthodontics was limited to a removable appliance therapy to correct anterior crossbite using Z spring at the age of 8 years. His contralateral incisor failed to erupt. Consequently, the right upper lateral incisor was subjected to surgical exposure to facilitate its orthodontic guided eruption.

Clinical examination

At the age of 14, this boy showed a grossly symmetric mesoprosopic face with mild retrusion of the upper lip. Facial heights were proportionate with a prominent chin. The nasal tip was rounded and deviated toward the right side. The ala on the left side was depressed. A visible scar on the left of the lip consequent to primary surgery was evident. He has mild asymmetry of vermilion on the left side. The lips were competent. There were no abnormal functional mandibular movements or signs of a temporomandibular joint (TMJ) disorder.

He was in the permanent dentition stage with a microdontic left upper lateral incisor. The molars and canines were in superClass I in relations to lower teeth. The overjet and overbite were adequate. The left upper central incisor was hypoplastic and was in edge-to-edge relation with lower incisors. The left upper first molar was in crossbite. The arches were symmetrical, with a mild crowding in the upper and lower anterior segment. Oral hygiene was satisfactory (**Fig. 23.5a**, **b**).

Radiographic findings

Radiographs showed a microdontic left maxillary lateral incisor with adequate length and excellent bone support, and deficient alveolar bone height. There was no radiological evidence of residual cleft in the alveolus. Lateral cephalogram shows vertical growth pattern and normally inclined upper and lower incisors with retrusive upper lips (**Fig. 23.5b**).

Orthodontic considerations and treatment approach

With minimal crowding in the lower arch, the case was approached with nonextraction treatment. It was possible to achieve optimum overjet and overbite and align the arches by relieving the crowding. Aesthetic rehabilitation of malformed central and lateral incisors necessitated intentional endodontic therapy of cleft-side rudimentary lateral incisor. The prosthodontic consult was obtained to improve smile aesthetics for the rehabilitation of the malformed incisors.

Treatment progress

Comprehensive nonextraction treatment with full fixed appliance was undertaken with preadjusted Roth appliance system. Initial levelling alignment was done using 0.014″ and 0.016″ NiTi wires. The lower arch crowding was relieved using compressed vertical loops made with 0.016″ SS wire. After levelling and alignment of both upper and lower arches were achieved, the rudimentary cleft-side lateral incisor was moved in the middle of available mesiodistal arch length. At this stage, the upper left lateral incisor was endodontically treated. The left central incisor received a metal fused porcelain crown and an all-porcelain crown was provided on the lateral incisor (**Fig. 23.5c**).

The treatment duration was 1 year and 6 months. A flexible lower lingual wire retainer and a Hawley retainer without a labial bow in the upper arch were the appliance of choice for the next 1 year. Hawley retainer primarily served to prevent the transverse collapse of the maxilla (**Fig. 23.5d**). The patient is now 18 years old and planning to have a revision of the lip and nose.

Fig. 23.5 **(a)** Secondary deformities of lip and nose in a young boy of an operated case of a unilateral cleft lip and alveolus of left side. He has scar on the left upper lip, deviated and rounded nasal tip, and depressed ala of the nose. *(Continued)*

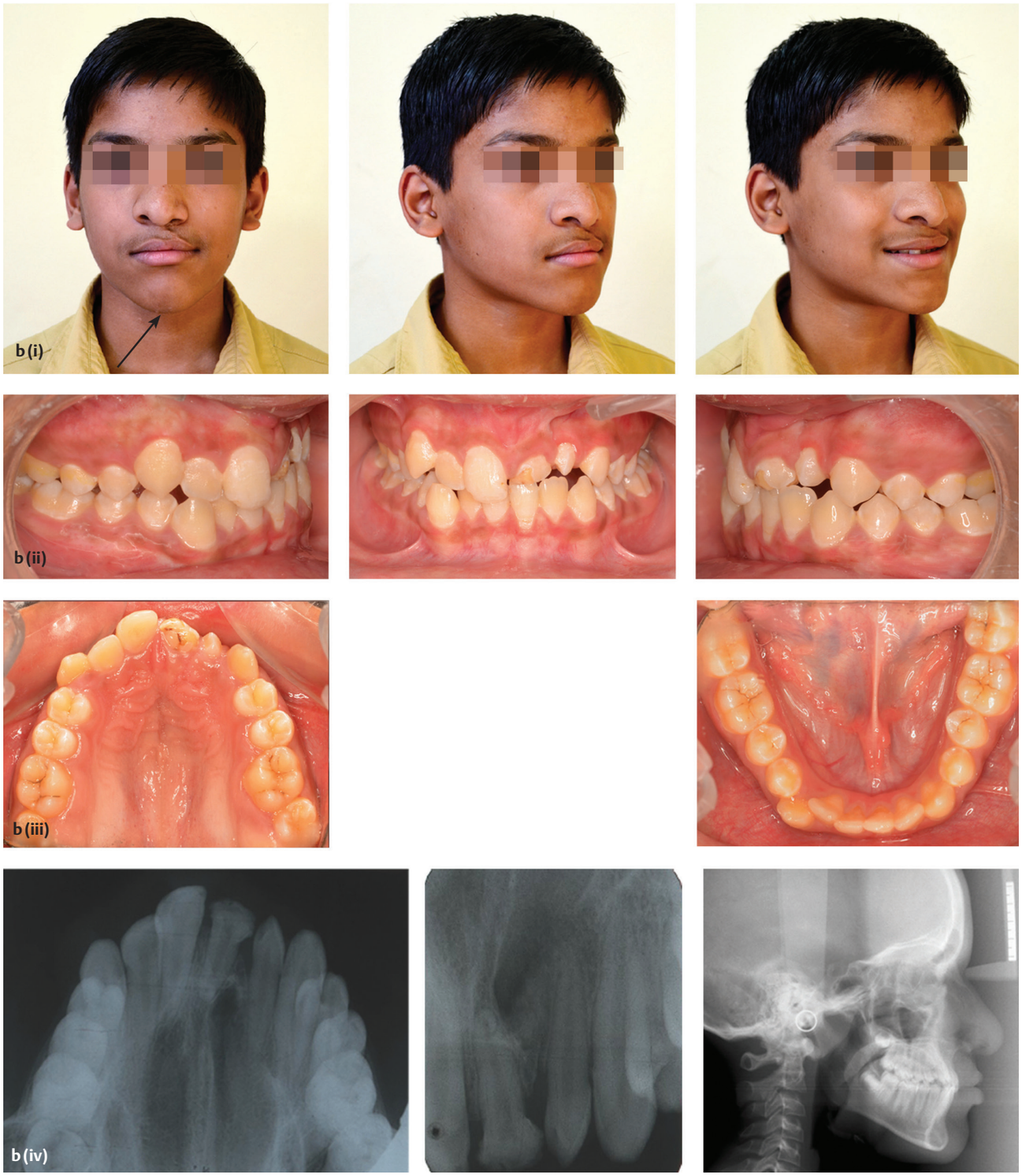


Fig. 23.5 *(Continued)* **(b)** Pretreatment records: **(i)** Extraoral photographs showing competent lips and mild retrusion of the upper lip with a prominent chin (*arrow*). **(ii, iii)** Intraoral photographs showing hypoplastic left maxillary central incisor and microdontic left lateral incisor, lower arch crowding, and mild marginal gingivitis. **(iv)** Radiographs showing microdontic left maxillary lateral incisor with adequate root length and excellent bone support. The alveolar bone is deficient at the alveolar crest. A lateral cephalogram is showing vertical growth pattern and normal inclined upper and lower incisors. *(Continued)*

Fig. 23.5 *(Continued)* **(c)** Treatment stages: **(i)** Pretreatment, **(ii)** levelling and alignment of upper and lower arches, **(iii)** lower arch alignment, and **(iv)** debonded upper and lower arches. *(Continued)*

in managing a child with cleft of lip and alveolus who did not require a bone graft. His microdontic lateral incisor required endodontic treatment for full crown prosthesis, and his malformed central incisor could be treated with aesthetic restoration.

Orthodontics for the large alveolar cleft should follow the principles of the SABG. Secondary bone grafting can repair the cleft alveolus without any effects on maxillary growth. Grafted cancellous bone fills in the residual alveolar cleft and is integrated with the adjacent bone, becoming indistinguishable in radiographic images after an average period of 3 months. The SABG helps to align the rotated incisor adjacent to the cleft site. It creates a periodontium that usually maintains an interdental bone septum of suitable height. The SABG is discussed in detail in Chapter 22. **Case study 3** (**Fig. 23.6**) is another interesting case of the rudimentary lateral incisor and a small alveolar cleft which were managed with comprehensive orthodontics, the SABG in maxillary lateral incisor region, and aesthetic restoration of the rudimentary lateral incisor.

Fig. 23.5 *(Continued)* **(d)** Post-treatment records: **(i)** Extraoral photographs show improved smile aesthetics. **(ii, iii)** Intraoral photographs show optimum overjet and overbite and well-aligned upper and lower arches. Note endodontically treated left lateral incisor and crowns on the left central and lateral incisor. **(iv)** Cephalogram and orthopantomogram (OPG) show optimum upper and lower incisor position.

Case study 3 Orthodontic management of unilateral cleft lip and alveolus with microdontic lateral incisor and alveolar bone graft (ABG).

History

A 15-year-old girl with a history of operated unilateral cleft lip and alveolus (R) reported to take second opinion about missing right upper lateral incisor which appeared rudimentary on intraoral X-ray. Previous radiographs taken at the age of 6 years and later at 13 years showed the presence of upper right deciduous canine and lateral incisor, normally erupting canine, and a tiny developing lateral incisor. A small alveolar cleft distal to right central incisor was seen.

Clinical examination

Examination of her face showed secondary lip and nose deformities on the right side. Intraoral examination revealed a normal status of teeth eruption for her age but for the teeth in the right anterior maxillary segment showing delayed eruption.

Treatment approach and progress

At this stage she was advised extraction of deciduous teeth, i.e., right maxillary deciduous canine and lateral incisor, and alignment of the arches with fixed appliance. Plan was to keep lateral incisor under observation which showed spontaneous eruption. Full fixed appliance treatment was initiated to resolve crowding and overjet. The alignment of the maxillary arch was done using sectional NiTi archwire. Secondary alveolar bone graft (SABG) was performed to close the alveolar defect. Intraoral periapical (IOPA) X-ray was taken 3 months after SABG to assess for its success. Newly grafted bone covered more than two-thirds of the roots adjacent to the cleft defect (Bergland score I) (**Fig. 23.6b**).

Following the successful SABG, the rudimentary tooth was bonded and aligned initially using light NiTi wires followed by rigid stainless-steel wires. At this stage, the patient was concerned about her secondary deformities of lip and nose. The ala was widened and depressed on the right side. The asymmetry of vermilion and scars on the right upper lip were present. The lip and nose revision was recommended. The scars on the upper lip and nasal symmetry improved after revision surgery (**Fig. 23.6c**).

The right upper supernumerary tooth was treated with the aesthetic restoration procedure to simulate lateral incisor after debonding. Since lower premolar extractions were not performed, the molar was finished in half cusp Class II molar and canine relation on the right side and Class I molar and canine relation on the left side. The radiographs show good root parallelism and optimal upper and lower incisor position over the basal bone with a well-balanced facial profile. The patient was given Hawley's retainer in the upper arch and bonded flexible spiral wire (FSW) retainer in the lower arch (**Fig. 23.6d**). On follow-up appointments, the patient showed a stable occlusion (**Fig. 23.6e, f**).The occlusion showed Class I canine and excellent interdigitation of the buccal segment teeth on the left side. The right side occlusion could have been attained in a similar fashion with Class II buccal occlusion after extraction of the rudimentary maxillary lateral incisor and orthodontic space closure in the maxillary arch after alveolar bone graft. This option of treatment was not acceptable to the child's mother, a dentist herself. The buccal occlusion on the right side has remained stable during 2 years of follow-up.

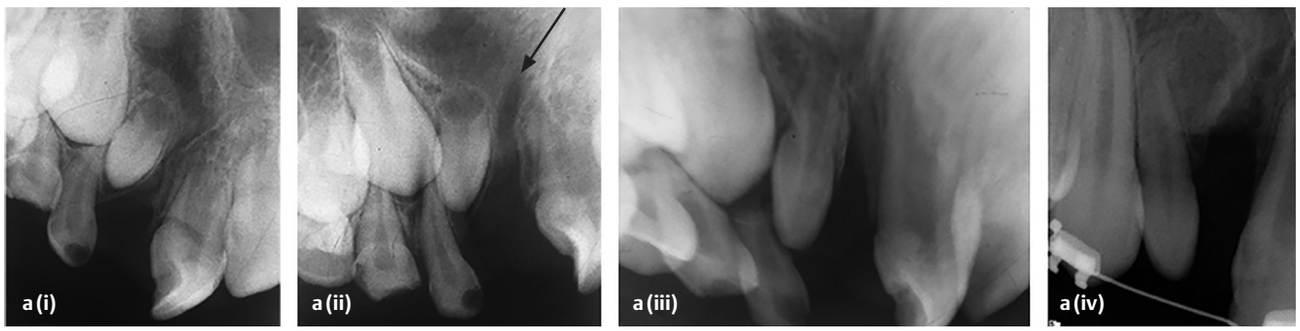


Fig. 23.6 **(a)** Intraoral periapical (IOPA) X-ray of the right maxillary region in a 6-year-old girl with unilateral cleft lip and alveolus (right) shows a rudimentary lateral incisor next to a tiny alveolar cleft defect (*arrow*). **(i)** Developing canine and retained deciduous lateral incisor are seen. **(ii)** The radiograph taken at different angles shows the severity of the cleft defect. At this stage, it was decided to wait and monitor the formation of the rudimentary lateral incisor or the supernumerary tooth. **(iii)** IOPA X-ray of the cleft site taken at the age of 13 years shows that rudimentary crown is now developed, migrated in occlusion direction with root formation. A retained upper right deciduous lateral incisor and canine are seen. The eruption of the rudimentary tooth is distal to the cleft defect. **(iv)** The deciduous lateral incisor and canine were extracted, and the child was left for a follow-up to evaluate the status of developing a rudimentary crown. Both the maxillary canine and rudimentary tooth showed normal eruption. The root of the rudimentary tooth is tiny, cylindrical, and shows dilacerations at the apical part. In the meantime, it was decided to initiate orthodontic treatment with a fixed appliance to align the upper and lower arches and consider secondary alveolar bone graft mesial to the erupting rudimentary lateral incisor. The maxillary canine was included in the fixed appliance arch wire. However, the rudimentary tooth was not included, being close to the alveolar defect. *(Continued)*

Fig. 23.6 *(Continued)* **(b)** Progress records at 15 years. **(i)** Facial photographs show a proportionate face with secondary lip and nose deformities on the right side. **(ii)** Intraoral photographs showing a defect of upper alveolus on the right side, and rudimentary tooth at the site of the missing upper right lateral incisor. **(iii, iv)** Occlusal photographs show asymmetric upper arch and segmental alignment. The lower arch is well aligned and symmetrical. The maxillary canine was included in the arch. However, the rudimentary tooth was not included as it was close to the alveolar defect. **(v)** The child underwent secondary alveolar bone graft. Intraoral periapical (IOPA) X-ray 3 months after the graft shows a successful graft with a Bergland score of 1. **(vi)** 6 months after the graft X-ray shows excellent bone architecture after remodeling. *(Continued)*

Fig. 23.6 *(Continued)* **(c)** Progress after secondary alveolar bone graft (SABG). **(i, ii)** Orthodontic treatment stages showing the alignment of the rudimentary tooth, initially using light NiTi wires followed by rigid stainless-steel wires. **(iii)** Extraoral photographs show secondary deformities of the lip and nose. The ala is widened and depressed on the right side. The asymmetry of vermilion and scars on the right upper lip are present. *(Continued)*

Fig. 23.6 *(Continued)* **(d)** Post-treatment records. **(i)** Extraoral photographs after lip and nose revision showing improved lip and nasal symmetry. **(ii)** Intraoral photographs showing the aesthetic build-up of right upper supernumerary tooth to resemble the lateral incisor with half cusp Class II molar and canine relation on the right side and Class I molar and canine relation on the left side. **(iii)** Arches are well aligned. A flexible spiral wire (FSW) retainer in the lower anterior has been provided. **(iv, v)** The radiographs show good root parallelism and optimal upper and lower incisor position over the basal bone, and a well-balanced facial profile. *(Continued)*

Fig. 23.6 *(Continued)* **(e)** Records at 1-year follow-up showing well-maintained occlusion and intact flexible spiral wire (FSW) retainers in the lower anterior teeth. *(Continued)*

Fig. 23.6 *(Continued)* **(f)** Records at 2-year follow-up showing well-maintained occlusion and intact flexible spiral wire (FSW) in the lower anterior teeth. The composite build-up with respect to right upper supernumerary tooth was substituted with all-ceramic crown enhancing the smile aesthetics. The radiograph shows good root parallelism, upper and lower incisor positions are maintained, and the grafted bone at the cleft site is stable. (Some parts of the figure are cited with permission from Kharbanda OP and Monga N. Orthodontics: Diagnosis and Management of Malocclusion and Dentofacial Deformities. 3rd ed, Elsevier India; 2019. pp 1158–59: Fig. 75.22.) *(Continued)*

Alveolar Bone Graft and Dentoalveolar Distraction

The success rate of the alveolar bone graft (ABG) performed after the canine eruption is lower compared to its nonerupted state. The other factors that may contribute to the high failure rate of the ABG include older age, wide alveolar cleft, and paucity of soft tissue. The closure of wide alveolar clefts is challenging because of the difficulty in achieving complete closure by using locally attached gingiva.[6] The deficiency of soft tissue in the cleft region may cause postoperative wound dehiscence and infection, leading to bone graft failure. Revision bone grafts have higher failure rates, which may be due to the scar tissue.[7] In such cases, the width of alveolar bone can be reduced by the local bone–teeth transport system called segmental dentoalveolar distraction.[6,8] A latency period of 3–5 days is scheduled after osteotomy of dentoalveolar segments. The distal segment of the dental arch is distracted and transported toward the cleft or defect, by using a tooth-borne intraoral distraction device (**Fig. 23.7**). The alveoli and gingivae on both ends of the cleft or defect get approximated after distraction osteogenesis. The need for extensive alveolar bone grafting is eliminated.[6]

Unlike conventional internal rigid distractors that move the bone segment linearly, an innovative technique involved bone transport in a curved path respecting the dental arch. This technique can achieve severe alveolar bone defects closure predictably. Curved distraction promotes a good dental arch form in coordination with the bony bases of its antagonist, thus obtaining a better nasal and lip projection. It also enables oronasal closure, improving muscular dynamics, restoring function, and increasing dental aesthetics[7] (**Fig. 23.8**).

Alveolar distraction promotes bony segments approximation leading to osteogenesis and stable results by closing the extensive defect. Residual minor defects can be managed easily with conventional osteoplasty.[8] This technique can be applied to both unilateral and bilateral clefts.[9] The maxillary canine substitutes the missing lateral incisor. In the case of multiple missing teeth in a distracting area, prosthetic replacement or autotransplantation can be done.[9] Distraction osteogenesis encourages bone and soft tissue growth and thus helps repair large alveolar cleft predictably. The technique is tolerated very well by the patient.[10,11]

The severity of the alveolar defect and nature of malocclusion, and coexistence of dental anomalies would influence the plan and course of the treatment of cleft lip and alveolus anomaly. These patients do not offer a significant challenge in the treatment of their malocclusion. Most children born with a cleft of the lip and alveolus can be treated to optimum aesthetics.

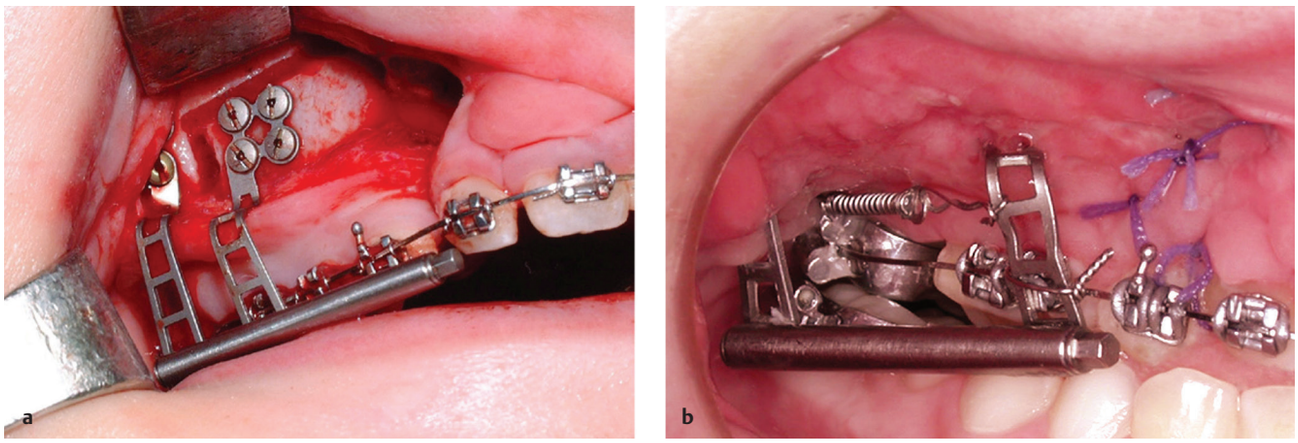


Fig. 23.7 **(a)** Intraoral distraction device and segmental osteotomy for interdental distraction osteogenesis. **(b)** The distraction device is used as a temporary anchorage device for postdistraction orthodontic tooth movement. A coil spring is attached to the first molar from the distractor to mesialize the molar into the distracted space. (Reproduced with permission from Liou EJW, Chen PKT. Intraoral distraction of segmental osteotomies and miniscrews in management of alveolar cleft. Semin Orthod 2009;15:257–267.)

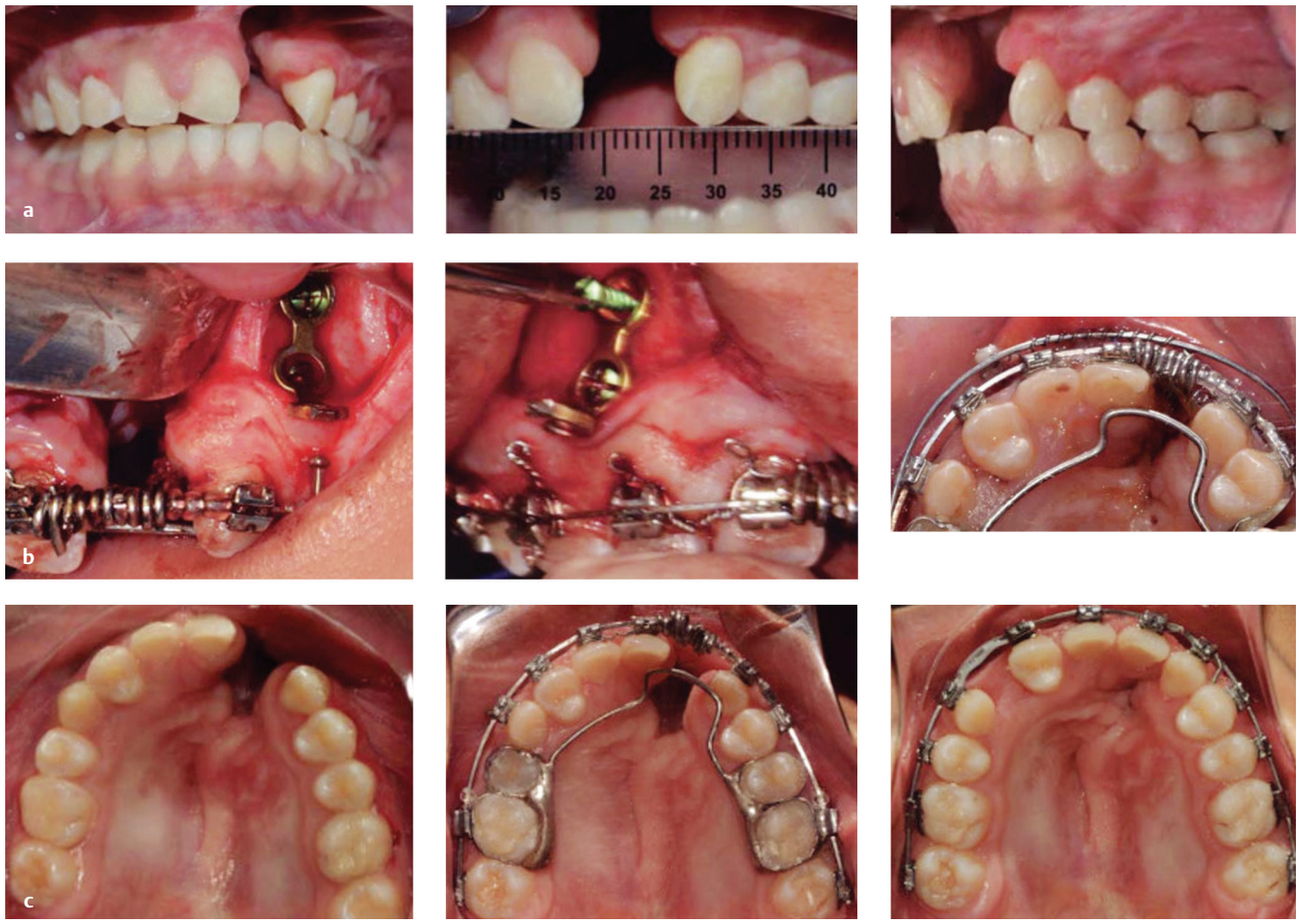


Fig. 23.8 **(a)** Patient with unilateral cleft alveolus measuring 9 mm between the cleft segment. The alveolar transport utilizing bone anchorage and sliding (ATBAS) was planned. **(b)** Under general anesthesia, the inter-radicular osteotomy was performed between teeth #13 and 14 and the subapical osteotomy of teeth #14, 11, and 21. Additionally, the supernumerary tooth located on the nasal floor was carefully removed. In the transported segment and the upper left segment, two fixation plates of the 2.0 System were placed that were modified at their end to hold the closed coil springs. The auxiliary labial arch is a guide for the closed coil anchored to the modified plates. After a latency period of 3 days, distraction was performed. The 9-mm alveolar defect was closed in 10 days at a rate of 0.9 mm per day using the ATBAS and a post-bone transport bone graft. **(c)** Maxillary occlusal view showing pretreatment, predistraction, and postdistraction phase. (Source: Reproduced with permission from Lara et al.[7])

Key Points

- Operated cases of cleft lip and alveolus (CLA) do not show significant adverse effects on the growth of the maxilla.
- Operated cases of unilateral cleft lip and alveolus show a minor alteration in alveolar bone and teeth position.
- The common dental anomalies in cleft lip and alveolus patients are: agenesis of the cleft-side lateral incisor, microdontic lateral incisor, enamel hypoplasia, and supernumerary teeth.
- If the cleft segment is broad, then the teeth adjacent to it may show rotations and pose a problem during de-rotation and alignment. In such cases, the SABG should be considered before dental alignment.
- The hypoplastic and malformed teeth may require endodontic treatment. These teeth can be restored for aesthetics with a composite restoration/laminate or a crown.
- The decision to retain a microdontic lateral incisor or extract will depend on various factors: the root length, bone support, and restorable crown structure. Orthodontic space closure for missing lateral incisor(s) is preferred over space maintenance and prosthetic rehabilitation.

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