Medical and Research Publications
International Open Access

Review Article **Journal of MAR Dental Sciences (Volume 3 Issue 6)**

Treatment Protocols in the management of Cleft Lip and Palate (CLCP) patients - An Orthodontic Perspective

Dr. Anju Sarah Jacob *[1], Dr. Harshavardhan Kidiyoor [2], Dr. Srinivas M. Basavaraddi [3].

1*,2,3 - Department of Orthodontics and Dentofacial Orthopedics, SDM College of Dental Sciences & Hospital

Corresponding Author: Dr. Anju Sarah Jacob. Department of Orthodontics and Dentofacial Orthopedics, SDM College of Dental Sciences & Hospital.

Copy Right: © 2021 Anju Sarah Jacob, this is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received Date: October 18, 2021

Published date: November 01, 2021

Abstract

Clefts are the second most common congenital anomalies (constituting one third of all kinds of congenital anomalies). It occurs as a result of non-fusion of the lip, primary and secondary palate. The management of cleft lip and palate involves a number of specialists to provide a comprehensive treatment plan from birth to adulthood. The role of the orthodontist in cleft management is essential as the core members of the interdisciplinary group assist the surgeon at all stages of reconstructive care. During infancy the orthodontist assists the cleft surgeon with presurgical nasal and maxillary orthopedics. During the deciduous dentition stage, the role of the orthodontist is confined to crossbite correction (if necessary). In the transitional dentition stage, alignment of the maxillary segments and dentition is necessary for preparation for secondary alveolar bone grafting.

During the permanent dentition and late adolescent years, the role of the orthodontist is to obtain satisfactory dental and occlusal relationships and to prepare the dentition for prosthetic rehabilitation and orthognathic surgery (if required). A full assessment of the child is necessary to provide good quality care and benefit to the patient

Introduction

A cleft is a discontinuity or fissure that occurs as a result of non-fusion of the lip, primary and secondary palate. Clefts are the second most common congenital anomalies of all kinds (most common - Clubfoot). These defects constitute one third of all congenital anomalies and the severity of the cleft may range from notching of the upper lip to complete non-fusion of the lip, primary and secondary palate

Cleft lip is seen more commonly affecting males whereas cleft palate is seen affecting females. Clefts may be unilateral or bilateral. 80% cases of unilateral cleft lip and palate have shown the left side to be more commonly affected than the right side.

Interdisciplinary Team

The management of cleft lip and palate involves a number of specialists to provide a comprehensive treatment plan from birth to adulthood. The core team involves mainly an Orthodontist, an Oral and maxillofacial surgeon and the Cleft Surgeon. The other core team members include a plastic surgeon, a prosthodontist, and a speech and ENT specialist.

Treatment Protocols in Cleft Patients

The role of the orthodontist in cleft management is essential as the core members of the interdisciplinary group assist the surgeon at all stages of reconstructive care. During infancy the orthodontist assists the cleft surgeon with presurgical nasal and maxillary orthopedics. During the deciduous dentition stage, the role of the orthodontist is confined to crossbite correction (if necessary). In the transitional dentition stage, alignment of the maxillary segments and dentition is necessary for preparation for secondary alveolar bone grafting. During the permanent dentition and late adolescent years, the role of the orthodontist is to obtain satisfactory dental and occlusal relationships and to prepare the dentition for prosthetic rehabilitation and orthognathic surgery (if required)

This is summarized in the table given below:

STAGE	***TREATMENT***
Infancy	Presurgical nasal and maxillary orthopedics • Feeding devices • Pre-surgical orthopedics • Nasoalveolar moulding • Primary Lip Surgery • Cleft Palate Surgery • Velopharyngeal Dysfunction & its treatment
Deciduous Dentition	Crossbite Correction (if necessary)
Transitional Dentition	Maxillary Expansion Intrusion of Premaxilla Maxillary Protraction Alveolar bone grafting
Permanent Dentition	Comprehensive Orthodontic Treatment Distraction Osteogenesis Orthognathic Surgery

Infancy

An infant with a cleft lip and palate always presents with a distorted maxillary arch. In bilateral cleft lip and palate patients, the premaxillary segment is usually displaced anteriorly and the posterior segments are collapsed lingually. These distortions are usually less severe in individuals with unilateral cleft lip and palate

Feeding Devices

Children born with cleft lip and palate commonly present with feeding difficulties as they are unable to obtain a good seal of the oral cavity. Due to the inability of the palate to separate the nasal and the oral cavities, choking and nasal regurgitation are common complications encountered.

Agarwal A et al used ethylene vinyl acetate with a floss for the feeding plate in a patient with a unilateral cleft lip and palate. The advantages of using ethylene vinyl acetate over acrylic was that it resulted in a smoother surface, soft in nature and there was no need for retentive wire. A floss was used because it prevents swallowing and helps in early retrieval of appliance. Once the appliance was placed in the oral cavity, the child could be easily fed

Presurgical Orthopedics

Introduced by Mc Neil in the early 1950s. According to Mc Neil, stimulating the growth of soft tissues overlying the hard palate, neonatal orthopaedics could alter the postnatal growth of the maxilla. The original philosophy was to create a butt joint between the alveolar segments of the cleft. The benefits of presurgical orthopedics include the creation of a good functioning plate, normalise tongue position and aids in speech development. Presurgical orthopaedics is also expected to improve the symmetry of nose and cleft maxilla and psychologically boost the morale of the patient

Nasoalveolar Moulding

Gralson et al described a technique to correct the alveolus, lip and nose simultaneously. This is done within the first couple of weeks after birth. The baby is fitted with a custom made molding plate that looks like an orthodontic retainer and a small tape is placed across the face. The device consists of an acrylic bulb (nasal stent) attached to the maxillary plate with a rigid wire. The bulb lifts the nasal dome and moulds the shape of the nostril and soft tissue of the cleft region. Alveolar moulding is done via active moulding and passive growth guidance. Typically, NAM is evaluated by the interdisciplinary cleft team 1-2 weeks after birth and needs to be modified and activated on a weekly basis. This helps to approximate the cleft segments and reduce the cleft gap

Advantages of NAM:

Use of this therapy benefits the patient by decreasing the cleft side alar curvature and increases the length of the columella, makes the prolabium more visible by retracting the premaxilla and thereby improves the aesthetic outcome of the surgery.

NAM Protocol:

VISIT	***PROCEDURE***
First visit (Birth - 2 weeks)	Parent Counselling Feeding instructions Lip taping only
Second visit	Impressions for NAM plate Lip taping
Third visit	Delivery of NAM plate Lip taping
Subsequent visit (every 2 weeks)	NAM plate adjustment Lip taping

Primary Lip Surgery

Cleft lip repair is generally undertaken around 10 weeks of age. This allows a complete medical evaluation of the patient so that any associated congenital defects affecting other organ systems may be known. Rule of 10 refers to the idea of delaying lip repair until the child was at least 10 weeks old, 10 pounds in weight and a minimum of 10 dL/mg hemoglobin value

The main objective of the primary surgery is to provide good aesthetics of the lip, prolabium and columella with a functioning lip which can provide a good lip seal.

2 popular methods for primary closure of lip are

1. Millard's rotation flap
2. Randall Tennison's triangular flap procedure

Cleft Palate Surgery

Cleft palate repair is usually done between 9-18 months. The 2 main goals of cleft palate repair during infancy includes a closure of the oronasal communication (involving the hard and soft palate) and the anatomic repair of the musculature (essential for normal speech). Many techniques have been described for the repair of the palate.

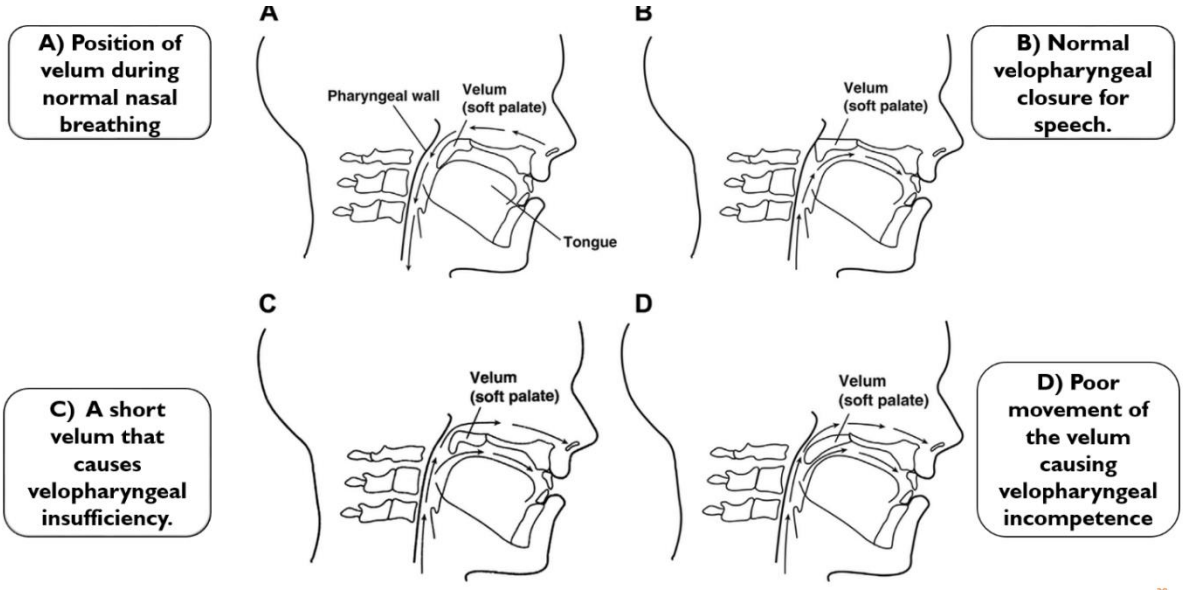
The commonly used techniques include:

1. Bardach two-flap palatoplasty
2. von Lange back palatoplasty

Push back techniques are not favoured as they cause more palatal scarring, restrict growth and do not show any improvement in speech

Velopharyngeal Dysfunction

Velopharyngeal Dysfunction occurs as a result of unwanted communication between the oral and nasal cavities. The primary purpose of the palate repair is to provide the child with an oronasal structure that supports normal speech and resonance. The palate needs to be closed to separate the nasal cavity from the oral cavity.



For normal speech, there needs to be firm and complete closure of the velopharyngeal valve during production of all oral sounds. The greatest concern for children with cleft palate is the risk for velopharyngeal insufficiency (VPI), which is defined as incomplete closure of the velopharyngeal valve caused by an abnormality of the structure.

Treatment of Velopharyngeal Dysfunction is by a secondary surgical procedure or by use of pharyngeal obturator.

Deciduous Dentition

Treatment in the deciduous dentition is limited to crossbite correction.

If there is no mandibular shift, it is advisable not to perform any palatal expansion in this period as there is a risk of widening pre-existing oronasal communications, higher risk of relapse and longer term retention is needed

If a mandibular shift is present, it is advisable to execute grinding of the premature contacts which cause the shift

Mixed Dentition

Maxillary Expansion

In a study conducted by Silva et al (2007), it was found that approximately 21% of children have some form of transverse skeletal discrepancy involving the dental arches. Therefore, most cleft cases require expansion.

The expansion appliances commonly used for cleft lip and palate patients include:

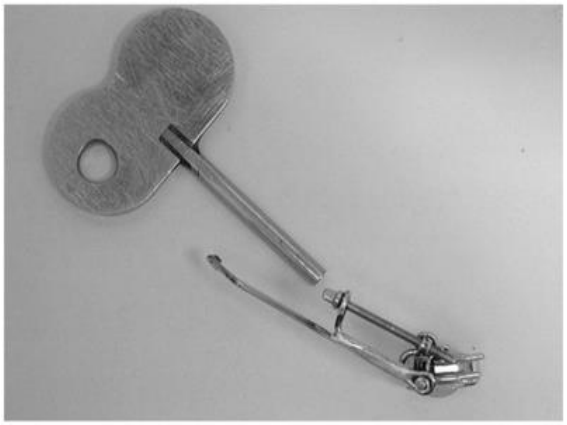
- Hyrax Expander (Biederman, 1968): Comfortable, Hygienic & prevents lesions to oral mucosa
- NiTi palatal expander (Arndt WV, 1993): Utilizes super-elastic and shape memory of Nickel Titanium wires
- Alternate Rapid Maxillary Expansion and Constriction (Eric Liou, 2005): Fan shaped expander which helps in the growth of a hypoplastic maxilla
- Quad Helix (Ricketts, 1978): Slow expander which provides both transverse and anterior asymmetrical expansion

RAPID MAXILLARY EXPANSION	SLOW MAXILLARY EXPANSION
Midline expansion screw bonded / banded to the teeth	Fixed palatal arch wire that is banded to the anchor teeth
Activated 0.2 to 0.5mm per day with active expansion time usually less than a month	Rates of expansion occur at 0.5-1mm/week (forces produced - several ounces to 2 pounds)
Half dental and half skeletal expansion	Maximize dental movement (tipping) & minimize skeletal movement (sutural separation)

Intrusion of Premaxilla

In primary and mixed dentition, one of the most common deformities in bilateral cleft lip and palate patients is a prominent and downward displaced premaxilla. Several studies indicated that the prominence of the premaxilla becomes less pronounced during the growth period and gradually resolves. Therefore, many authors recommend that the premaxillary deformities be left untreated until adulthood. However, leaving these deformities unsolved until adulthood may complicate the alveolar bone grafting and impact the young patients psychologically.

Liou et al developed an intraoral tooth borne distraction device that delivers an intermittent and heavy force for the orthopedic intrusion of the premaxilla. As the screw is turned clockwise, the extension arm and screw pivot around the hinge and hinged bolt move upward and slightly backward, generating intrusive force



Maxillary Protraction

Maxillary hypoplasia commonly seen with CLCP. Treatment of mild cases with Class III malocclusion can be done non-surgically with the use of a protraction headgear (PHG) / facemask therapy. It acts by stimulating the sutural growth at the circum-maxillary sutures in growing patients. The major drawbacks of facemask therapy are non-compliance, dentoalveolar compensation and clockwise rotation of the mandible.

In order to transmit the orthopedic force from the protraction facemask to the maxilla, intraoral devices such as a labiolingual arch, quad helix, and rapid maxillary expansion have been used. A new method, Bone Anchored Maxillary Protraction allows direct transmission of orthopedic force to circum-maxillary sutures. Therefore, an extraoral facemask was no longer needed and intermaxillary traction could be applied 24 hours per day

Alveolar Bone Grafting (ABG)

The first successful alveolar bone graft was described over a hundred years ago in 1914 by Drachter. It is aimed at providing a bony bridge to the cleft in the alveolus area.

Successful ABG provides stability to the maxillary arch, adequate bone for the periodontal health and support of the teeth, improvement of nasal esthetics by normalizing the piriform rim anatomy & improvement of speech parameters. Whereas, an unsuccessful ABG could lead to tooth loss, persistent nasal regurgitation and nasal air emission and compromises future orthodontic and orthognathic treatment

Primary and early secondary bone grafting is not in practice now because of the burden and risks of additional surgery required to harvest bone at a relatively young age. These surgeries could result in increased growth disturbances of the maxilla.
Secondary bone grafting was introduced by Boyne and Sands in 1972. The cleft segment is bridged with grafted cancellous bone, harvested from the iliac crest (becomes indistinguishable
in radiographic images after an average period of 3 months)

Permanent Dentition

Comprehensive Orthodontic Treatment

Patients will typically present for comprehensive orthodontic treatment between the ages of 10 and 15 years. The treatment is postponed until all primary teeth have exfoliated and the permanent teeth have erupted. However, in cleft lip and palate patients, treatment may be initiated earlier i.e. treatment can be started 2-3 years after the secondary bone grafting, when the permanent canines have erupted.

The case is assessed for orthodontic treatment and alternatively orthodontic treatment combined with orthognathic surgery. (Based on negative overjet & deficiency of the maxilla)
The orthodontic treatment is accomplished by using fixed appliances. This helps in correction of dental malpositions and good alignment of the arches. If the lateral incisor is present in a cleft region, all attempts should be made to preserve it. If the lateral incisor is missing, either the space is closed by orthodontic treatment or space can be maintained for prosthetic rehabilitation

Orthognathic Surgery

Patients with major maxillomandibular basal jaw discrepancies combined with unfavourable growth patterns require orthodontics and orthognathic surgical treatment to achieve good aesthetics and stable dental occlusion. Usually, a Le Fort I osteotomy is performed to advance the mandible. This procedure is done alone or along with BSSO (Bilateral Sagittal Split Osteotomy) for the reduction of mandibular length

Cleft orthognathic surgery poses considerable difficulty due to infection of soft tissues, bone necrosis, loss of teeth and delayed healing. The major causes of these complications arise from the impairment of vascularity and scarring from previous surgeries. Patients with palatal clefts present with the risk of worsening velopharyngeal insufficiency due to the forward movement of the soft palate along with the maxillary advancement. (increased hypernasality of the voice). Therefore, a pre-operative evaluation by the speech pathologist is always required. Distraction osteogenesis is a viable option for consideration for such patients

Distraction Osteogenesis

Distraction Osteogenesis is a method of generating new bone following corticotomy or osteotomy by moving the two sides of the bone apart. Initially described for orthopaedic surgery, distraction osteogenesis has now been advocated as an effective technique in the management of several craniofacial deformities. It allows for progressive bone generation accompanied by a simultaneous expansion of the surrounding soft tissue envelope, which contributes to better long-term stability of the reconstruction, lessening the risk of relapse.

Distraction osteogenesis can be carried out with the help of an external or internal distractor. The steps involved include

1. Osteotomy and placement of the distraction device
2. Latency period (Callus organisation)
3. Distraction (time when gradual traction is applied and distraction regenerate is formed). Gradual distraction is carried out at 0.5-1mm per day
4. Consolidation (allows maturation and corticalization of the regenerate after traction forces are discontinued)

Treatment Timing

PROCEDURE	TIMING
Primary Alveolar Bone Grafting	First few days of life - 2.5 years
Lip Closure (Infant Orthopedics)	10 weeks
Palate Closure	12-18 months
Early Secondary Alveolar Bone Grafting	2-5 years

Alignment of maxillary incisors	7-8 years
Secondary Alveolar Bone Grafting (Before eruption of lateral incisor, if present, or canine)	7-8 years
Comprehensive Orthodontic Treatment	Adolescence
Late Alveolar Bone Grafting	Late Adolescence
Lip and Nose Revision	Late Adolescence

Conclusion

Treatment of a child affected with cleft lip and palate begins from the day he / she is born. The treatment of cleft patients poses a challenge to many dentists and involves multiple disciplines, time and cost. A full assessment of the child is necessary to provide good quality care and benefit to the patient.

References

1. Kharbanda, Om. (2019). "Orthodontics: Diagnosis and Management of Malocclusion and Dentofacial Deformities". 3rd Ed, Elsevier India; 2019. 1258 Pages, 12 Videos

2. Figueroa, Alvaro & Polley, J.W.. (2006). "Orthodontics in cleft lip and palate management. Plastic Surgery". 4. 271-310

3. Proffit, W. R., Fields, H. W., & Sarver, D. M. (2013). "Contemporary Orthodontics". St. Louis, Mo: Elsevier/Mosby

4. Agarwal A, Rana V, Shafi S. "A Feeding Appliance For A Newborn Baby With Cleft Lip And Palate". Natl J Maxillofac Surg. 2010 Jan-jun; 1(1): 91–93.

5. Shetye PR, Grayson BH. "Nasoalveolar Molding Treatment Protocol In Patients With Cleft Lip And Palate". Semin Orthod. 2017; 23: 261-67

6. Kummer AW. "A Pediatrician's Guide to Communication Disorders Secondary to Cleft Lip/Palate". Pediatric Clinics of North America. 2018: 65;31-46.

7. Jain S, Shrivastav S, Jain NK. “Maxillary Expansion In Cleft Lip And Palate Cases- A Review”. Int J Advanced Res. 2015; 3: 1455-461

8. Liou EJ, Chen PK, Huang CS, Chen YR. “Orthopedic Intrusion Of Premaxilla With Distraction Devices Before Alveolar Bone Grafting In Patients With Bilateral Cleft Lip And Palate”. Plast Reconstr Surg. 2004 Mar;113(3):818-26

9. Meazzini, Maria & Lematti, Lara & Mazzoleni, Fabio & Rabbiosi, Dimitri & Bozzetti, Alberto & Brusati, Roberto. (2010). “Vertical Excess of the Premaxilla in Bilateral Cleft Lip and Palate Patients: A Protocol for Treatment”. The Journal of craniofacial surgery. 21. 499-502

10. Doğan S. “The Effects Of Face Mask Therapy In Cleft Lip And Palate Patients”. Annals Of Maxillofacial Surgery. 2012; 2: 116-120.

11. Baek SH, Kim KW, Choi JY. “New Treatment Modality For Maxillary Hypoplasia In Cleft Patients - Protraction Facemask With Miniplate Anchorage”. Angle Orthod. 2010; 80: 783-91

12. Wirthlin JO. “The Orthodontist’s Role In The Management Of Patients With Cleft Lip And Palate Undergoing Alveolar Bone Grafting”. Semin Orthod. 2017; 23: 268–278

13. Rachmiel, A., & Shilo, D. (2015). “The Use Of Distraction Osteogenesis In Oral And Maxillofacial Surgery. Annals Of Maxillofacial Surgery”, 5(2), 146–147

14. Mancini L, Gibson TL, Grayson BH, Shetye PR. “Orthodontic Treatment In Adolescents With Cleft Lip And Palate”. Semin Orthod. 2017; 23: 295–304

15. Rachmiel, A., & Shilo, D. (2015). “The Use Of Distraction Osteogenesis In Oral And Maxillofacial Surgery”. Annals Of Maxillofacial Surgery, 5(2), 146–147.

16. Phillips, J. H., Nish, I., & Daskalogiannakis, J. (2012). “Orthognathic Surgery In Cleft Patients. Plastic And Reconstructive Surgery”, 129(3), 535e–548e.