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Orthodontic-Surgical Treatment Planning for Skeletal Class II Malocclusion with Mandibular Retrognathia: A Case Report

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Abstract

Skeletal Class II malocclusion with mandibular retrognathia is a common dentofacial deformity affecting facial esthetics, occlusal function, and psychosocial well-being. Management of growing patients presenting with moderate skeletal discrepancies requires careful evaluation of growth potential and long-term treatment planning. The current case reported the diagnosis and proposed orthodontic–surgical treatment plan for a 13-year-old patient presenting with a Class II skeletal pattern characterized by mild-to-moderate mandibular retrognathia, increased ANB angle, convex facial profile, mild positive overjet, and a Class II dental relationship. Following comprehensive clinical and cephalometric assessment, a three-phase treatment approach was planned, consisting of pre-surgical orthodontic decompensation, mandibular advancement surgery through bilateral sagittal split osteotomy (BSSO) after skeletal maturity, and post-surgical orthodontic finishing. Post-treatment outcomes included normalization of skeletal relationships, improvement in facial profile, establishment of Class I occlusion, reduction of facial convexity, and enhancement of soft tissue balance. The study emphasized the importance of interdisciplinary planning in managing skeletal Class II malocclusion.

Keywords: Skeletal Class II Malocclusion, mandibular retrognathia, orthodontic, orthodontic–surgical treatment, facial profile, dental compensation.

Introduction

Skeletal Class II Malocclusion represents the most common orthodontic problem characterized primarily by mandibular retrusion and a convex facial profile (Lone et al., 2023). This condition is frequently associated with skeletal and dental discrepancies, resulting in functional impairment and compromised facial aesthetics (Elfouly et al., 2024). Epidemiological studies have reported prevalence rates ranging from 15-30%, affecting nearly one-fifth of the global population (García-Cando & Puebla-Ramos, 2023). This malocclusion may arise from mandibular retrognathism, maxillary prognathism, or a combination of both. Mandibular retrognathia is defined as a condition in which the mandible is posteriorly positioned relative to the anterior cranial base. The association between jaw bases and craniofacial morphology significantly affects the malocclusion pattern (Liu et al., 2021).

Mandibular retrognathia has affected 23–29% of the population and is known to have a polygenic etiology. In severe cases, it may also contribute to aesthetic impairment and obstructive sleep apnea (Alfuriji et al., 2025). Patients with mandibular deficiency tend to have a recessed chin, limited lower facial projection, an incompetent lip, and an unbalanced facial profile (Gębska et al., 2025). These skeletal and soft tissue properties can have a negative impact on mastication, speech, airway function and self-esteem, especially in adolescence when facial appearance assumes greater significance (Basso et al., 2022). Diagnosis and treatment planning are therefore critical to obtain stable functional and aesthetic outcomes.

Treatment of skeletal class II malocclusion is determined by multiple factors, including patient age, severity of skeletal discrepancy, residual growth potential, dental compensation and soft tissue profile. In growing patients, functional orthopedic appliances can stimulate mandibular growth and improve skeletal relationships when sufficient growth is present (George et al., 2021). However, in cases of severe mandibular retrognathia or poor response to growth modification, orthodontic camouflage may not sufficiently address the underlying skeletal imbalance. For such patients, a combined orthodontic-surgical treatment is regarded as the most successful treatment modality (Murotani et al., 2026).

Orthodontic-surgical treatment is designed to achieve

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functional occlusion while improving facial balance through correction of skeletal discrepancies. Treatment planning relies on precise diagnosis, integrating clinical examination, cephalometric analysis and evaluation of growth potential (Isci et al., 2024). In adolescents, the appropriate timing of surgical intervention is essential as premature surgery may result in relapse due to ongoing skeletal growth (Huo et al., 2023). Despite standardized treatment protocols for skeletal Class II malocclusion, consensus regarding the optimal timing of orthognathic surgery remains limited in patients with transitional growth status. Furthermore, variations in growth prediction methods and treatment sequencing continue to complicate the predictability of achieving skeletal and aesthetic outcomes.

Therefore, the current case study presented the diagnosis and treatment planning of a 13-year-old male with skeletal Class II malocclusion secondary to mandibular retrognathia. A multidisciplinary approach using pre-surgical orthodontics, delayed mandibular advancement surgery at skeletal maturity, and post-surgical orthodontic finishing was planned. Cephalometric, skeletal, and soft tissue changes were demonstrated to determine the expected changes in facial balance, profile aesthetics, and occlusal relationships in adolescent patients, as well as the need for evidence-based planning and long-term growth monitoring.

Case Presentation

A 13-year-old patient presented for orthodontic assessment with complaints of dental and facial profile imbalance and dental misalignment. The patient was in an active growth phase and exhibited no relevant systemic medical history that could interfere with craniofacial development or orthodontic treatment planning.

Clinical Examination

Extraoral examination revealed a convex facial profile, suggestive of mandibular deficiency. The chin was positioned posteriorly relative to the craniofacial skeleton, resulting in increased facial convexity. Lip competence was adequate, although facial balance was reduced to insufficient mandibular projection.

Upon Intraoral examination, a mild Class II dental relationship with increased overjet was observed. Mild crowding and alignment irregularities were present, indicating the need for orthodontic alignment prior to definitive treatment. During the initial assessment, no significant discrepancies in the transverse direction were noticed.

Diagnostic Findings

Comprehensive clinical and radiographic evaluation confirmed a diagnosis of skeletal Class II malocclusion, mainly due to mild-to-moderate mandibular

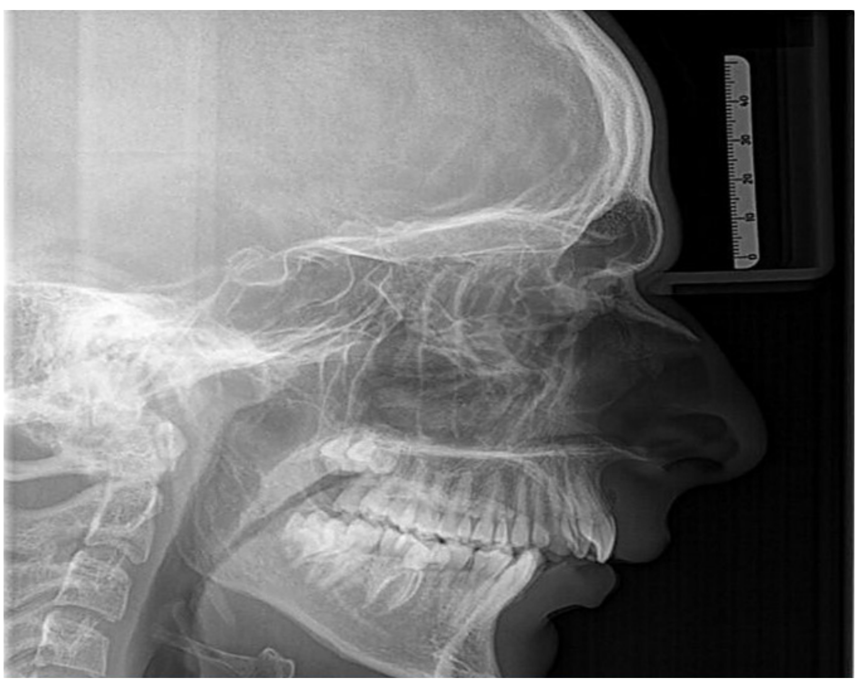

Figure 1. Pre-treatment lateral cephalometric radiograph

retrognathia. Cephalometric analysis demonstrated an increased ANB angle, confirming a skeletal Class II relationship. Clinically, the patient exhibited a convex facial profile with a mild positive overjet and a mild Class II dental relationship (Figure 1).

Given the patient's age and ongoing craniofacial development, definitive orthognathic surgery was postponed until skeletal maturity.

Treatment Plan

Phase I: Pre-surgical Orthodontics

The initial phase was planned for approximately 12-18 months. Treatment included alignment and leveling of dental arches, correction of crowding, arch coordination and dental decompensation. Adequate orthodontic preparation was critical to position the teeth within the supporting alveolar bone and ensure optimal surgical correction.

Phase II: Orthognathic Surgery

Following attainment of skeletal maturity, anticipated at approximately 16-17 years of age, mandibular advancement surgery was planned. Bilateral sagittal split osteotomy (BSSO) was selected as the preferred surgical procedure due to its proven predictability, stability and effectiveness in achieving controlled mandibular advancement. Preliminary cephalometric analysis indicated a mandibular advancement of approximately 4-6 mm, the final surgical movement would be determined using updated cephalometric records at the time of surgery.

Phase III: Post-Surgical Orthodontics

Post-surgical orthodontic treatment time was anticipated to continue for about 6-8 months. Treatment objectives included final detailing, occlusal settling and intercuspation. Upon completion of active treatment, a long-term retention protocol was subsequently implemented to maintain treatment outcomes and prevent relapse.

Post-Treatment Outcomes

Successful completion of the planned orthodontic-surgical treatment resulted in correction of the underlying skeletal discrepancy and establishment of improved occlusal relationships. Cephalometric changes revealed a decrease in ANB angle to 2-4° and an increase in SNB angle due to improved positioning of the mandible. Additional outcomes included ideal overjet of 2-3mm, Class I molar relationship, enhanced chin projection, reduced facial convexity and improved soft tissue balance.

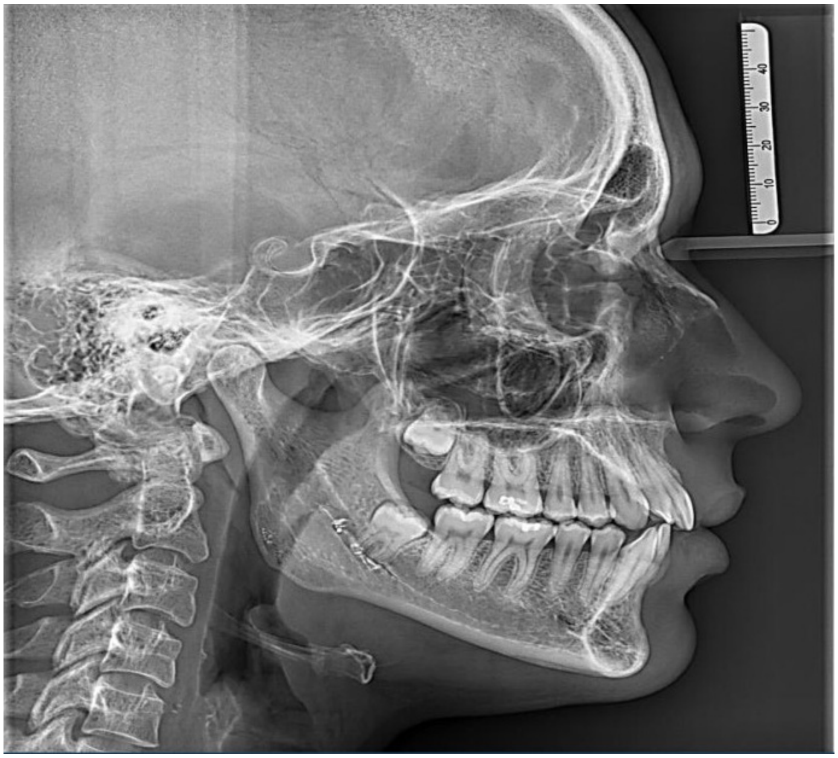

Figure 2. Post-treatment lateral cephalometric Radiograph

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Discussion

Skeletal Class II malocclusion is a common dentofacial deformity characterized by an anteroposterior discrepancy between the maxilla and mandible, most often attributed to mandibular retrognathia. Diagnosis can be complicated in growing patients as a result of craniofacial growth and dental compensations that can mask the underlying skeletal imbalance (Al-Hadad et al., 2022). The present study demonstrated a 13-year-old male with skeletal Class II malocclusion secondary to mandibular retrognathia associated with an increased overjet, convex facial profile, and decreased lower facial height. Clinical and cephalometric findings confirmed a significant skeletal discrepancy with dentoalveolar compensations. Considering the patient's growth status, a staged orthodontic-surgical treatment plan was designed, including pre-surgical decompensation, delayed mandibular advancement surgery at skeletal maturity, and post-surgical orthodontic refinement. This approach was intended to achieve optimal skeletal correction, facial harmony, and long-term stability.

Management of Skeletal Class II malocclusion associated with mandibular retrognathia continues to pose a significant challenge in orthodontics and orthognathic surgery. According to Bazarova et al. (2021), the difficulty is in differentiating skeletal discrepancies from dentoalveolar compensation, specifically during growth, and in identifying adequate treatment timing and sequencing for long-term stability. The current study showed definite characteristics of mandibular retrusion with an increased ANB angle, convex facial profile and reduced chin projection, which confirmed the skeletal etiology of the patient rather than dental origin.

Furthermore, the current study observed severe sagittal discrepancy, and at the age of 13, the patient was still a growing child. Under such conditions, the orthodontic camouflage was considered to be inadequate to obtain an acceptable facial and occlusal result. Correspondingly, a systematic review compared orthognathic surgery and dentoalveolar compensation on Class III malocclusion patients, which revealed that significant skeletal discrepancies may not be corrected optimally with dentoalveolar compensation alone but rather with combined orthodontic-surgical treatment (Alam et al., 2022).

Another important factor was the timing of the treatment. Successful orthodontic-surgical treatment in adolescents is based on growth status and skeletal maturity. Inchingolo et al. (2023) determined that early surgery prior to completion of mandibular growth may result in post-operative changes in the skeleton and relapse. Accordingly, the current study followed a strategy of growth monitoring and deferral of surgical correction until skeletal maturity was achieved. Additionally, the correct evaluation of skeletal maturity by cephalometric and clinical signs is also important to maximize the predictability in adolescent orthognathic surgery cases (Eckmüller et al., 2022).

Pre-surgical orthodontic decompensation is essential for successful treatment outcomes. In the present study, dental compensations were eliminated to reveal the actual discrepancy in the skeleton, although these may temporarily lead to worse occlusion. This phase is generally recommended in the literature as it allows for more accurate surgical correction and better surgical quality results (An et al., 2021). Inadequate decompensation has been correlated with a restricted amount of skeletal correction achieved during mandibular advancement surgery (Le et al., 2024).

Bilateral sagittal split osteotomy (BSSO) remains the gold standard for mandibular advancement in skeletal Class II malocclusion. This procedure has been known to have a high success rate, stability, and to provide controlled repositioning of the mandible within a clinically acceptable range in previous studies (Panda et al., 2025). Findings of the current study showed that mandibular advancement was planned to achieve a substantial improvement in sagittal jaw relationship, which is consistent with existing literature on orthognathic surgery studies (Jain et al., 2024; Van den Bempt et al., 2022).

Additionally, soft tissue response represents a critical determinant for overall treatment success.

Chin projection, decreased facial convexity, and lower lip position are generally improved after BSSO; however, the results vary depending on age, relapse and relaxation factors (Hallulli & Sjöström, 2026). Similar to these findings, soft tissue enhancements were observed in terms of pogonion projection and lower facial balance. These changes were more noticeable to patients than the skeletal or cephalometric changes and are considered important components of patient satisfaction.

Conclusion

This case study demonstrated that Skeletal Class II malocclusion with mandibular retrognathia required a staged orthodontic-surgical treatment to achieve adequate outcomes. Delayed mandibular advancement at skeletal maturity combined with pre-surgical orthodontics contributed to improved facial esthetics, occlusal function and treatment stability. Careful monitoring of growth potential was necessary to optimize favorable long-term treatment outcomes.

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