

Review Article

An overview of treatment strategies for class II and class III malocclusions

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ABSTRACT

Class II and class III malocclusions represent common yet complex dental conditions that affect both aesthetics and function. Managing these malocclusions requires an approach tailored to the patient's growth stage, with early interventions focusing on growth modification and adult cases often necessitating surgical solutions. In class II malocclusions, growth modification with functional appliances such as the Twin Block and Herbst appliance promotes mandibular advancement and improves facial harmony in younger patients. For older individuals or those with more severe malocclusions, orthodontic camouflage or mandibular advancement surgery, including bilateral sagittal split osteotomy, is recommended to achieve a balanced occlusal relationship and improve facial proportions. Class III malocclusions, often involving a prognathic mandible or maxillary deficiency, are particularly challenging. For young patients, facemask therapy and rapid maxillary expansion can encourage maxillary growth, while chin cup therapy can control mandibular projection, aiming to improve skeletal balance. In severe adult cases, combined orthodontic-surgical treatments, such as maxillary advancement through Le Fort I osteotomy or mandibular setback procedures, provide durable, functionally stable outcomes. Surgical-orthodontic approaches, including bimaxillary surgery, are particularly advantageous for severe class III cases by effectively addressing the underlying skeletal imbalances and enhancing facial aesthetics. Growth modification techniques emphasize the importance of early diagnosis and intervention, aiming to harness natural growth potential and reduce the need for more invasive treatments later in life. For adult patients, surgical interventions present a definitive solution, delivering substantial improvements in function and appearance. Ongoing advances in both orthodontic and surgical techniques are refining the precision and stability of treatment outcomes, underscoring the need for individualized, age-appropriate strategies in managing class II and class III malocclusions.

Keywords: Class II malocclusion, Class III malocclusion, Orthodontic treatment, Growth modification, Orthognathic surgery

INTRODUCTION

Class II and class III malocclusions are among the most prevalent dental anomalies, significantly impacting both aesthetics and functional aspects of the dentition. Defined by their distinct characteristics—class II malocclusions involve a retrusive mandible, while class III malocclusions are marked by a protrusive mandible or retrusive maxilla—these conditions can lead to complications in chewing, speech, and overall facial harmony. Their treatment often demands comprehensive, multidisciplinary approaches tailored to the individual's growth stage, severity of malocclusion, and specific craniofacial morphology.^{1,2}

For class II malocclusions, orthodontic intervention is commonly directed toward improving the occlusal relationship by enhancing mandibular growth or retracting maxillary structures. In growing patients, functional appliances such as the Herbst appliance, Twin Block, and Bionator have been frequently utilized to stimulate mandibular growth, providing effective outcomes when initiated during the pubertal growth spurt.³

In adults, however, treatment may require orthognathic surgery to achieve a stable occlusal relationship, given that the potential for significant skeletal modification is limited beyond the growth period.^{1,4} Class III malocclusions, which are often complicated by a skeletal component, present even greater challenges. Treatment can vary widely, from early orthopedic correction using facemasks in young patients to surgical interventions for more severe or progressive cases.²

Both class II and class III malocclusions require a customized treatment plan that accounts for the patient's age, skeletal development, and aesthetic needs. Treatment planning becomes increasingly complex when addressing adult patients due to the limited potential for growth modification and the need for increased stability in outcomes. As a result, surgical-orthodontic approaches become essential for patients with severe skeletal discrepancies, while camouflage orthodontics may suffice in mild-to-moderate cases where the primary goal is aesthetic enhancement rather than complete skeletal correction.⁴

Despite advancements in treatment techniques and materials, the management of class II and III malocclusions remains challenging, with ongoing debates regarding optimal timing and method of intervention. Understanding the advantages, limitations, and specific indications for each treatment modality is crucial for achieving favorable, stable, and patient-centered outcomes.

This review aims to provide an overview of current strategies in treating class II and class III malocclusions, focusing on orthodontic, orthopedic, and surgical interventions.

REVIEW

Orthodontic treatment strategies for class II and class III malocclusions vary significantly depending on patient age, severity of malocclusion, and the desired aesthetic and functional outcomes. In class II malocclusions, growth modification using functional appliances, such as the Twin Block, is effective in younger patients due to the potential to alter mandibular positioning during growth periods.⁵ These appliances encourage forward mandibular development, which helps to achieve a more harmonious jaw relationship. However, such growth-modifying approaches have limited applicability in adults, where skeletal maturity restricts structural changes, necessitating alternative methods like orthodontic camouflage or surgical correction for pronounced discrepancies.⁶

Class III malocclusions often require a more complex approach due to their potential skeletal basis, typically involving mandibular excess or maxillary deficiency. In children, early intervention with facemask therapy aims to protract the maxilla, effectively treating skeletal imbalance before skeletal maturity sets in.⁵ For adults or severe cases, orthognathic surgery combined with orthodontics may be essential to reposition the jaws, providing more stable and enduring results. Treatment decisions thus hinge on skeletal maturity and the severity of malocclusion, with each option tailored to balance aesthetics, function, and long-term stability.⁶

Orthodontic approaches in managing class II malocclusions

Class II malocclusions are characterized by a retrusive mandible or a protrusive maxilla, resulting in a distinct anteroposterior discrepancy between the upper and lower jaws. This misalignment can impact both aesthetics and function, often prompting patients to seek treatment for the combined issues of appearance, bite, and comfort. Management approaches for class II malocclusions are broad, spanning growth modification techniques, dental camouflage, and orthognathic surgery, each chosen based on the patient's age, skeletal maturity, and the malocclusion's severity.

In growing patients, growth modification remains a primary strategy, as it offers the potential to harness skeletal growth for lasting results. The use of functional appliances, such as the Twin Block and Herbst appliances, has become a staple in correcting mandibular deficiency in younger patients.⁷ These appliances stimulate mandibular growth by posturing the jaw forward, which encourages natural growth processes and promotes a more balanced jaw relationship. Functional appliances like the Twin Block are particularly effective when used during the peak growth spurt, as they capitalize on the active phase of bone growth to achieve desired outcomes.⁸ Research shows that the Twin Block can result in a significant forward repositioning of the mandible, improving class II profiles without the need for invasive procedures in many cases.

Another widely utilized functional device is the Herbst appliance, which similarly positions the mandible forward and holds it there to encourage growth changes over time. Studies indicate that the Herbst appliance provides comparable results to the Twin Block but can be more advantageous for patients with compliance issues, as it is fixed to the dentition and cannot be removed by the patient.⁹ The appliance is effective in inducing mandibular growth, which gradually translates into improved dental and skeletal relationships. However, while the Herbst appliance is promising, some practitioners have raised concerns about potential risks, such as increased risk of mandibular incisor proclination, particularly in cases with limited mandibular growth potential.

For patients beyond their primary growth phases, camouflage orthodontics is often preferred to address class II discrepancies by repositioning the teeth without altering the underlying skeletal structure. This approach is frequently used in mild-to-moderate Class II cases where aesthetic outcomes can be achieved without significant skeletal modification.¹⁰ Camouflage typically involves retracting the upper anterior teeth using fixed appliances like braces, often accompanied by extractions of the upper first premolars to create the necessary space for retraction. While camouflage does not correct the skeletal discrepancy itself, it can substantially improve facial aesthetics and occlusal function, offering a non-surgical alternative for patients seeking minimally invasive treatment options. Evidence suggests that orthodontic camouflage is effective in enhancing dental alignment and can yield stable results when performed with careful planning and consideration of individual patient anatomy.

For patients with severe class II malocclusions or those who have completed skeletal growth, orthognathic surgery combined with orthodontic treatment may be recommended to address both aesthetic and functional concerns. This combined approach, known as surgical-orthodontic treatment, typically involves preoperative orthodontics to align the teeth, followed by surgery to reposition the jaws. Le Fort I osteotomy for maxillary retrusion and bilateral sagittal split osteotomy for mandibular advancement are commonly performed procedures, and they are often associated with positive aesthetic and functional outcomes in patients with significant skeletal discrepancies (Figure 1). Surgical correction is generally reserved for severe cases, as it offers a permanent solution that cannot be achieved with growth modification or camouflage alone.⁶ While this approach carries inherent surgical risks, it has shown high rates of patient satisfaction and provides a predictable solution for adult patients with pronounced skeletal malocclusion.

Orthodontic approaches in managing class III malocclusions

Class III malocclusions, often characterized by a prognathic mandible or a retrognathic maxilla, present distinctive challenges in orthodontics due to their complex

skeletal foundation. These malocclusions not only affect aesthetics but can also compromise functional occlusion, leading to further issues with chewing and speech. Treatment modalities for class III malocclusions vary by the age and developmental stage of the patient, with non-surgical orthopedic interventions typically reserved for younger patients, while adult cases often require surgical correction combined with orthodontics.

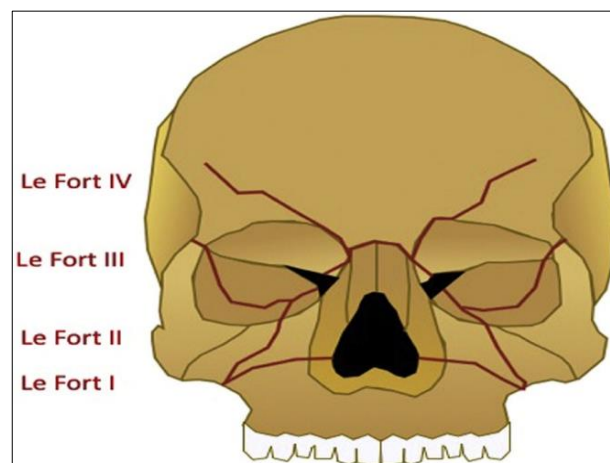


Figure 1: The Le Fort classification according to Manson in 1986, I: Le Fort I fracture line; II: Le Fort II fracture line; III: Le Fort III fracture line; and IV: Le Fort IV fracture line.¹¹

In pediatric patients, early orthopedic treatment is commonly employed to modify jaw growth and address skeletal imbalances. Facemask therapy, for instance, is used to stimulate maxillary protraction in young patients, particularly those with maxillary deficiency. This appliance, often combined with a rapid maxillary expander, applies forward traction to the maxilla, promoting growth and improving the jaw relationship.¹² Studies have shown that early intervention with facemask therapy can significantly alter the skeletal structure in growing patients, reducing the need for more invasive procedures later on. For optimal results, facemask therapy is generally recommended before the pubertal growth spurt, as the maxilla is more responsive to protraction during early childhood.

The chin cup is another approach aimed at redirecting mandibular growth to manage prognathic tendencies in class III cases. By exerting upward and backward force on the mandible, the chin cup can mitigate excessive mandibular growth and restrain forward projection, helping to balance the facial profile in young patients with mandibular prognathism.^{12,13} Although this method is less commonly used today, studies suggest that it can be effective when used consistently over a period of several years, particularly in younger children who exhibit early signs of mandibular prognathism. However, the chin cup's long-term stability has been debated, as its effects are often limited by post-treatment growth changes, underscoring the importance of timing and careful patient selection.

For patients who have completed skeletal growth, orthodontic camouflage becomes a viable option for managing mild-to-moderate class III malocclusions. Camouflage treatments involve repositioning the teeth to compensate for the skeletal discrepancy without altering the underlying bone structure. For example, mandibular incisor extraction may be performed to allow for retraction of the lower anterior teeth, thus creating a more balanced occlusal relationship.¹³ This technique is commonly employed in cases where surgical intervention is either not feasible or not desired by the patient. Camouflage treatment provides an effective solution for improving aesthetics and function in patients with minor skeletal discrepancies, though it may not be sufficient for cases with severe skeletal issues. Research suggests that, with careful planning, orthodontic camouflage can yield stable and satisfactory results for many patients, although achieving ideal aesthetics may be challenging in more pronounced cases.

In cases of severe class III malocclusion, where skeletal discrepancies are marked and camouflage options are insufficient, a combined orthodontic-surgical approach is often recommended. Orthognathic surgery, typically involving a Le Fort I osteotomy for maxillary advancement or a mandibular setback, is performed in conjunction with orthodontics to achieve both functional and aesthetic improvements. This surgical correction is particularly beneficial for adult patients who have exhausted growth modification options and require a comprehensive solution to address significant skeletal imbalances.¹⁴ Pre-surgical orthodontics aligns the dental arches in preparation for surgery, while post-surgical orthodontics helps to refine occlusal relationships and ensure stability. Despite the inherent risks associated with surgery, this approach has demonstrated high success rates and improved quality of life for patients with complex skeletal class III malocclusions, as it directly addresses the underlying structural issues rather than solely relying on dental compensation.

Surgical interventions for severe class II and class III malocclusions

For patients with severe class II and class III malocclusions, where skeletal discrepancies are beyond the reach of orthodontic or orthopedic treatments alone, surgical intervention becomes a key treatment strategy. Orthognathic surgery, combined with pre- and post-surgical orthodontics, provides a comprehensive approach that addresses both functional and aesthetic demands, especially when malocclusion involves complex skeletal abnormalities. Unlike orthodontic treatments that primarily adjust tooth position, orthognathic surgery enables direct modification of jaw structure, significantly enhancing outcomes in patients with severe class II or class III profiles.

In class II malocclusion cases, mandibular advancement surgery is commonly performed to address retrusive

mandibles and improve the anteroposterior jaw relationship. A bilateral sagittal split osteotomy (BSSO) is one of the most frequently employed procedures for this purpose, offering predictable and stable results.¹⁵ BSSO allows surgeons to move the mandibular body forward in a controlled manner, creating a harmonious balance between the maxilla and mandible. When combined with orthodontic alignment, BSSO can achieve substantial improvements in occlusion, function, and facial aesthetics. While mandibular advancement surgery has high success rates, post-operative care is essential for maintaining stability, as relapse can occur in some cases if not managed carefully.¹⁶

In cases of class III malocclusion characterized by a prognathic mandible or maxillary deficiency, maxillary advancement surgery, often through a Le Fort I osteotomy, is frequently recommended. This surgical procedure enables the repositioning of the maxilla to correct the midface deficiency and improve occlusal and facial balance.¹⁷ The Le Fort I osteotomy is highly versatile, allowing for various movements of the maxilla—forward, upward, downward, or even rotated—based on the patient's specific needs. By addressing the underlying skeletal imbalance, maxillary advancement provides a significant aesthetic improvement and corrects the occlusal disharmony that is common in severe class III cases. However, complications such as sinus issues, relapse, and neurosensory deficits are possible and require careful pre-surgical planning and post-surgical management.

For patients with extreme skeletal imbalances in both the maxilla and mandible, a bimaxillary surgery, which combines both maxillary and mandibular adjustments, may be indicated. Bimaxillary surgeries address discrepancies by simultaneously advancing or repositioning both jaws, offering enhanced control over facial proportions and occlusal relationships.¹⁸ This approach is particularly beneficial in cases where isolated mandibular or maxillary surgery alone would not sufficiently correct the malocclusion or facial asymmetry. Although bimaxillary surgery is a more extensive procedure with a potentially longer recovery period, studies show it can offer superior aesthetic outcomes and greater stability in patients with severe skeletal discrepancies. Orthodontic treatment is required both pre- and post-operatively to align the teeth and refine occlusion, ensuring the best possible functional and aesthetic results.

In addition to specific jaw surgeries, adjunctive procedures, such as genioplasty, are sometimes incorporated into the surgical plan to further refine facial aesthetics. Genioplasty, or chin surgery, is especially useful in cases where chin position affects the overall facial profile. This procedure can be performed concurrently with BSSO or Le Fort I osteotomy to enhance facial symmetry and harmony.⁸ By modifying the chin position, genioplasty complements jaw alignment, particularly in cases of mandibular advancement or maxillary setback. Although it is considered a secondary procedure,

genioplasty plays a significant role in achieving balanced facial proportions and is frequently used in class II and III surgical corrections where chin prominence or retrusion is evident.

Role of growth modification techniques in early treatment

Growth modification techniques play an instrumental role in the early management of class II and class III malocclusions, capitalizing on the natural growth potential in young patients to correct skeletal imbalances before they become more severe. These approaches are particularly advantageous in pediatric and adolescent patients, as the skeletal structure is still malleable, allowing for interventions that can reshape growth patterns. While growth modification is primarily beneficial in children, its effectiveness depends heavily on the timing of treatment initiation, as well as the type and severity of the malocclusion.

For class II malocclusions, where mandibular retrusion is common, functional appliances such as the Twin Block and Herbst appliance are often utilized to encourage forward mandibular growth. The Twin Block appliance, designed to position the lower jaw forward, stimulates the condylar growth process, encouraging the mandible to develop in a more balanced alignment with the maxilla.⁸ Studies have shown that, when used during the pubertal growth spurt, the Twin Block appliance can produce marked improvements in mandibular positioning, significantly reducing the severity of class II profiles in young patients. The appliance's dual-block design not only corrects the jaw relationship but also promotes changes in soft tissue, contributing to an overall improvement in facial aesthetics. Another prominent growth modification device for class II malocclusions is the Herbst appliance, a fixed appliance that applies a continuous forward force to the mandible. The Herbst appliance is advantageous for patients with compliance issues, as it remains fixed in the mouth and cannot be removed, thus providing consistent growth stimulation.⁹ Research on the Herbst appliance indicates that it can yield significant skeletal changes, particularly in younger patients with high growth potential. By applying sustained pressure on the mandible, the Herbst appliance stimulates the remodeling of both the mandibular condyle and the temporomandibular joint, which aids in advancing the lower jaw forward. However, like other functional appliances, the success of the Herbst depends on appropriate patient selection and correct timing relative to growth phases.

In managing class III malocclusions, where maxillary deficiency or mandibular prognathism often occurs, early orthopedic interventions are employed to either encourage maxillary growth or control mandibular projection. Maxillary protraction with a facemask, often combined with rapid maxillary expansion, is one such approach that exerts forward traction on the maxilla, encouraging forward growth and improving jaw alignment.¹⁹ Facemask

therapy has been widely documented as an effective method for addressing maxillary deficiency when initiated at an early age, ideally before the peak pubertal growth phase. By stimulating forward growth of the maxilla, facemask therapy can effectively modify skeletal development, reducing the severity of the class III malocclusion as the child grows. Additionally, combining the facemask with maxillary expansion widens the dental arch, creating more space and improving occlusal stability in conjunction with skeletal changes.

For young patients with class III malocclusions and an overactive mandibular growth pattern, a chin cup may be used to redirect mandibular growth and prevent excessive forward movement. The chin cup applies an upward and backward force on the mandible, which helps to control growth direction and reduce the prominence of the lower jaw.²⁰ Though less frequently used than facemask therapy, the chin cup remains an option for patients who exhibit mandibular prognathism at an early age. Studies on chin cup therapy reveal that it can alter the direction of mandibular growth to some extent, although its long-term stability has been a point of debate, particularly in cases where the patient continues to exhibit strong growth tendencies post-treatment. Growth modification techniques underscore the importance of early diagnosis and intervention in skeletal malocclusions. By addressing the underlying skeletal issues at a young age, these techniques can often prevent the need for more invasive treatments in the future and promote a harmonious facial profile and functional occlusion.

CONCLUSION

The treatment of class II and class III malocclusions requires a tailored approach, integrating orthodontic, orthopedic, and surgical options based on patient age, growth stage, and the malocclusion's severity. Growth modification techniques are most effective in young patients, while adults often benefit from combined surgical-orthodontic interventions to achieve functional and aesthetic stability. Early intervention and individualized treatment planning remain essential for optimizing outcomes. As research and techniques evolve, these strategies continue to refine the precision and predictability of malocclusion management.

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