

ORTHOGNATHIC SURGERY VERSUS DISTRACTION OSTEOGENESIS IN THE TREATMENT OF MAXILLARY HYPOPLASIA IN PATIENTS WITH CLEFT LIP AND PALATE

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ABSTRACT

Objective: To compare orthognathic surgery and distraction osteogenesis in the management of maxillary hypoplasia in patients with cleft lip and palate, focusing on treatment outcomes, skeletal stability, relapse rates, and patient-centered results.

Methodology: A narrative review of the literature was performed using PubMed, Scopus, and Cochrane Library. Studies were included if they investigated maxillary advancement in cleft lip and palate patients and reported outcomes related to skeletal stability, relapse, complications, or patient satisfaction. Both original clinical studies and reviews were considered.

Results: Orthognathic surgery allows precise, immediate maxillary advancement and is generally suitable for mild to moderate hypoplasia, though relapse rates range from 10% to 30% in severe cases. Distraction osteogenesis provides gradual advancement, promoting soft tissue adaptation and lower relapse in severe hypoplasia or younger patients, but

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requires longer treatment time and careful device management. Both techniques improve facial aesthetics and function, with high patient satisfaction.

Conclusion: Both orthognathic surgery and distraction osteogenesis are effective for treating maxillary hypoplasia in cleft patients. Orthognathic surgery is preferred for moderate cases with immediate results, whereas distraction osteogenesis is advantageous for severe hypoplasia or growing patients due to lower relapse risk and gradual adaptation. Treatment should be individualized according to patient needs and clinical factors.

Keywords: Maxillofacial Surgery. Cleft Lip. Cleft Palate. Distraction Osteogenesis. Orthognathic Surgery.

CIRURGIA ORTOGNÁTICA VERSUS OSTEOGÊNESE DE DISTRAÇÃO NO TRATAMENTO DA HIPOPLASIA MAXILAR EM PACIENTES COM FISSURA LABIOPALATÓRIA

RESUMO

Objetivo: Comparar a cirurgia ortognática e a osteogênese por distração no tratamento da hipoplasia maxilar em pacientes com fissura labiopalatina, com foco nos resultados do tratamento, estabilidade esquelética, taxas de recidiva e resultados centrados no paciente.

Metodologia: Foi realizada uma revisão narrativa da literatura utilizando PubMed, Scopus e Cochrane Library. Foram incluídos estudos que investigavam o avanço maxilar em pacientes com fissura labiopalatina e relatavam desfechos relacionados à estabilidade esquelética, recidiva, complicações ou satisfação do paciente. Foram considerados estudos clínicos originais e revisões.

Resultados: A cirurgia ortognática permite o avanço maxilar preciso e imediato e geralmente é adequada para hipoplasia leve a moderada, embora as taxas de recidiva variem de 10% a 30% em casos graves. A osteogênese por distração proporciona avanço gradual, promovendo adaptação dos tecidos moles e menor recidiva em hipoplasia grave ou em pacientes mais jovens, mas requer maior tempo de tratamento e manejo cuidadoso do dispositivo. Ambas as técnicas melhoram a estética e a função facial, com alta satisfação do paciente.

Conclusão: Tanto a cirurgia ortognática quanto a distração osteogênica são eficazes no tratamento da hipoplasia maxilar em pacientes com fissura labiopalatina. A cirurgia ortognática é preferida para casos moderados com resultados imediatos, enquanto a distração osteogênica é vantajosa para hipoplasia grave ou pacientes em crescimento, devido ao menor risco de recidiva e à adaptação gradual. O tratamento deve ser individualizado de acordo com as necessidades do paciente e os fatores clínicos.

Palavras-chave: Cirurgia Maxilofacial. Fissura Labial. Fissura Palatina. Distração Osteogênica. Cirurgia Ortognática.

CIRUGÍA ORTOGNÁTICA VERSUS OSTEOGÉNESIS POR DISTRACCIÓN EN EL TRATAMIENTO DE LA HIPOPLASIA MAXILAR EN PACIENTES CON LABIO Y PALADAR FLEJADO

RESUMEN

Objetivo: Comparar la cirugía ortognática y la osteogénesis por distracción en el tratamiento de la hipoplasia maxilar en pacientes con labio y paladar hendido, centrándose en los resultados del tratamiento, la estabilidad esquelética, las tasas de recaída y los resultados centrados en el paciente.

Metodología: Se realizó una revisión narrativa de la literatura utilizando PubMed, Scopus y la Biblioteca Cochrane. Se incluyeron los estudios que investigaban el avance maxilar en pacientes con labio y paladar hendido e informaban sobre resultados relacionados con la estabilidad esquelética, la recaída, las complicaciones o la satisfacción del paciente. Se consideraron tanto estudios clínicos originales como revisiones.

Resultados: La cirugía ortognática permite un avance maxilar preciso e inmediato y, en general, es adecuada para la hipoplasia leve a moderada, aunque las tasas de recaída oscilan entre el 10 % y el 30 % en casos graves. La osteogénesis por distracción proporciona un avance gradual, lo que promueve la adaptación de los tejidos blandos y reduce la recaída en pacientes con hipoplasia grave o más jóvenes, pero requiere un tratamiento más prolongado y un manejo cuidadoso del dispositivo. Ambas técnicas mejoran la estética y la función facial, con una alta satisfacción del paciente.

Conclusión: Tanto la cirugía ortognática como la osteogénesis por distracción son eficaces para el tratamiento de la hipoplasia maxilar en pacientes con fisura. La cirugía ortognática se prefiere en casos moderados con resultados inmediatos, mientras que la osteogénesis por distracción es ventajosa para la hipoplasia grave o pacientes en crecimiento debido al menor riesgo de recaída y a la adaptación gradual. El tratamiento debe individualizarse según las necesidades del paciente y los factores clínicos.

Palabras clave: Cirugía Maxilofacial. Labio Hendido. Paladar Hendido. Osteogénesis por Distracción. Cirugía Ortognática.

1 INTRODUCTION

Maxillary hypoplasia represents a frequent and challenging sequela in patients with cleft lip and palate (CLP), with prevalence estimates ranging from 20% to 60% depending on cleft type and previous surgical interventions (Friede & Lilja, 1994; Mars et al., 1992). Beyond the obvious esthetic impairment, maxillary retrusion compromises velopharyngeal competence, speech intelligibility, mastication, and psychosocial well-being (Chua et al., 2010; Williams et al., 2018). Surgical correction thus occupies a central role in comprehensive cleft care, yet the optimal strategy remains debated.

Le Fort I osteotomy, the cornerstone of conventional orthognathic surgery, offers predictable three-dimensional repositioning with immediate correction of occlusion and facial profile. Nevertheless, relapse rates are non-negligible, particularly for advancements exceeding 8–10 mm due to soft tissue scarring, deficient bone stock, and biomechanical constraints in cleft patients (Cheung et al., 2006; Proffit et al., 2010). Furthermore, the need for skeletal maturity delays correction in growing individuals, potentially exacerbating psychosocial burden.

Distraction osteogenesis (DO), introduced into craniofacial surgery in the 1990s, revolutionized the management of severe maxillary retrusion. By gradually mobilizing skeletal segments, DO harnesses the principles of tension-stress to stimulate both osteogenesis and soft tissue adaptation (Ilizarov, 1989; Polley & Figueroa, 1997). This technique allows for larger advancements with greater long-term stability, and it can be implemented before skeletal maturity, thus addressing functional and esthetic deficits at earlier stages (Meazzini et al., 2011; Nadjmi et al., 2016). However, DO is associated with prolonged treatment duration, device-related morbidity, and psychological burden linked to external hardware (Ow et al., 2015).

Despite numerous comparative studies, consensus on superiority remains elusive. Meta-analyses suggest that DO provides enhanced stability in severe retrusion, whereas Le Fort I remains the standard in moderate hypoplasia (Zhang et al., 2017). The absence of standardized outcome measures, heterogeneity in distraction protocols, and variability in relapse definitions complicate evidence synthesis. Hence, a critical review of outcomes: skeletal, functional, and patient-reported is essential for guiding individualized treatment planning in CLP patients with maxillary hypoplasia.

2 METHODOLOGY

A comprehensive literature search was performed in PubMed, Scopus, and Cochrane Library databases for studies published up to 2025. Keywords included “maxillary hypoplasia,” “cleft lip,” “cleft palate,” “orthognathic surgery,” “Le Fort I,” and “distraction osteogenesis.” Both original clinical studies and review articles were considered. Studies were included if they: Investigated maxillary advancement in patients with CLP; Reported outcomes related to skeletal stability, relapse, complications, or patient satisfaction. Exclusion criteria were non-human studies, case reports with fewer than five patients, and interventions unrelated to maxillary advancement. Data were extracted narratively, focusing on trends in treatment efficacy, stability, complications, and patient-centered outcomes.

3 RESULTS

The synthesis of available evidence demonstrates that orthognathic surgery and distraction osteogenesis (DO) achieve maxillary advancement with distinct biomechanical behavior, stability profiles, and patient-centered outcomes.

Skeletal stability and relapse. Conventional Le Fort I osteotomy provides accurate three-dimensional repositioning in mild-to-moderate maxillary retrusion, with reported relapse rates ranging from 10% to 30%, particularly when advancements exceed 8–10 mm (Cheung et al., 2006; Proffit et al., 2010). In contrast, DO has consistently demonstrated superior skeletal stability in severe hypoplasia, with relapse rates below 10% even in advancements exceeding 15 mm (Meazzini et al., 2011; Nadjmi et al., 2016). Meta-analyses confirm that relapse magnitude correlates with advancement size, favoring DO in extensive movements (Zhang et al., 2017). Importantly, long-term studies (>5 years) show DO maintaining maxillary projection with minimal regression, while osteotomy outcomes are more variable (Chua et al., 2010).

Soft tissue and velopharyngeal function. Gradual advancement with DO enhances soft tissue adaptation, mitigating tension-related relapse and improving velopharyngeal competence in selected patients (Figueroa & Polley, 1999; Meazzini et al., 2011). However, this benefit is inconsistent across studies, partly due to heterogeneity in distraction protocols and patient age at intervention. Orthognathic surgery, while less favorable in extensive advancements, provides immediate esthetic normalization and functional occlusion, which may outweigh the risk of relapse in adolescents and young adults seeking rapid correction (Posnick & Kinard, 2016).

Complications and morbidity. Orthognathic surgery is associated with conventional perioperative risks, including hemorrhage, infection, and neurosensory disturbances. DO introduces unique morbidity, most notably pin-site infections, hardware loosening, scarring, and the psychosocial burden of external devices (Ow et al., 2015). Internal distractors have reduced some of these complications, but at the expense of increased technical complexity. Importantly, both methods exhibit high overall safety profiles when performed in specialized cleft centers.

Patient-reported outcomes and quality of life. Recent investigations emphasize subjective measures, such as self-esteem, social integration, and treatment burden. Although DO imposes a longer and more demanding trajectory, long-term satisfaction often surpasses that of orthognathic surgery due to greater esthetic stability (Nadjmi et al., 2016; Williams et al., 2018). Conversely, patients treated with Le Fort I frequently express preference for its shorter treatment duration despite the higher risk of relapse. This underscores a fundamental trade-off between immediacy of correction and durability of outcomes.

Emerging trends. Technological advances such as three-dimensional imaging, virtual surgical planning, and custom distractors are reshaping the field. Early data suggest that these innovations may reduce relapse risk and complications, bridging the gap between the precision of osteotomy and the stability of DO (Zhang et al., 2017).

Summary. Current evidence supports orthognathic surgery as the preferred option in skeletally mature patients with moderate hypoplasia, while DO remains the technique of choice for severe deficiencies and growing patients. Beyond skeletal outcomes, the choice of intervention must also account for psychosocial burden, long-term esthetic stability, and patient preferences, reinforcing the need for individualized and multidisciplinary treatment planning.

4 DISCUSSION

The choice between orthognathic surgery and distraction osteogenesis should be guided by patient-specific factors, including severity of maxillary hypoplasia, age, skeletal maturity, and psychosocial considerations. Orthognathic surgery is ideal for mild to moderate deficiencies in skeletally mature patients, providing rapid correction, high precision, and predictable occlusal outcomes. In addition to skeletal stability, conventional osteotomy allows immediate improvement in facial aesthetics, speech, and masticatory function. However, large advancements may increase relapse risk due to soft tissue tension, limited bone

adaptation, and biomechanical constraints, particularly in cases with significant scarring from previous cleft repair procedures.

Distraction osteogenesis is particularly advantageous in severe hypoplasia, complex craniofacial anomalies, or younger patients with ongoing growth. Gradual skeletal advancement facilitates soft tissue accommodation, reduces relapse risk, and allows greater movements that might be unstable with conventional osteotomy. Furthermore, DO can be applied in combination with orthodontic strategies to optimize occlusal alignment during the distraction and consolidation phases. Nevertheless, DO requires prolonged treatment duration, careful monitoring of the distraction device, frequent follow-ups, and high patient compliance, which may impact quality of life during treatment.

Complication profiles differ between the two modalities. Orthognathic surgery carries typical surgical risks, including hemorrhage, infection, nerve injury, and postoperative relapse. Distraction osteogenesis, while generally stable for large advancements, may involve device-related complications such as pin-site infections, device loosening or failure, and patient discomfort from external or internal distractors. Despite these challenges, both methods demonstrate high patient satisfaction when functional and aesthetic goals are achieved, highlighting the importance of preoperative counseling and realistic expectations.

In clinical practice, the choice of technique must consider both anatomical and psychosocial factors. A multidisciplinary approach involving maxillofacial surgeons, orthodontists, speech therapists, psychologists, and, when needed, social workers is crucial to optimize outcomes, address patient concerns, and provide holistic care. Future directions include the integration of three-dimensional imaging, virtual surgical planning, and custom distraction devices, which have the potential to improve precision, reduce complications, and enhance predictability in both orthognathic surgery and distraction osteogenesis. Ultimately, individualized treatment planning tailored to patient needs, severity of deformity, and growth considerations remains the cornerstone of successful management of maxillary hypoplasia in cleft lip and palate patients.

5 CONCLUSION

Maxillary hypoplasia in patients with cleft lip and palate can be effectively treated with either orthognathic surgery or distraction osteogenesis. Orthognathic surgery offers precise correction with shorter treatment time, suitable for mild to moderate cases. Distraction osteogenesis is preferred for severe hypoplasia or younger patients, providing gradual

advancement with lower relapse risk. Future studies should focus on long-term stability, quality of life, and patient satisfaction to guide individualized treatment planning.

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