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Holistic rehabilitation: Multidisciplinary care for cleft lip and palate

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Abstract

Managing cleft lip and palate necessitates comprehensive orthodontic and surgical treatment, emphasizing interdisciplinary collaboration to achieve optimal esthetics and function. Treatment spans infancy through post-growth phases, with pediatric dentistry crucial for promoting oral health and supporting growth. Success hinges on accurate diagnosis and customized planning for functional occlusion and esthetics through collaborative efforts. Orthodontic intervention typically begins at approximately 8-9 years old, involving procedures such as bone grafts, maxillary expansion, and palatal retainers. As patients enter permanent dentition, the focus shifts to align teeth and closing gaps. Cases with complete cleft lip and palate, often involving mid-face deficiencies, may require orthognathic surgery to enhance facial aesthetics and achieve proper occlusion. This review outlines treatment strategies across developmental stages: infancy, early mixed dentition, early permanent dentition, and completion of facial growth.

Keywords: Cleft Lip, Cleft Palate, Pediatric Dentistry, Orthodontics. Interdisciplinary Treatment, Esthetic, Function.

Introduction

Cleft lip and palate affects about 1 in 700 to 800 births globally, impacting maxillary growth and dental development.[1] Following surgical repair, adults may face reduced quality of life due to appearance dissatisfaction. Effective management requires a holistic approach addressing aesthetics, function, and stability, navigating medical complexities and social impacts. It affects approximately 700 children daily worldwide, with prevalence varying among ethnic groups.[2] Etiology includes genetic inheritance, teratogenic drugs, nutritional deficiencies, chemical exposures, radiation, maternal hypoxia, and physical obstructions.[3] Non-syndromic cases involve polygenic inheritance and environmental factors. Care involves multidisciplinary teams including plastic surgeons, geneticists, speech therapists, and Ear, Nose & Throat specialists.[4] Early prenatal diagnosis enhances care standards by addressing diagnostic errors. Cleft lip and palate challenge feeding, breathing, hearing, speaking, and aesthetics, requiring comprehensive treatment at specialized centers with diverse medical professionals. Orthodontists manage such patients, performing pre-surgical maxillary orthopaedics and aligning segments for alveolar bone grafting and dental rehabilitation. Treatment for cleft lip and palate spans infancy to adulthood with an interdisciplinary team.[5] This includes lip surgery at 3 months, palate surgery at 1 year, and alveolar bone grafting at 9-12 years.[6] Rehabilitation for cleft lip and palate involves speech therapy, maxillofacial surgery, and standardized oral care.[7] Pediatric dentistry supports oral health from infancy through mixed dentition, monitoring craniofacial growth and dental development. Pediatric dentists are integral in managing dental challenges of cleft patients, addressing intra-arch anomalies and crowding through early detection and orthodontic referrals for missing teeth. They oversee oral growth until adolescence, promoting breastfeeding and oral hygiene, diagnosing malocclusions, and facilitating orthodontic care.[8]

Orthodontic treatment for cleft lip and palate involves a systematic approach integrating orthodontic, orthopedic, and surgical interventions from infancy through facial growth completion. This coordinated effort manages dimensions like antero-posterior, transverse, and vertical growth, balancing benefits and risks to mid facial and dental development. Effective interdisciplinary communication ensures cohesive pre surgical orthodontics and predictable outcomes for cleft palate patients. Orthodontists manage complex malocclusions, working closely with maxillofacial surgeons. Adapted breastfeeding and specialized feeding techniques, such as latex-nippled bottles, are essential to prevent ulcers and minimize choking and nasal reflux. Cleft palate increases risks of respiratory infections and hearing loss. Delaying sugar introduction promotes healthier diets.[9] Common dental issues include abnormalities in maxillary lateral incisors, gingival cysts, natal teeth, and supernumerary teeth.[10] Loose teeth near the cleft may require extraction to prevent aspiration. Delayed deciduous dentition development increases cavity risks, necessitating regular counselling during mixed dentition to monitor permanent tooth growth. Cleft-affected palates often cause misaligned eruption of the first maxillary molar due to reduced maxillary length.[11] Children with cleft lip and palate face specific dental challenges, such as enamel changes and often peg-shaped or absent lateral incisors. Maintaining oral health is critical for successful, sterile cleft repair surgeries. Early oral hygiene practices begin before teeth erupt, involving the use of gauze or cloth and boiled or filtered water to establish good habits. Once teeth emerge,

brushing with fluoridated toothpaste is essential to prevent cavities and gum issues. Specialized dental care includes hygiene maintenance, dietary counselling, plaque control, and addressing developmental and behavioural concerns. Dental anaesthesia is carefully managed, particularly around anatomical complexities like cleft areas.[12]

Paediatric dentists face unique challenges, such as abnormal tooth positions and surgical complications like lip fibrosis. Periapical X-rays pinpoint tooth positions accurately. Scar tissue toughens mucosa, increasing initial needle discomfort. Maxillary lateral incisor hypodontia often requires prosthetic rehabilitation.[13] Effective dental care for cleft patients includes precise infiltration and palatal anaesthesia, with rubber dam isolation crucial in unrepaired cleft palate cases to prevent airway contamination. Careful placement of dental clasps and floss ligatures minimizes aspiration risks. Timely detection and treatment of cavities are essential, alongside pre-surgery oral health maintenance to reduce infection risks. Preserving supernumerary or mal positioned deciduous teeth near the cleft supports bone tissue integrity.[14]

Discussion

Genetic and environmental factors influence facial growth into early adulthood, impacting treatment outcomes. Orthodontic treatment in permanent dentition can address mild skeletal issues and replace missing teeth prosthetically, though challenges are heightened in cleft patients due to maxillary deficiencies and common cross bites. Dental issues in cleft palate patients include missing permanent lateral incisors, malformed teeth, supernumerary teeth, ectopic tooth positions, and limited bone support for tooth movement. Additional concerns involve an accentuated curve of Spee, collapsed arch form, and oral health issues such as cavities and gum disease. [15] Orthodontic care in permanent dentition mirrors non-cleft patients but addresses unique cleft palate characteristics, requiring close coordination of treatment timing to balance surgical needs and psychosocial development. Skeletal surgery, orthodontics, and prosthetic rehabilitation precede soft tissue revisions or rhinoplasty to optimize outcomes.[16] Orthodontic preparation for prosthetic replacement typically spans 12 to 18 months, focusing on teeth alignment. Post-surgery orthodontic refinement, integrated with prosthodontic care, generally finishes within 4 to 6 months.[17]

Treatment aims include teeth alignment, continuous maxillary arch establishment, cross bite correction, stable occlusion, and improved dentofacial aesthetics. Managing missing or peg lateral incisors involves choosing between orthodontic closure or space maintenance based on individual factors and malocclusion. Significant facial asymmetry in cleft lip/palate patients requires detailed surgical planning for addressing malocclusion, bony deficiencies, and facial symmetry.[18] Advanced imaging techniques improve surgical outcome predictions and reduce intra operative adjustments. Future advancements include simulated operations for parental education and 3D computer-assisted treatment planning to enhance precision in managing facial asymmetry and optimizing surgical results.[19] Post-repair of cleft lip and palate, cephalometric analysis often reveals sagittal maxillary deficiency with reduced SNA and SN.ANS angles.[20] Clefts affecting the lip and alveolar ridge resemble non-cleft individuals, while cleft palate can lead to maxillary and mandibular retrusion with a hyper divergent growth pattern.[21] Mandibular morphology generally shows similarity in unilateral and bilateral clefts. Internal intraoral distractors minimize psychological impact,

offer long-term support, improve skeletal and soft tissue profiles, increase the nasolabial angle, and enhance inferior facial height, promoting patient compliance with minimal discomfort. Internal distractors for maxillary advancement (<10 mm) in cleft lip/palate patients with midface hypoplasia are effective but carry risks like defective distraction vectors and limited jaw movement direction. In mixed dentition, rapid maxillary expansion corrects transverse issues in bilateral or unilateral clefts, while a face mask addresses antero-posterior discrepancies, particularly in unilateral cases. Post-orthodontic treatment, prosthetics are crucial for comprehensive esthetic and functional rehabilitation in such patients, enhancing oral health and fulfilling both functional and esthetic needs. [22]

Complete bilateral cleft cases often exhibit Class III skeletal patterns and post-surgery anterior cross bite. Isolated cleft lip or palate typically does not experience post-surgery maxillary growth issues. Early palatoplasty and the absence of the mid palatal suture can reduce maxillary arch dimensions, often necessitating orthodontic expansion for correcting posterior crossbites. Diagnosis of cleft lip and palate relies on facial and dental photos, casts, and radiographs.[23] Despite maxillary deficiency, the nasolabial angle typically remains closed (85-90 degrees) due to a low nasal columella position. Complete bilateral cleft lip and palate cause convex facial profiles in childhood, progressing to concave in adolescence due to sagittal maxillary deficiency and hyper divergent growth patterns. Mandibles resemble those with unilateral clefts. Incomplete clefts generally do not cause sagittal midfacial deficiency. Isolated cleft palate presents with a short cranial base, retruded maxilla and mandible, and a vertical facial pattern. Cleft lip alone shows cephalometric characteristics similar to non-cleft individuals. Diagnostic imaging includes panoramic and intraoral radiographs for dental anomalies and standardized occlusal and periapical radiographs for alveolar defects and bone graft monitoring. Orthodontic evaluations assess inter-arch relationships and intra-arch irregularities using dental casts.[24] Goslon Yardstick scores predict outcomes for complete unilateral and bilateral cleft lip and palate cases.[25] Treatment includes pre-alveolar bone graft orthodontics, secondary grafting, post-graft orthodontics, orthognathic surgery, and retention, typically starting around age 8 to correct maxillary deficiencies and prepare for bone grafts. Treatment for complete bilateral cleft lip and palate involves extending the Haas expander anteriorly for premaxilla advancement during maxillary protraction. Evaluation of dental casts is crucial, utilizing methods like the Kappa statistic in cleft orthodontic studies.[26] Treatment stages include pre-alveolar bone graft orthodontics, secondary grafting, post-graft orthodontics, orthognathic surgery, and retention.

Orthodontic intervention typically starts around age 8 to correct maxillary deficiencies and prepare for bone grafts. Both anterior and posterior crossbites are managed initially with expansion, followed by specific corrections. Class III elastics are used post-alignment to promote maxillary molar extrusion and beneficial mandibular rotation, particularly beneficial for cleft palate patients. Early interventions like 2x4 edgewise appliances or torquing arches advance maxillary incisors labially. Postsurgical orthodontics, lasting 4 to 6 months, focus on occlusion refinement, space closure, and transverse correction maintenance. Transpalatal arches or "piggy-back overlay 2'' arches in headgear tubes help maintain or expand maxillary transverse dimensions postoperatively.[27] Canine movement is facilitated using Titanium Molybdenum Alloy wire cantilevers anchored

to molars and supported by a transpalatal bar. Scrupulous oral hygiene is crucial for successful bone grafting outcomes.[28] Periapical and occlusal radiographs assess grafted bone quality and quantity. Orthodontic treatment may begin 60-90 days after secondary alveolar bone grafting if canines are erupted; otherwise, their development is monitored.[29] In unilateral complete clefts, sagittal maxillary deficiency often results in a prognathic mandibular appearance, while vertical maxillary deficiency can worsen a Class III skeletal relationship. Orthodontic adjustments in patients without mid facial deficiency start after permanent dentition. Post-graft orthodontics for maxillary advancement surgery due to moderate to severe sagittal deficiency is typically delayed until age 16-17. Managing cleft areas intra-arch involves preserving maxillary lateral incisors, closing gaps if missing, maintaining space for future implants, and placing implants post-canine movement to preserve bone. Decision factors include canine position, tooth size, and arch alignment.[30] Space closure is preferred with mesial canine eruption, crowding, and Class II sagittal alignment. For distal canine eruption and Class I alignment, implants or prosthetics may be suitable based on patient preferences.

Mandibular crowding may require extractions, with unilateral clefts possibly needing premolar or non-cleft lateral incisor extraction for symmetry. Treatment for Class III skeletal patterns varies by severity and aesthetics.[31] Individuals with Goslon 3 scores and satisfactory facial esthetics may benefit from compensatory orthodontic approaches, possibly including mandibular extractions alone for alignment. Conversely, Goslon 4 or 5 scores, or Goslon 3 scores with less favourable aesthetics, typically necessitate decompensation orthodontics before orthognathic surgery. About 30% of cases ultimately require orthognathic surgery for comprehensive correction. In preoperative orthodontic planning for cleft individuals with a Class III pattern, maxillary incisors generally do not need decompensation due to their natural inclination post-lip surgery.[32] However, mandibular incisors may require proclination, particularly with a wide symphysis and good gingival quality, especially when mild crowding is present.[33] Orthognathic surgeries, such as Le Fort I osteotomy for maxillary advancement, are typically scheduled after facial growth has been completed to optimize long-term outcomes.[34] Orthodontic treatment for individuals with clefts focuses on achieving coordinated dental arches, proper inter cuspation, positive overjet and overbite, and functional occlusion to support dental and periodontal health. Common hypodontia often results in a Class II molar relationship on the cleft side, necessitating adjustments for optimal occlusion. Post-treatment, retention is crucial, particularly for the maxilla to prevent relapse.[35] At the Hospital for Rehabilitation of Craniofacial Anomalies - USP, retention includes a modified Hawley appliance for the maxillary arch and a 3x3 mandibular retainer. Initially worn full-time for one year, and then nightly for another if stability is achieved, followed by intermittent use for six months before discontinuation. For patients with good oral hygiene, a permanent mandibular 3x3 retainer is recommended, with regular professional cleanings and 3 to 5 years of follow-up post-removal to monitor third molar eruption and plan extractions if needed. Occasionally, pre-prosthetic augmentation may be required for aesthetic or implant placement purposes. For anterior fixed prostheses, cementing a soldered lingual arch to plain molar bands ensures transverse retention, as conventional Hawley appliances may lack long-term reliability due to compliance issues. Orthodontic retention is critical for

cleft palate patients. Immediate placement of a retainer after removing fixed appliances is essential.[36] A removable Hawley-type retainer with replacement teeth can be used for edentulous areas often preferred for its esthetic benefits over temporary clear vacuum-formed retainers, which may not adequately control dimensions or prevent posterior cross bite relapse. When periodontal health allows, removable or fixed prostheses are considered, favouring fixed bridges when feasible. Fixed lingual arches provide indefinite retention but require annual removal for inspection and reapplication with glass ionomers cement to prevent caries. Treatment of a syndromic patient has to be done in consultation with different specialities.[37] Patients with unilateral or bilateral cleft lip, alveolus and palate may require orthodontic treatment during the following four different stages:-1. Neonatal maxillary orthopedics in an infant. 2. Orthodontic-orthopedic treatment during the primary dentition. 3. Orthodontic treatment during the mixed dentition.4.Orthodontic treatment alone or in conjunction with orthognathic surgery in the permanent dentition. The Kernahan Rosenstein Procedure, developed in the 1950s, utilizes a pre-surgical passive plate to aid in swallowing and prevent tongue twisting before lip surgery. Post-lip closure, it aligns arch segments using sub periosteal rib graft support for 6–8 weeks, particularly effective for bilateral clefts. The Latham-Millard Pinned Appliance employs palatal pins to mechanically align maxillary segments, promoting facial growth in complete unilateral and bilateral clefts by reconstructing the nasal floor and supporting the alar base.[38]

The Zurich Approach, developed in the early 1970s, employs a 24/7 passive plate for 16 to 18 months until soft palate surgical closure, optimizing growth potential and maintaining arch form. Presurgical Nasoalveolar Molding (PNAM) improves long-term nasal aesthetics, reduces the need for nasal surgeries and secondary bone grafts, and corrects protruded premaxilla while enhancing the deficient columella. For bilateral cleft lip and palate, PNAM adjusts the premaxillary segment with plates, tape, elastics, and nasal stents to align with alveolar clefts and modify palatal shelves. Cheek tapes secure the PNAM appliance with rubber bands, adjusted every 1–2 weeks in 1 mm increments, with acrylic resin modifications. Ongoing evaluation is crucial due to ongoing controversies in cleft surgery and orthopedics.[39] Alveolar cleft defects in primary dentition may delay eruption and lead to malformed or missing primary lateral incisors, indicating underlying skeletal issues. After cleft repair, unilateral or bilateral cross bites often occur, necessitating orthodontic correction such as equilibration and anterior orthopedic protraction. Orthodontic techniques for cleft management include quad-helix appliances for upper arch expansion, protraction face masks for growth redirection, and customized intraoral splints with buccal hooks to clear incisors. The Delaire face mask uses heavy elastics to apply forward force at an angle to the occlusal plane. Since the 1970s, secondary alveolar bone grafting has significantly improved managing cleft maxilla by closing residual clefts. Orthodontic intervention in mixed dentition addresses current issues, risks, and benefits, increasingly performed post-alveolar bone grafting. The timing of graft surgery depends on dental development, ideally when the permanent cuspid root is half to two-thirds formed, typically between ages 8 and 11.[40]Earlier grafting may improve outcomes for a lateral incisor. Once teeth erupt into the cleft site, their periodontal support does not improve with a bone graft, as crest alveolar bone resorbs to its original level.

Therefore, grafting should precede permanent cuspid eruption or earlier if the lateral incisor is affected. Primary bone grafting can adversely affect maxillary development, whereas secondary grafting when maxillary growth is nearly complete has no impact on facial development thereafter.[41]

Conclusion

Children with cleft lip and palate frequently experience emotional difficulties due to aesthetic concerns, affecting how they view themselves and interact with others. It's vital to start medical care early, from before birth through adulthood, to manage their health and mental well-being effectively, involving families throughout. Successful treatment involves a team of experts addressing physical, functional, and appearance-related issues. Orthodontic care, which can last several years with frequent visits, demands clear communication with patients and cooperation among specialists to ensure personalized treatment and achieve desired outcomes, despite its challenges and potential setbacks.

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