



Management of cleft lip and palate: Orthodontic perspective

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Abstract

The management of cleft lip and palate represents a commitment to the care of the afflicted child over the course of the child's development into adulthood. The role of a qualified surgeon in this population of patients is obvious; however, the special needs of children with clefts are best served by the participation of a craniofacial team. This team is composed of an array of specialists including nurses, dentists, orthodontists, oral surgeons, otolaryngologists, geneticists, prosthodontists, speech therapists, radiologists, psychologists, feeding specialists, and plastic surgeons. Hence; in the present review, we aim to summarize the orthodontic perspective of management of patients with cleft lip and palate.

Keywords: cleft lip, cleft palate, orthodontic perspective

Introduction

The orthodontist's role in the management of patients with orofacial clefting is challenging, rewarding and as varied as the different types of cleft encountered. No two clefts are the same and each patient has different needs, aspirations and desires. There are several occasions during a child's first two decades of life where orthodontic intervention may be required. These packages of orthodontic care are often designed to optimise the jaws and dentition for the intervention of other specialities, particularly the surgical, restorative, dental and speech therapy teams. Quality orthodontic care hinges upon the prerequisite of excellent oral hygiene and a pristine or well-restored, disease-free dentition. Active disease must be treated urgently and completely and a preventative regimen instigated^[1].

There is evidence that children with an intraoral cleft have high dental caries experience and to counter this, at all stages, an aggressive preventative regime should be encouraged. Regular liaison with the general dental practitioner and paediatric dental specialist, as well as the oral hygienist, is crucial to enable the orthodontist to deliver a quality outcome. The cleft specialist orthodontist will offer care at different developmental stages and these treatments may last many months or even several years. These prolonged phases of contact with the patient and their family places the orthodontist in the position of the patient's advocate. The orthodontist often facilitates onward referral to other specialists, both dental and medical, within and beyond the cleft team. The orthodontist is the key in collecting a number of different records that demonstrate clinical outcomes for the patient born with oro-facial clefting^[2, 4].

Embryological Anomalies

In clefting confined to the lip, maxillary arch development is generally normal though some anomalies of maxillary lateral incisor development may occur. In clefts extending to the alveolus, incisor tooth germ development is invariably disturbed. In complete clefts, the deciduous and permanent lateral incisors are generally absent, ectopic, diminutive or represented by two small conical teeth in each cleft margin.

The adjacent central incisor inclines towards the cleft and may have a marked curvature. Where there has been considerable mesodermal deficiency, the deciduous and permanent central incisor tooth buds may occasionally be absent too. Elsewhere, tooth formation is generally normal though the incidence of hypodontia is higher and the teeth are slightly smaller. In complete bilateral clefts the premaxilla is situated too far forwards beyond the tip of the nasal septum, while in complete unilateral clefts the major segment appears to be rotated outwards so that the incisal area is rather prominent^[3, 5].

In both the bilateral and unilateral condition the position of the lateral segment(s) is more variable and though there is commonly an apparent outward displacement producing a wide alveolar cleft, inward displacement and segmental overlap is also possible. In isolated palatal clefting, the only anomaly noted at birth is excessive intertuberosity width. These distortions of maxillary arch form persist throughout the fetal period, being modified only by the possible moulding effect of the tongue and the disrupted activity of the orbicularis oris when muscle function commences. It is particularly interesting that the lateral segments maintain a normal anteroposterior position, despite their disconnection from the nasal septum, underlying the complexity of facial growth control and compensation^[5, 8].

Pre-Surgical Orthopaedics

Molding the perioral structures of the infant with a CLP has been a clinical technique in use since before the 1950s. Attempts are made to reposition the nasolabial and maxillary segments closer to each other. It has been mainly used in the first few weeks after birth and in the months prior to palate repair. PSO treatment involves primarily the active movement of the maxillary fragments with passive or active alveolar plates prior to the surgical repair; this is often referred to as alveolar molding. Whenever a nasal stent is added to the alveolar plate, it is considered as nasoalveolar molding (NAM). Approximately half of surveyed centers in Europe used PSO techniques with mostly passive plates, whereas some teams also used a plate to assist with feeding^[6, 10].

Objectives of PSOs [6, 10]

The main objectives of this presurgical step of treatment have been cited as:

- facilitating intra-oral feeding;
- improving maxillary growth;
- improving the projection of the nasal tip;
- reducing nasal deformity;
- facilitating primary lip, nasal, and alveolar surgeries; and
- Retracting and repositioning the premaxilla more posteriorly in patients with bilateral cleft.

Prior to Alveolar Bone Graft (ABG) Surgery [11, 14]

Individuals with CLP typically present with transverse maxillary deficiency and posterior crossbites. The primary objective of orthodontic treatment during this mixed dentition phase is to prepare the maxillary segments for receiving the ABG, thus maxillary expansion is typically required. Different type of appliances can be used to achieve this goal and the type of appliance used is directly dependent on the maxillary arch form, clinical presentation of the crossbite and on the orthodontist's preference and personal experience. The most common appliances used at HSC are the fan-shaped and Hyrax maxillary expanders with a slow pattern of activation. A quad Helix can also be used to achieve the same objectives. The timing for completing the ABG surgery is critical. This surgical procedure is commonly performed approximately at 8–10 years of age, when the permanent canine in the cleft area presents half to two thirds of root formation and before it erupts into the cleft defect [11, 14].

The maxillary expander promotes an expansion through widening the cleft. Therefore, there is a lateral positioning of the alveolar segments. The plastic surgery department is subsequently notified in order to coordinate a pre-surgical assessment appointment and to enable preparation for the extraction of any deciduous and/or supernumerary (unerupted or erupted) teeth in the cleft area six to eight weeks prior the planned surgical procedure. In the CLP individuals the expansion is not followed by bone formation, as is seen with non-CLP individuals, due to the absence of a medial palatine suture. The ABG provides several potential advantages to the patient such as: closure of the oro-nasal fistula, repair of the alveolar cleft, bony support and mucosal coverage to the adjacent teeth, bony matrix to support the teeth erupting in the cleft site, stabilization of maxillary segments, and adequate volume of bone for future implant rehabilitation [14, 18].

The patient is clinically evaluated at the Orthodontic Department 6 weeks after the ABG surgery in a coordinated appointment with the Plastic Surgery Department to determine the initial outcome and healing of the ABG site [14, 18].

Orthodontics after Alveolar Bone Graft Surgery

Once the ABG Surgery is complete, typically no comprehensive orthodontic treatment is indicated as skeletal growth in the CLP patient population continues to be dysplastic and typically definitive corrective treatment is only initiated once the patient approached skeletal maturity. However, in the interim, an early stage of orthodontic treatment may be initiated in specific situations such as: the presence of impacted teeth, severe crowding affecting the periodontal health or if the malocclusion is affecting the

patient's self-esteem. Nevertheless, the patient and family need to be advised that a second stage of fixed orthodontic treatment with or without surgery will be necessary in the future [14, 18].

The orthodontist will evaluate all the clinical and radiographic records of the patient and according to parameters such as: sagittal skeletal relation, maxillary transverse relation, crowding, positioning of the maxillary canine in the cleft area, midline deviation; the craniofacial orthodontist will delineate a personalized treatment plan for the CLP patient. Comprehensive orthodontic treatment for CLP individuals that do not present with significant skeletal alterations, that have mild/moderate midfacial deficiency, and that have no facial aesthetic concerns, can be initiated at an earlier age. However, careful assessment and monitoring of the growth patterns is essential. The existing alternatives to compensate a Class III malocclusion may include but are not limited to: proclination of the maxillary incisors and retroinclination of mandibular incisors within acceptable limits; orthopaedic traction of the maxilla, extraction of mandibular first premolars in combination with the extraction of the maxillary first premolar on the non-cleft side and canine substitution for the missing lateral incisor on the cleft side and orthodontic finishing with a class I molar relation. Post-surgical orthodontics aims to finish and detail the occlusion after jaw surgery and prepare the occlusion for possible future prosthetic replacement of missing teeth [14, 18].

Incisal Alignment

The most common dental malpositions seen in CLP patients are:

- Rotations
- Ectopic eruption of maxillary incisors
- The space needed is obtained through the expansion

Aims

1. To eliminate incisal trauma.
2. If before bone graft careful to move the teeth close to the cleft due to the risk of root resorption and periodontal defects
3. Avoid in this phase excessive dental compensation (do not excessively procline incisors) [18, 22].

Literature

Leiva Villagra N *et al* in a case report presented full orthodontic treatment of an operated cleft lip adult patient. An 18-year-old patient consulted for severe crowded teeth. He comes from a poor family. At that time he already had four operations (velum, palate, lip, and myringotomy). Treatment included maxillary expansion, tooth extraction, and fixed orthodontic, as well as kinesiologic and speech therapy treatment. A multidisciplinary approach allowed us to achieve successfully an excellent result for this patient and gave him a harmonic smile and an optimal function without orthognathic surgery. Two years after treatment, occlusion remains stable [22].

Adusumilli SP *et al* described the importance of interdisciplinary approach and gives an understanding on management of an adolescent with unilateral cleft lip and palate. A girl, aged 15 years reported with a chief complaint of unesthetic appearance of her maxillary anterior teeth. She had unilateral cleft lip and palate and had received cheiloplasty and palatoplasty when she was in young age

and rhinoplasty when she was 14 years of age. At pretreatment evaluation, she had concave profile with maxillary arch constriction and oroantral fistula and mesially tipped maxillary left canine. This patient's treatment was unconventional, but it was successful in significantly improving her masticatory function and smile, along with favorable dental and facial results. Generalized esthetics and function were significantly improved in this patient without orthognathic surgery, and treatment results were stable 3 years after the appliance removal. Clinical considerations, sequencing of treatment phases as shown in their case report can be utilized while treating an adolescent with cleft lip and palate. If the skeletal discrepancy is mild and esthetic concerns are minimal, dental compensation by orthodontic treatment alone might be recommended [23].

Germec-Cakan D *et al* reported case report of a 20-year-old woman with bilateral cleft lip and palate, who had a chief complaint of unesthetic appearance of her teeth and the presence of oronasal fistulae. Her clinical and radiographic evaluation showed a dolichofacial growth pattern, a Class II skeletal relationship with retroclined maxillary central incisors, 5 mm of negative overjet, maxillary constriction, maxillary and mandibular crowding, congenitally missing maxillary right incisors and left lateral incisor, and a transposed maxillary left canine. Her treatment plan included the extraction of 3 premolars, maxillary expansion, segmental maxillary osteotomy, repair of the oronasal fistulae, rhinoplasty, periodontal surgery, and prosthodontic rehabilitation. To obtain a better occlusion and reduce the dimensions of the fistulae, orthognathic surgery comprising linear and rotational movements of the maxillary segments (premaxilla, right and left maxillary alveolar segments) in all 3 axes was planned by performing 3-dimensional virtual surgery on 3-dimensional computerized tomography. At the end of the interdisciplinary treatment, a functional occlusion, a harmonious profile, and patient satisfaction were achieved. Post treatment records after 1 year showed stable results [24].

Al-Ruwaithi MM *et al* reported an interdisciplinary approach for the care of a cleft patient. A 17-year-old male patient presented with a chief complaint of "unpleasant appearance of my teeth" and a history of surgical repair of unilateral CLP on the left side. He presented with Class III molar relationships, Class II canine relationships, crossbite related to maxillary right first premolar and lateral incisor, severe maxillary and mandibular crowding, maxillary anterior tooth size deficiency, congenitally missing upper left lateral incisor. Patient was treated with a pre-adjusted edgewise appliance in conjunction with extraction of multiple teeth and distalization of the lower right first molar using a temporary anchorage device. In addition, alveolar bone graft and implant were placed to restore the missing upper left lateral incisor and a final esthetic work was performed for anterior teeth. The case was finished with Class I molar and canine relationships, minimal overjet and overbite. Total treatment time was about 31 months with satisfactory results. Post-treatment evaluation after 8 months showed stable results [25].

De Souza RM *et al* reported case of a 9-year-old patient with unilateral cleft lip and palate, with anterior and posterior crossbite on the left side, absence of the maxillary left lateral incisor, and transposition of the maxillary left canine and first premolar. The patient was treated with slow maxillary expansion, secondary graft and fixed orthodontic

appliance, transposition maintenance and closing of the lateral incisor space with the first premolar, by means of mesialization of the posterior teeth. At the end of the treatment, good intercuspation and an important aesthetic gain for the patient were achieved. The analysis three years after treatment revealed a good stability of the results obtained [26].

Late and Retreatment Adult Orthodontics

Adult patients often seek opinions regarding possible options for new treatments and also advice regarding revision of procedures carried out in their childhood as well as maintenance of work done years earlier. Some patients require advice only or minor interventions to achieve an optimal result whilst others require comprehensive retreatment. If retreatment is planned, this will likely commit an adult patient to a demanding and protracted treatment plan. Serious consideration should be given both to the burden of care and the clinical risk to the tissues of a now mature individual. Careful consideration of retreatment needs to be given both by the patient and by the clinical team and a thorough risk-benefit analysis undertaken prior to embarking on comprehensive care. Although an ideal outcome is what all want to see, a compromise may be required where disease processes have affected the orofacial tissues or when full commitment to the plan is not practical. As much time as is reasonably practical needs to be allowed for a patient to make their mind up before embarking on a multidisciplinary treatment plan. Consultation with the team psychologist and the use of simulations as well as meetings and discussions with other patients will all add benefit to the decision-making process [24, 26].

Conclusion

The challenge for today's orthodontist is to set aside personal prejudices and inter-centre rivalries, and to advance the management of children with clefts of the lip and palate through effective collaborative research.

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