

# Severe Malocclusion: The Importance of Appropriately Timed Treatment

A Synchronized and Simultaneous Interdisciplinary Plan  
Using Cosmetic Dentistry Principles

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## Abstract

This article discusses challenging issues clinicians face when treating malocclusions and illustrates a solution in a severe Class III malocclusion case. Interestingly, and the motivation for this article, principles of cosmetic dentistry and timing determined the treatment plan. Orthodontics and a three-dimensional visualization and spatial diagnosis were required, along with carefully orchestrated orthognathic surgery with simultaneous rhinoplasty. The final result showed dramatic improvements in the facial profile and smile.

**Key Words:** Class III malocclusion, orthodontics, craniofacial growth, vertical maxillary deficiency, orthognathic surgery, rhinoplasty



Is the answer contained only in the sometimes perplexing cephalometric radiograph?

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## Introduction

Treatment of Class III malocclusions can comprise a number of options, depending upon who is undertaking the diagnostic and treatment-planning responsibilities. This can cause some challenging issues for the dentist, such as when the best time to treat the malocclusion is and what the best approach is. Is the answer contained only in the sometimes perplexing cephalometric radiograph? Surprisingly, in today's orthodontics the cephalometric radiograph is not the main determinant of the treatment plan.<sup>1</sup> Rather, a critical piece of the answer lies in principles commonly used in cosmetic dentistry. The case described here is an excellent example of how the relationship of the soft tissues to the hard tissues (the "soft tissue paradigm") is the major factor in determining treatment.

## Initial Patient Presentation and Findings

This patient first came to our office with his parents when he was six years old. He had a short lower facial height and an overclosed appearance at rest (Fig 1). His underbite was immediately evident and vertical maxillary deficiency was diagnosed because of the characteristic short lower face and little to no maxillary incisor display in his smile (Fig 2). Even at his young age, the patient's skeletal deformity was obvious (Fig 3). His primary dentition had negative overjet with no anterior slide (Fig 4). An important clinical finding is that if the incisors are edge to edge in CR, the mandible has to slide forward for the posterior teeth to articulate. This type of CR-CO discrepancy has a greater likelihood of successful early treatment. However, when there is no anterior slide, then the position of the mandible relative to the maxilla is less successfully treated with early intervention. At this point, however, it was hard to determine the etiology of the Class III malocclusion.

As with most young patients, an attempt was made to protract the maxilla, but it soon became clear that any treatment at that time would be futile given the severity of the skeletal deformity. Therefore, it was decided to follow the patient for a number of years until he reported he had stopped growing toward the end of high school.

## Treatment

### Timing

When is the right time to proceed to orthodontics and surgical correction? Particularly in Class III malocclusion cases, the patient should be finished growing in terms of statural height. Long-term data, however, support the idea that our dentoalveolar and craniofacial growth never completely stops.<sup>2</sup> But in this type of surgical/orthodontic treatment, the critical gold standard for the orthodontist is to follow craniofacial growth with a series of cephalometric radiographs taken six months apart. When three consecutive films can be superimposed on the stable cranial base with no changes evident, the patient's treatment may be initiated. By age 20, this patient had met all the criteria for beginning his treatment (Fig 5). His incomplete incisor display on smile and deep nasolabial folds had a great influence on our treatment planning (Fig 6). It remained obvious that his facial and dental malformations were quite severe (Figs 7 & 8). A complicating factor in our decision-making process was that there was an extreme excess of space in the lower arch. An attempt to close all that space would not only be difficult, but also would be contrary to the principles of proper orthodontic preparation for an ideal surgical outcome. The position of the lower incisors was excellent, and to retract them would tilt them lingually, which would adversely affect how much the maxilla could be advanced. We decided to leave the space, and planned implant placement to restore the integrity of the mandibular arch (Fig 9). Due to vertical maxillary deficiency (lack of vertical growth of the maxilla), incomplete incisor display was evident on both the facial smile and the close-up smile. This had a significant impact on the surgical placement of the maxilla, since the position of the maxillary incisor drives the treatment plan (Fig 10).

### Orthodontics

Orthodontic treatment was begun to decompensate the dentition in preparation for the patient's jaw surgery. Once the teeth were properly positioned for surgery, it became critical to determine the cause of the malocclusion. In Class III malocclusion, the procedure itself sometimes drives what is perceived as the problem. For example, many would correct this malocclusion by surgically moving the mandible back. While this might correct malocclusion, facially it results in a more obtuse chin-neck contour (i.e., a fatter-looking neck). Commonly, the maxilla is moved forward to avoid that problem. But rather than limiting our thinking only to the anteroposterior plane of space, a more three-dimensional spatial diagnosis was required. This type of malocclusion may be the result of mandibular prognathism, maxillary deficiency (insufficient anterior growth of the maxilla), or vertical maxillary deficiency (vertical undergrowth of the maxilla resulting in a clockwise rotation of the mandible).



**Figure 1:** The patient first presented at age six with short lower facial height and an overclosed appearance at rest. The short lower facial height is a visual cue for vertical maxillary deficiency, one of the possible etiologic agents in a Class III malocclusion.



**Figure 2:** The patient's underbite was evident and Class III malocclusion was diagnosed.



**Figure 3:** Although the patient's skeletal deformity was obvious even at this young age, it was hard to determine the potential multifactorial etiologies of the Class III malocclusion.



**Figure 4:** This intraoral image shows negative overjet with no anterior slide.

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When is the right time to proceed to orthodontics and surgical correction?

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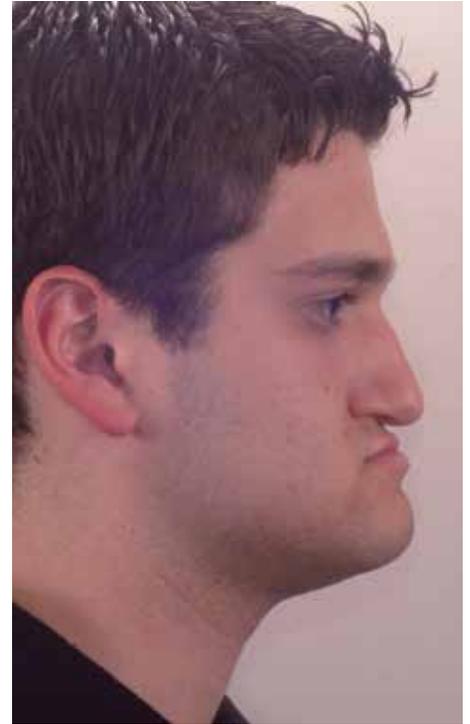
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**Figure 5:** At age 20, the patient's prominent mandible and flat midface remained obvious.



**Figure 6:** The patient's incomplete incisor display on smile and deep nasolabial folds had a significant impact on our treatment decisions.



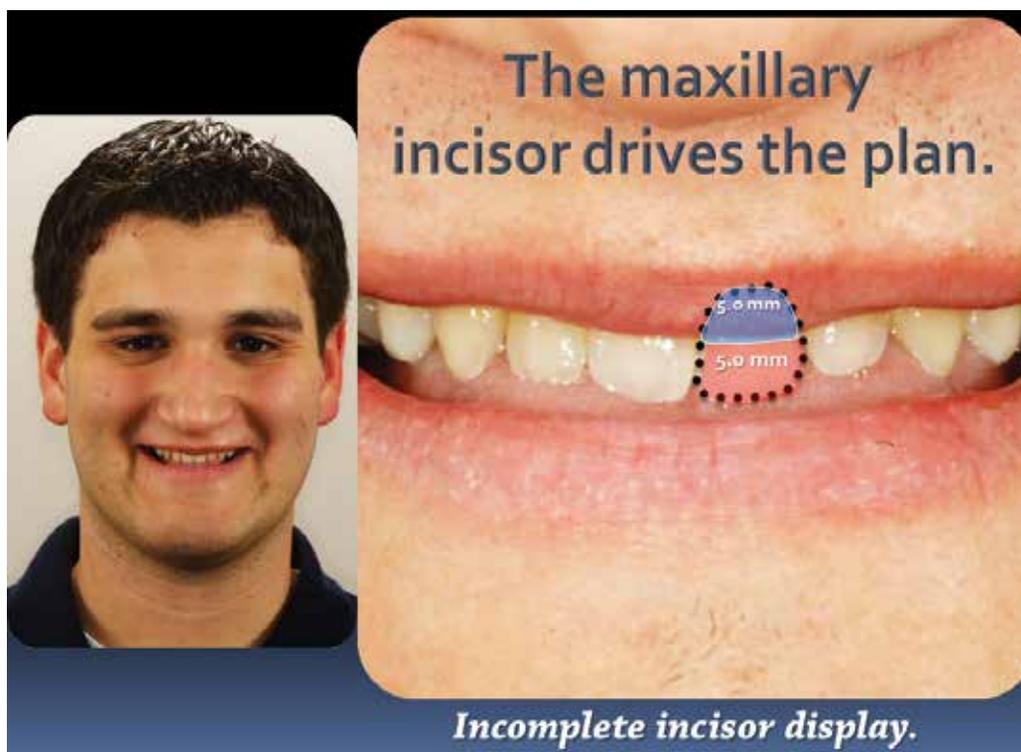
**Figure 7:** The severity of the patient's facial deformity clearly remained, as demonstrated in this profile image.



**Figure 8:** The severity of the Class III malocclusion is reflected in this intraoral photograph.



**Figure 9:** The mandibular arch had an overabundance of space and we decided not to close it because that would have retroclined the lower incisors (thus compromising the negative overjet, necessary for appropriate skeletal correction).

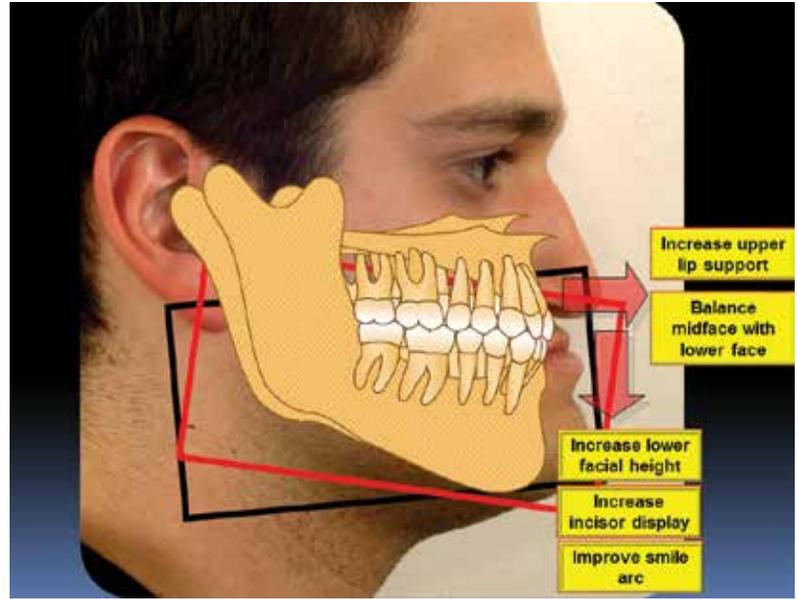


**Figure 10:** Determining the placement of the maxillary incisor was a primary factor in determining where we positioned the maxilla, since the position of the maxillary incisor drove the treatment plan.

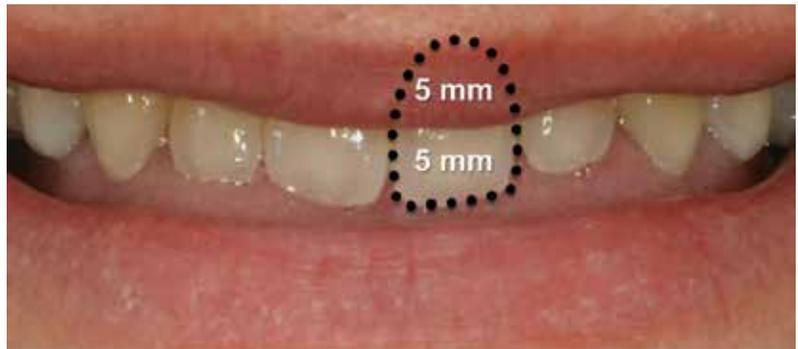
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## Surgical Treatment Planning

The clinical measurements of upper lip to incisor relationships are essential to proper diagnosis. First, during our clinical examination, we noted that there was no incisor display at rest. Second, on smile, the patient's incisor display was 5 mm while his crown height was measured at 10 mm. As is the case in cosmetic dentistry, the ultimate desired position of the maxillary central incisor determines the surgical placement of the incisal edge. **Figure 11** demonstrates the overall surgical plan after orthodontic preparation. As the illustration indicates, the maxilla was planned to come forward to increase upper lip support and improve the soft tissue nasolabial folds. Anterior maxillary downgraft was also planned to increase the lower facial height (improving the overclosed appearance) and to increase the amount of incisor display and improve the smile arc. As a result, we calculated a 5-mm anterior downgraft of the maxilla, which would result in 5 mm of tooth display at rest and full incisor display on smile (**Fig 12**). The oral and maxillofacial surgeon performed a Z osteotomy to provide maximum stability to the maxillary downgraft, so that as the maxilla moves downward and forward, bony contact is still maintained between the maxilla and the zygomatic process (**Fig 13**). This allows the surgeon to place rigid fixation plates solidly in bone, providing greater stability, since maxillary downgraft is regarded as an inherently unstable procedure. All other skeletal movements were planned around the placement of the maxilla, resulting in bimaxillary surgery with clockwise occlusal plane rotation.<sup>3-6</sup>

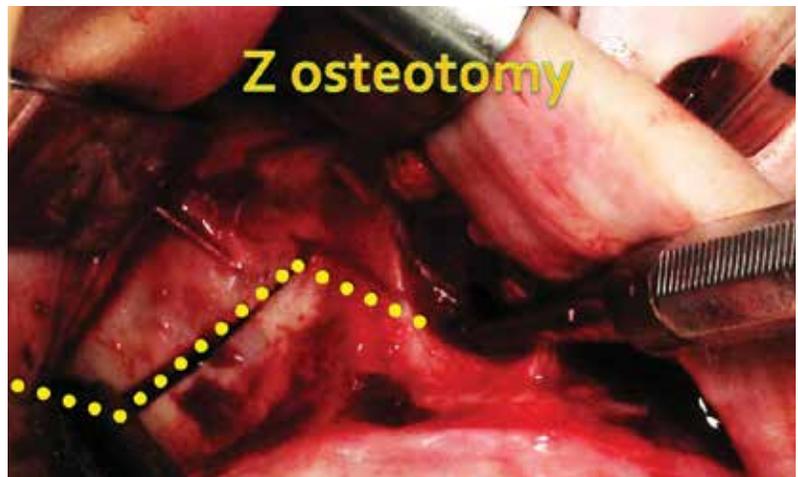


**Figure 11:** The surgical plan illustrates how the maxilla needed to come forward to increase upper lip support and improve the soft tissue nasolabial folds. It also indicates an anterior maxillary downgraft to increase incisor display and improve the smile arc.



**Figure 12:** On smile, the patient showed 5 mm of tooth, while the total crown height was 10 mm. This dictated that the anterior maxilla should be moved inferiorly 5 mm.

But rather than limiting our thinking only to the anteroposterior plane of space, a more three-dimensional spatial diagnosis was required.

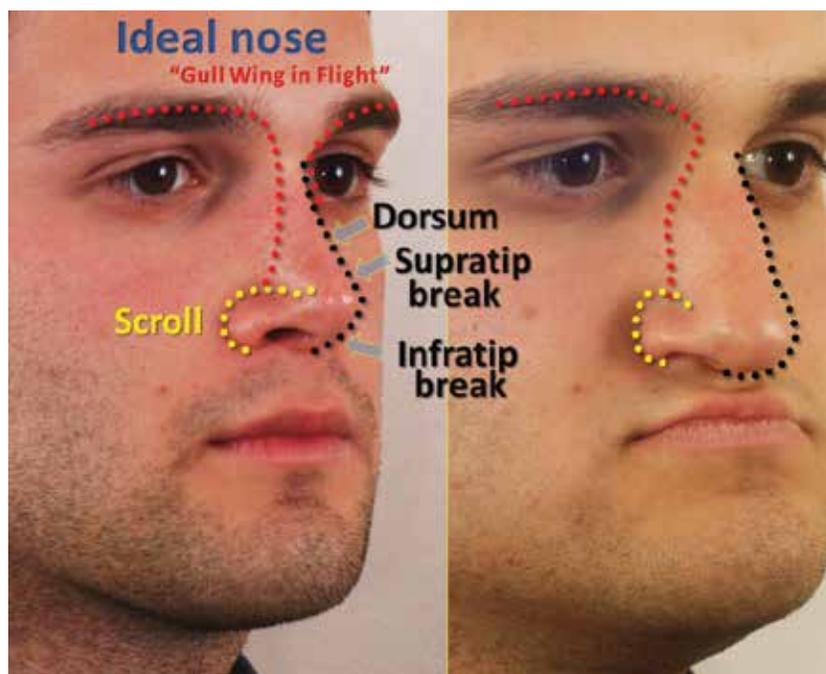


**Figure 13:** A Z osteotomy provided maximum stability to the downgraft of the anterior maxilla, while still maintaining bone contact.

The oblique view of the face is what I term the “social view” (i.e., the angle at which people are most often seen in social situations). While the patient presented with a rather prominent mandible, his vertical maxillary deficiency was also characterized by the overclosed look. Also on this view, the low position of the nasal tip and the broad lateral nasal cartilages without a distinct “scroll” (the curvature from the base of the nose into the lateral nasal tip cartilages) are apparent (Fig 14). The anatomy of what is considered an “ideal” nose is shown in the post-treatment (left-hand) image of Figure 15. The pretreatment (right-hand) image demonstrates a lack of scroll in this patient due to large lateral nasal cartilages. The dorsum represents the juncture of the nasal bone and the nasal cartilage—the body of the nose—and ideally it should have a general curve to it without projection. The supratip represents the junction of the septal cartilage with the nasal tip cartilages, producing a slight “supratip break.” The elevation of the nasal tip is evident compared with the pretreatment image, and the sweep from the base of the nose to the dorsum and the eyebrows is referred to as the “gull wing in flight,” which is considered esthetically desirable. The maxillary deficiency is evident in both vertical and horizontal planes of space. There is incomplete incisor display and very deep nasolabial folds on smile (Fig 16). After orthodontic preparation and during the orthognathic procedure, the implants were placed for maximum efficiency of treatment (Fig 17).



**Figure 14:** This image shows a prominent mandible with an overclosed appearance and a low position of the nasal tip with broad lateral nasal cartilages without a distinct “scroll.”



**Figure 15:** The image on the left shows the anatomy of what is considered an “ideal” nose. The image on the right demonstrates a lack of scroll due to large lateral nasal cartilages.



**Figure 16:** The maxillary deficiency is evident, with incomplete incisor display on smile and deep nasolabial folds.

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The facial profile was further enhanced by the rhinoplasty, which significantly improved the appearance of the nose.

## Rhinoplasty and Orthognathic Surgery

With an expanded team approach, a rhinoplasty was performed simultaneously with the very precise orthognathic surgery. The oblique image in **Figure 18** displays the facial plastic surgeon's superb nasal management: advancement of the maxilla improved the nasolabial folds and achieved excellent balance of the upper face and the lower face. **Figure 19** demonstrates the balance of the chin projection with the upper face. The upper jaw was moved downward and forward to help support the lips and show more tooth when the patient smiled, and the lower jaw was rotated downward and forward in a clockwise fashion, resulting in dramatic improvement in the length of the lower third of the face. The facial profile was further enhanced by the rhinoplasty, which significantly improved the appearance of the nose. The final result is striking in terms of improved occlusion (**Fig 20**), mandibular arch (**Fig 21**), and incisor display (**Fig 22**); and an exceptionally more esthetic profile (**Fig 23**) and smile (**Fig 24**).

## Synchronization Plan

This case proceeded as most orthognathic cases do in an orthodontic practice. An important part of the decision process is for the orthodontist to assess how the teeth articulate in a simulated Class I relationship. In other words, models are taken and held by hand into the desired Class I relationship and the following evaluations are made:

- Whether the angulations of the anterior teeth are sufficient to allow coupling of the anterior teeth, and simultaneously ideal posterior occlusion. For example, if the lower incisors are too retroclined, then it is virtually impossible to attain good buccal interdigitation. The orthodontist must decide how to decompensate the dentition for good occlusion.



**Figure 17:** Orthodontic preparation for the orthognathic procedure and ideal implant placement, placed during the orthognathic procedure.



**Figure 18:** This post-treatment oblique image shows excellent nasal management and facial balance with an advancement of the maxilla to improve the nasolabial folds.



**Figure 19:** This oblique image reflects excellent balance of chin projection with the upper face.

- The transverse relationships are then evaluated. If the maxilla is too narrow and expansion is required, the orthodontist must decide whether the expansion is minor and orthodontic arch coordination is all that is needed, or if surgical expansion of the maxilla should be performed at the same time.
- The vertical relationships of the occlusal plane are evaluated. If the maxilla exhibits a differential vertical position between the anterior teeth and posterior teeth, then the maxilla may be segmented to level it and attain a flat occlusal plane in a stable manner. In other words, if there is a pronounced Curve of Spee in the maxillary arch resulting



**Figure 20:** The final occlusion.

**Figure 21:** The mandibular arch after restoration of the implants.



**Figure 22:** The close-up smile demonstrates the consonance of the smile arc and improved incisor display on smile.



**Figure 23:** The final profile.



**Figure 24:** The final full-face image with complete incisor display and consonant smile arc.

# CLINICAL COVER CASE

in an anterior open bite, then presurgical flattening of the arch through orthodontic treatment has a high chance of instability. In this situation, the orthodontist must align the anterior and posterior teeth in separate segments so that the surgeon can perform a LeFort I osteotomy in segments to maximize stability of the final outcome.

Probably the most challenging aspect of this type of case is coordination of the orthognathic surgery and rhinoplasty. In our setting, the oral and maxillofacial surgeon previously planned with the facial plastic surgeon for the procedure to begin with nasal intubation while the jaw osteotomy was performed and stabilized with rigid fixation. Once the osteotomy was complete and the fixation securely in place, the intubation was changed from nasal to oral. This required close coordination of the surgeons and the anesthesia team: When the nasal intubation was cut at its entry to the nose, the surgeon reached in to grasp the pharyngeal tube and pull it back through the mouth to remove it, while the anesthesia team changed the nasal tube to an oral tube to be inserted immediately after removal of the nasopharyngeal tube. This procedure is neither complicated nor time-consuming, but it is essential to the success of the combined orthognathic surgery and rhinoplasty.

## Summary

Orthognathic surgery used to be considered a drastic procedure. However, there have been dramatic changes in approach in the past few decades. Today, with rigid fixation, it can be performed simultaneously with other facial esthetic procedures such as rhinoplasty, with few complications and comparatively uneventful recovery. The evolution of rigid fixation has freed the interdisciplinary team from the necessity of wiring the teeth together, thus facilitating the simultaneous esthetic procedures and allowing the patient to have a much more comfortable postoperative period. In the case discussed here, interdisciplinary treatment—orthodontics followed by simultaneous orthognathic surgery and rhinoplasty—resulted in a life-transforming change for the patient.

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