

Orthodontic Treatment of Patients with Cleft Lip and Palate-3

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Received: January 04, 2020; Published: January 22, 2020

Abstract

Introduction: A child with cleft lip and palate has a defect which can disturb the appearance of individual and speech communication because of the various location of cleft lip and palate within the oral cavity and face region. It drastically affects the growth of the individual and causes esthetic, functional, and psychological disorders. Clefts occur in the embryonic period of intrauterine life present multifactorial etiology associated with genetic and environmental factors. The rehabilitation of clefts involves interdisciplinary approaches such as plastic lip surgery, palatal surgery, secondary alveolar bone grafting as primary surgeries from age 3 to 12 months followed by maxillofacial surgery, orthodontic intervention and speech therapy.

Aim of the Study: The study aims to understand the orthodontic treatment protocol of children with cleft lip and palate.

Methodology: The review is comprehensive research of PUBMED from the year 1993 to 2012.

Conclusion: Cleft lip and palate are one of the most prevalent malformation worldwide and considered to be one relevant health problem by the World Health Organization. Hence the treatment of cleft lip and palate should be initiated soon after the birth and continues up to adulthood. Rehabilitation of cleft involves an interdisciplinary approach. The orthodontic intervention of clefts follows the same principles as an individual without clefts. The protocol includes for intervention of clefts should be consistent, simplified and prioritizing approached which have significant impact on final outcome. The orthodontic intervention of clefts at an early age is avoided due to poor stability, which makes treatment more cumbersome for both parent and child.

Keywords: Cleft Lip; Cleft Palate; Orthodontic Intervention

Morphological and functional abnormalities in children with cleft lip and palate

The most common functional abnormality encountered by an infant is breastfeeding. The presence of cleft lip and palate alter the feeding process. More complex the cleft is greater the difficulty for infant to extract milk directly. Due to the presence of negative intraoral pressure, the swallowing reflex is ineffective up to a great extent. The cleft of the lip makes the lip sealing inadequate to grasp the breast. In this situation, the lip seal can be achieved using a mother's assistant. Similarly, the cleft affecting the palate, the child is unable to apply negative pressure to extract milk. Thus, breastfeeding depends on mother's attempt and infant's adaptation to it. The mother may experience some difficulty depending on the location, type, and extent of cleft, yet breastfeeding should be encouraged since it is important in developing a child's immunity in the first month of life [1,2].

When breastfeeding is not feasible, the mother is instructed to use a bottle of latex nipple should have an orthodontic shape with 0.8 to 1mm orifice), disposable cups or spoons. A feeding obturator helps restore separation between oral and nasal cavities. Infant should be positioned vertically during feeding, reduces the risk of choking and milk reflux to the nasal cavity [1].

Communication between oral and nasal cavity make the infant more susceptible to ear infections, inappropriate filtering, and heating of inspired air leads to airway infection, common cold, rhinopharyngitis, pharyngotonsillitis, bronchitis, bronchopneumonia. Food reflux may lead to otitis media and conductive hearing loss due to the accumulation of secretion in the middle ear [1].

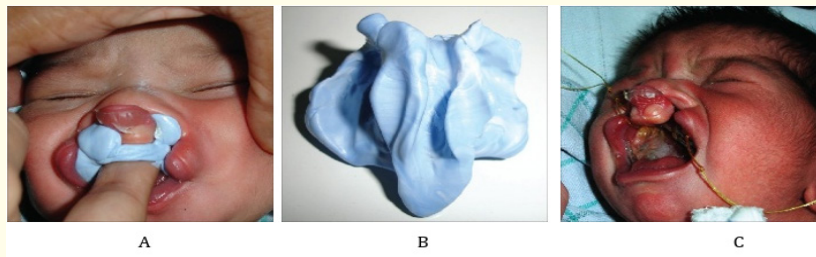


Figure 1: Image showing (A) and (B) Impression making an impression for obturator (C) Obturator in place [12].

The morphological anomalies may be present in the form of alteration in deciduous dentition at the cleft area, especially later incisor [3]. The newborn may present with a gingival and palatal cyst of newborn, natal and neonatal teeth at the region of cleft most commonly lateral incisor or supernumerary teeth [1,4].

Delayed tooth eruption may be present in the cleft region, which may delay up to two years. Dental anomalies of number, shape (Peg-shaped lateral incisor), structure and position are common, which in turn lead to greater dental biofilm accumulation and consequently to dental caries [3,5]. Ectopic eruption of permanent maxillary first molar is seen related to smaller anteroposterior length and retro positioning of the maxilla in relation to the cranial base. Thus, the oral rehabilitation of children with cleft lip and palate is directly related to the oral condition and respective repair surgery and correction for a satisfactory outcome. Diet counseling and basic oral hygiene at the initial stages are important for further intervention [6].

Orthodontic malocclusion in children with cleft lip and palate

The malocclusions associated with cleft presents complexities which differ from malocclusion present in individuals without clefts. A complete cleft lip and palate represents two separate inter/intra arch malocclusion such as:

Dental anomalies and mispositioning [7,8]:

- Contra-angulated and rotated maxillary central incisors, the crown turned towards the distal side of cleft space.
- Excessive mesial angulation of maxillary canines with the crown turned towards cleft space representing Class II sagittal relationship even in the presence of class III skeletal pattern.
- Deviation of maxillary midline towards the affected side.
- Deficient sagittal and transverse maxillary growth leads to crowding.
- Agenesis of maxillary lateral incisor and presence of supernumerary lateral incisor distal.
- Hypodontia of maxillary and mandibular second premolars and third molar.



Figure 2: An alveolar bone defect in the cleft region [9].

Bone defect of the alveolar ridge

The primary plastic surgeries are confined to correct the morphological and palatal soft tissue defects in early childhood, but the bony defect persists. These bony defects may hinder in tooth movement due to the risk of dehiscence and fenestration in teeth adjacent to cleft. The orthodontic intervention involves leveling of the maxillary arch with contra-angulation of maxillary central incisor and over-angulation of maxillary canine, adjacent to cleft [9].

Sagittal maxillary deficiency

A marked restriction of maxillary anteroposterior growth is seen in case of complete unilateral cleft lip and palate usually after primary plastic surgery. It is due to tension in reconstructed lip and scar formed by cheiloplasty, which restricts the anterior maxillary growth. This ultimately causes skeletal Class III malocclusion and anterior crossbite [10].

Transverse deficiency

The reduced transverse dimension of the maxillary dental arch is due to the absence of mid-palatal suture. The early palatoplasty contributes more to this. Posterior crossbite is often seen in complete clefts, which further requires expansion procedures [10,11].

Orthodontic diagnosis and treatment

Diagnosis of individuals with clefts is like the ones without clefts. Assessment includes:

- Facial analysis
- Panoramic and intra-oral radiographs
- Cephalometrics
- Dental Casts

Phases in the orthodontic intervention of children with cleft lip and palate can be classified as Pre and Post and during secondary alveolar bone grafting, orthognathic surgery, and final retention [6].

Orthodontic intervention before alveolar graft

The orthodontic treatment is initiated in the middle to late mixed dentition periods, at the age of 8 years. At first, it aims to correct maxillary arch transverse deficiency posterior crossbite to suitably receive the secondary alveolar graft. In the presence of permanent maxillary canines with roots half to two third formed, Hyrax or Hass type expanders are used for rapid maxillary expansion.

Since delayed dental development in individuals in clefts, dental age is a more critical parameter than chronological age [6].

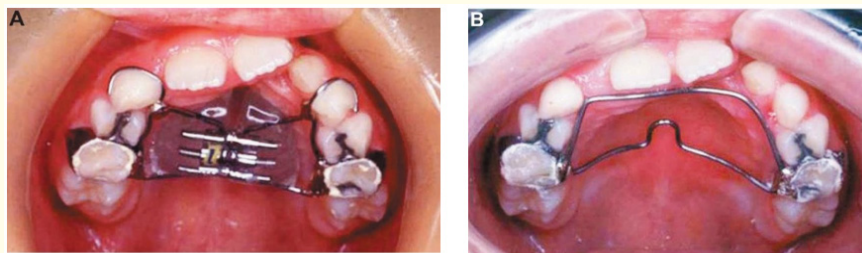


Figure 3: (A) Hyrax type expander for rapid maxillary expansion (B) Retainer used after RME [9].

A fixed palatal arch retainer is placed and maintained until the postalveolar graft stage.

The anterior and posterior crossbite is corrected in this stage. Presence of anterior skeletal crossbite due to maxillary deficiency is corrected using a face mask while the dental crossbites are fixed using a modified quadri-helix appliance with anterior extension or with using arch wires with loops or omega loops. If posterior crossbite is present along with anterior crossbite, treatment planning involves expansion followed by anterior crossbite correction. The thin periodontal bone around the alveolar cleft limits the tooth movement this rotated teeth adjacent to cleft should not be corrected to avoid dehiscence and fenestration before surgery. Supernumerary teeth present palatally requires extraction three months before grafting [3].

Post alveolar graft treatment

Post graft, if the canines do not erupt, the orthodontic treatment should follow the development and eruption of canines through graft. If canines have erupted the therapy should be initiated 60-90 days post alveolar grafting. The comprehensive orthodontic treatment includes intra and inter-arch correction. The intra-arch options include maintenance of maxillary lateral incisor, space closure of missing region of the lateral incisor, and space maintenance for implant placement, implant placement at the canine-premolar region.

The inter-arch therapeutic options with Class III skeletal pattern may include compensatory orthodontic treatment. Mandibular tooth extraction may be necessary.

Orthognathic surgery may be indicated for individuals with unpleasant facial esthetics and is performed after completion of facial growth usually involves LeFort I osteotomy for maxillary advancement [9].

Orthodontic treatment during permanent dentition period

A variable degree of maxillary hypoplasia is seen in a patient with cleft lip and palate. The abnormal facial morphology in treated cleft patients may have skeletal and soft tissue deficiencies or a combination of both. The severity of cleft and palate deformities may vary at the time of birth such as failed fused segments of the cleft with adequate tissue volume or some amount of missing tissue (soft tissue, bone and teeth) with non-fusion of cleft segments and hence both the group respond differently to the treatment protocol. Clinical findings in a patient with cleft show concave profile, class III skeletal pattern, midface deficiency. Presence of deficient maxilla in transverse and vertical plane contributes to posterior skeletal crossbite and reduced midface height [13].

There may be lingually inclined incisors and constricted maxillary posterior arch width, which provides to an anterior and posterior crossbite. Abnormality of midface growth may vary from mild to severe, depending on the severity of malocclusion presented the management can be categorized as [13]:

- Patient with no skeletal discrepancy- orthodontic correction is limited to tooth movement only. In this category, the treatment does not vary much from that of non-cleft patients. The anterior and posterior crossbites can be corrected using advancing archwire and archwire expansion with removable quad helix respectively. Missing lateral incisor is managed either with dental implant or movement of canine into lateral incisors place. Space must be maintained in case of dental implant by pontic tooth that contains bracket and is ligated to archwire. The permanent canine would need recontouring for esthetic purpose.
- Mild skeletal discrepancy- Treatment includes camouflaging the malocclusion by orthodontic tooth movement alone. Orthodontic dental compensation is recommended in patients with mild skeletal discrepancy and least esthetic concerns. Proclination maxillary incisors and lingual inclination of lower incisors can adequately camouflage a mild skeletal discrepancy.
- Moderate to severe skeletal deformity- combined surgical/orthodontic intervention. Depends on the severity of skeletal deformity, the surgical intervention may include maxillary advancement or a combination of maxillary advancement and mandibular setback. If the maxillomandibular skeletal discrepancy is severe, then an early surgery during mixed or permanent dentition stage is indicated. In these cases, the patient and family maybe cautioned that patient may outgrow the early surgery during growth and may require another corrective surgery. For a growing patient, distraction osteogenesis is an alternative option in such cases, induces new bone formation at site of osteotomy, large advancement without the need for bone graft and gradual stretching of scared soft tissue. Velopharyngeal competence can be monitored during advancement since the rate of distraction osteogenesis and midface advancement are performed at the rate of 1 mm/day. For a skeletally mature patient with severe skeletal discrepancy, advancement of midface with distraction osteogenesis is proven to be good treatment option [13].

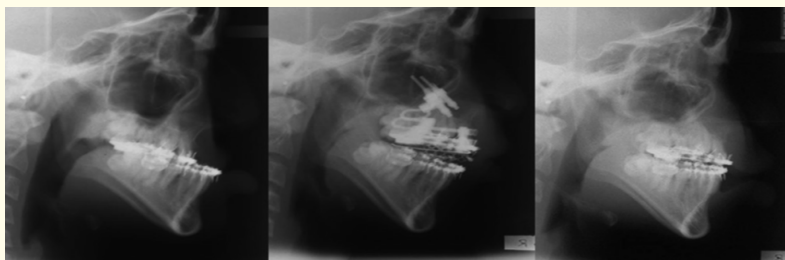


Figure 4: Patient treated for LeFort I midface advancement with internal distraction, before, during and after midface distraction [13].

Retention

The retention period starts after the dental arches have been coordinated throughout the movement, adequate intercuspation achieved with positive overjet and overbite and functional occlusion in check. The period of retention is utmost important to due high chances of relapse of the maxilla. Retention is achieved using Hawley appliance in maxillary arch retained in mandibular arch for one year. On stable occlusion, Hawley plate is used at nighttime for one additional year, and permanent mandibular retainer with follow up is advised [9].

Conclusion

Treatment of cleft lip and palate is an interdisciplinary approach that requires plastic surgeries, maxillofacial surgery, pediatric attention, restoration, and orthodontic intervention combined with speech therapy at different stages. Orthodontic intervention starts at mixed dentition period for receiving the secondary alveolar graft. Rapid maxillary expansion occurs at this stage, and the palatal retainer is fixed before the graft. Comprehensive orthodontic treatment starts on completion of permanent dentition, aims at tooth alignment and space closure. Patients with complete cleft lip and palate with poor facial esthetics will require orthognathic surgery for a better outcome and functional restorability.

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Volume 19 Issue 2 February 2020

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