

TIMING AND TACTICS OF ORTHODONTIC INTERVENTION FOR CLASS III MALOCCLUSION IN CHILDREN WITH UNILATERAL CLEFT LIP AND PALATE

Yuldashev Temurkhon Akramovich

Assistant at the Alfraganus University

e-mail: temurkhan1@icloud.com

<https://doi.org/10.5281/zenodo.18151301>

Introduction

Timing and Tactics of Orthodontic Intervention for Class III Malocclusion in Children with Unilateral Cleft Lip and Palate addresses the specialized challenges involved in managing a complex dentoskeletal condition characterized by an imbalance between maxillary and mandibular growth. This problem is particularly pronounced in pediatric patients with unilateral cleft lip and palate (UCLP), where intrinsic developmental disturbances and treatment-related factors contribute to the severity of Class III malocclusion. The etiology of this condition is multifactorial, involving genetic influences, altered craniofacial growth patterns, and environmental factors, all of which result in functional limitations and esthetic concerns that require carefully planned orthodontic management.

The timing of orthodontic intervention plays a decisive role in determining treatment success. Early orthodontic treatment is aimed at creating favorable growth conditions, correcting developing occlusal discrepancies, and limiting the progression of skeletal imbalance. Particular emphasis is placed on the correction of anterior and posterior crossbites, improvement of maxillary transverse dimensions, and guidance of dental eruption. Three key phases of orthodontic intervention are commonly recognized: early interceptive treatment during mixed dentition, orthodontic preparation for definitive surgical procedures, and pre-surgical orthodontics performed in preparation for orthognathic correction.

Clinical evidence suggests that orthodontic intervention initiated prior to the pubertal growth spurt is associated with improved treatment outcomes and may reduce the severity of skeletal discrepancies. Timely treatment during this growth phase can decrease the complexity of later interventions and, in some cases, lessen the need for extensive orthognathic surgery once skeletal maturity is reached. However, in patients with pronounced skeletal Class III patterns, surgical correction often remains necessary despite early orthodontic efforts.

The tactical management of Class III malocclusion in children with UCLP requires a coordinated, multidisciplinary approach that integrates orthodontic and surgical expertise. Treatment typically follows a staged sequence beginning with orthodontic alignment and arch coordination, followed by surgical intervention when indicated, and concluding with post-surgical orthodontic refinement to achieve stable occlusal relationships and improved facial harmony. Long-term retention and continuous monitoring are essential components of care, as ongoing growth can influence treatment stability and increase the risk of relapse.

Despite advances in treatment protocols, considerable debate remains regarding the optimal timing and effectiveness of orthodontic intervention for Class III malocclusion in UCLP patients. Variability in individual growth patterns, the unpredictability of craniofacial development, and differences in treatment response necessitate careful diagnosis and personalized treatment planning. While early intervention offers meaningful advantages, it must be guided by thorough growth assessment and realistic expectations to ensure that therapeutic decisions are both effective and biologically sound.

Pathophysiology

Class III malocclusion is a complex growth-related dentofacial deformity characterized by a skeletal imbalance between the maxilla and mandible. This condition most commonly presents as mandibular prognathism, maxillary deficiency, or a combination of both and is frequently encountered in patients with unilateral cleft lip and palate (UCLP). The pathophysiology of Class III malocclusion reflects the interaction of genetic predisposition, altered craniofacial growth patterns, and environmental influences, making its diagnosis and management particularly challenging in the growing patient.

Genetic factors play a substantial role in the development of Class III malocclusion. Familial aggregation of mandibular prognathism has been well documented, with historical examples such as multigenerational mandibular prominence illustrating the hereditary nature of this skeletal pattern. However, the precise mode of inheritance remains unclear. While some studies suggest autosomal dominant or recessive inheritance, others support a polygenic model in which multiple genes contribute to mandibular growth potential and maxillary development. This genetic complexity partly explains the wide variability in clinical presentation and treatment response.

Epidemiological studies have demonstrated marked variation in the prevalence and expression of Class III malocclusion across different ethnic and geographic populations, further supporting the role of genetic diversity. Morphologically, the condition may arise from insufficient forward growth of the maxilla, excessive mandibular growth, or combined sagittal, transverse, and vertical skeletal discrepancies. These variations can result in anterior crossbite, negative overjet, facial concavity, and functional disturbances, including compromised mastication and speech.

Environmental and functional factors also contribute significantly to the pathogenesis of Class III malocclusion. Abnormal mandibular posture, particularly habitual anterior positioning, can influence condylar growth direction and stimulate excessive mandibular development. Additional contributing factors include chronic nasal airway obstruction, mouth breathing, altered tongue posture, and prolonged oral habits, all of which can disrupt the equilibrium of craniofacial growth. In children with UCLP, these influences are often compounded by structural discontinuities and altered muscle function associated with the cleft.

The interaction between genetic predisposition and environmental modulation results in a broad spectrum of Class III malocclusion phenotypes. This variability highlights the importance of early recognition and intervention to prevent progression of skeletal discrepancies during growth. In growing patients, untreated Class III patterns may worsen during adolescence due to continued mandibular growth, leading to more severe skeletal disharmony at skeletal maturity.

Accurate assessment of the pathophysiology underlying Class III malocclusion relies heavily on cephalometric analysis and longitudinal growth evaluation. Cephalometric measurements allow clinicians to assess sagittal relationships, vertical growth tendencies, and dentoalveolar compensations. Advanced analytical approaches, such as growth vector assessments, have been proposed to help predict future growth behavior and identify patients at risk for unfavorable mandibular growth following orthodontic intervention.

In patients with unilateral cleft lip and palate, understanding the pathophysiological mechanisms of Class III malocclusion is essential for effective treatment planning. The presence

of maxillary hypoplasia, surgical scarring, and asymmetrical growth patterns necessitates a growth-sensitive and individualized approach. Orthodontic and orthopedic interventions must be carefully timed and coordinated with surgical management to address skeletal imbalance while accommodating the unique anatomical and functional challenges imposed by the cleft condition.

Timing of Orthodontic Intervention

Establishing the optimal timing for orthodontic intervention in children with Class III malocclusion, particularly those affected by unilateral cleft lip and palate (UCLP), requires comprehensive evaluation of clinical presentation, dental maturation, and skeletal development. Accurate timing is a critical determinant of treatment success, as it directly influences craniofacial growth modification, occlusal correction, and long-term stability of outcomes.

Clinical assessment must integrate facial analysis, occlusal relationships, and growth indicators to distinguish between transient developmental discrepancies and true skeletal imbalances. Consideration of both dental age and skeletal age is especially important in UCLP patients, whose growth patterns may deviate from those of unaffected children due to intrinsic developmental disturbances and the effects of prior surgical intervention.

Early Intervention Strategies

Early interceptive orthodontic treatment is frequently advocated to establish favorable growth conditions and address developing occlusal problems, such as anterior and posterior crossbites. In children with UCLP and skeletal Class III tendencies, early intervention aims to guide maxillary growth, improve transverse relationships, and reduce functional shifts that may exacerbate skeletal disharmony.

Three principal stages of orthodontic intervention are commonly recognized in early life: early interceptive treatment during mixed dentition, orthodontic preparation for definitive surgical repair, and pre-surgical orthodontics prior to orthognathic correction. Initiating treatment before the pubertal growth spurt has been associated with improved outcomes in selected patients, as growth modification is more responsive during this period. Early treatment may also reduce the severity of skeletal discrepancies and, in some cases, limit the need for extensive surgical correction in adulthood.

Surgical Considerations

In patients with moderate to severe skeletal discrepancies, comprehensive orthodontic treatment is often deferred until near completion of craniofacial growth. Delaying definitive treatment allows clinicians to better assess residual growth potential and avoid instability or relapse associated with ongoing skeletal changes.

When surgical intervention is indicated, treatment typically involves a structured sequence beginning with pre-surgical orthodontics to align teeth and decompensate dentoalveolar relationships. Surgical options may include maxillary advancement, mandibular setback, or a combination of both, depending on the underlying skeletal imbalance. Following surgery, post-surgical orthodontic treatment focuses on refining occlusion, ensuring functional stability, and addressing any restorative or prosthetic needs.

Factors Influencing Timing

The timing of orthodontic intervention is influenced by multiple factors, including chronological age, stage of dentition, and radiographic indicators of skeletal maturation, such

as cervical vertebral development. These indicators help clinicians estimate growth potential and identify optimal windows for intervention.

Accurate prediction of individual growth patterns remains a challenge, particularly in UCLP patients, where growth may be altered by surgical scarring or asymmetrical development. In cases where unfavorable growth trajectories are anticipated, postponing intervention may be advisable to reduce the risk of relapse or incomplete correction. Continuous growth monitoring and flexible treatment planning are therefore essential components of successful orthodontic management in this population.

Adabiyotlar, References, Литературы:

1. Mossey PA, Little J, Munger RG, Dixon MJ, Shaw WC. Cleft lip and palate. *The Lancet*. 2009;374(9703):1773–1785. doi:10.1016/S0140-6736(09)60695-4
2. Proffit WR, Fields HW, Larson B, Sarver DM. *Contemporary Orthodontics*. 6th ed. St. Louis: Elsevier; 2019.
3. Kuijpers-Jagtman AM, Long RE Jr. State of the art: Orthodontic treatment in cleft lip and palate patients. *Cleft Palate–Craniofacial Journal*. 2000;37(6):527–532. doi:10.1597/1545-1569_2000_037_0527_sotaot_2.3.co_2
4. Ross RB. Treatment variables affecting facial growth in complete unilateral cleft lip and palate. *Cleft Palate Journal*. 2021;24(1):71–77.
5. Semb G. Effect of alveolar bone grafting on maxillary growth in unilateral cleft lip and palate patients. *Cleft Palate–Craniofacial Journal*. 2018; 25(3):288–295.
6. Bongaarts CA, van 't Hof MA, Prah-Andersen B, et al. Infant orthopedics and facial growth in complete unilateral cleft lip and palate. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2016;130(4):512–518. doi:10.1016/j.ajodo.2005.03.038
7. Bishara SE. Orthodontic management of patients with clefts of the lip and palate. *Seminars in Orthodontics*. 1996;2(2):85–94. doi:10.1016/S1073-8746(96)80015-2
8. Mars M, Asher-McDade C, Brattström V, et al. A six-center international study of treatment outcome in patients with clefts of the lip and palate: Part 3. Dental arch relationships. *Cleft Palate–Craniofacial Journal*. 20;29(5):405–408.