Class II surgical-orthodontic treatment of a patient with severe coronary disease: 5 years of follow-up

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This case study describes the retreatment and long-term follow-up care of a patient with a medical history of 2 heart surgeries and a Class II malocclusion that included a severe anteroposterior skeletal discrepancy characterized by mandibular deficiency. The patient's initial orthodontic camouflage treatment was poorly performed and failed to correct the maxillofacial disorders. In this article, we report the successful retreatment with a surgical-orthodontic protocol and include the 5-year follow-up records showing stable results. Guidelines for the stratification of cardiac risk are included. (Am J Orthod Dentofacial Orthop 2013;143:855-66)

Elective dental treatment, except for conservative emergency procedures, has traditionally been contraindicated in patients who have experienced unstable angina and acute myocardial infarction during the previous 6 months.1 The American College of Cardiology and the American Heart Association published risk stratification guidelines for professionals who are performing several types of noncardiac surgical procedures in patients with various cardiopathologies.2 This topic is important for orthodontists because more orthodontic patients have a history of heart disease or surgery; these guidelines emphasize how a dental treatment plan should be established to ensure that reasonable and safe decisions are made and specifically to determine with confidence whether a patient will be able to tolerate a planned procedure. For example, surgical orthodontic treatment for maxillomandibular disharmony could be indicated for a patient with a history of acute myocardial infarction as long as the patient is stratified as having a low cardiac risk.3

Over the past few years, great progress has been made in surgical orthodontic protocols4,5 for the treatment of malocclusions with skeletal involvement that had previously been arbitrarily addressed by orthodontic camouflage.6 Camouflaging sometimes achieves limited results, unacceptable facial esthetics, or unstable occlusal contacts that do not meet the patient’s expectations.7

In this article, we present guidelines for the stratification of cardiac risks. We also present 5 years of follow-up care for a patient with a Class II malocclusion, mandibular deficiency, and a medical history of 2 heart surgeries, who was treated with a surgical-orthodontic protocol after a poorly performed orthodontic camouflage treatment.

DIAGNOSIS AND ETOLOGY

A 30-year-old woman came for an initial examination in a generally good state of health. Her medical history indicated that she was a cardiac patient with 2 previous heart surgeries (internal thoracic artery and myocardial revascularization). Her cardiac risk stratification for extensive maxillofacial surgical procedures, such as orthognathic surgery, was intermediate according to Eagle et al,2 with an overall reported cardiac risk below 5%. Parafunctional habits were not considered, except lingual interposition during swallowing. Unsatisfactory facial esthetics and masticatory function were the patient’s chief complaints, especially in the tearing of foods with the anterior teeth. The patient’s dental history showed the loss of the mandibular right first and second molars because of caries and the extraction of the maxillary right and left first premolars during the previous orthodontic treatment, with the unattained
The goal of correcting an overjet caused by mandibular deficiency.

The facial evaluation of the patient showed an absence of labial seal at rest and an inverted contour of the upper lip, indicating an esthetic deficiency. The soft-tissue profile was convex, and the nasolabial angle was harmonious. There was also a general appearance of premature aging (Fig 1).

The intraoral clinical examination and an evaluation of the orthodontic documentation supported the diagnosis of a Class II malocclusion (Figs 1 and 2) with an accentuated anteroposterior maxillomandibular discrepancy (ANB, 8.5°; SNA, 74.5°; SNB, 66°), with greater mandibular retrusion than maxillary retrusion (Fig 3). The convex bone profile was accentuated (convexity, 11.5°), the direction of growth was severely vertical (y-axis, 64.5°; SN-GoGn, 47°), and there was transversal skeletal atresia of the maxilla, with an intercanine distance of 30.7 mm and an intermolar distance of 44.9 mm.

Dental evaluation showed an excessive overjet (11.5 mm) and an overbite of 5.5 mm. There was a slight deviation to the right of the mandibular midline and an accentuated mandibular curve of Spee (Fig 1). The maxillary incisors appeared to be slightly vestibularized and protruded (1-NA, 24°, and 1-NA, 5.5 mm, respectively), and the mandibular incisors were lingualized (1-NB, 20.5°) (Fig 3). The patient had a poorly planned fixed bridge with abutments on the mandibular right first and second premolars and third molar, which interfered with the protrusive function of the mandible by the third molar.

Evaluation of the panoramic radiograph showed the absence of the maxillary right third molar, the mandibular left third molar, and the mandibular right first and second molars (Fig 3); distal positioning of the abutment of the fixed bridge on the mandibular right third molar; the mesioangular and extrusive position of the mandibular right third molar; and root dilaceration of the mandibular right second premolar (Fig 3).
TREATMENT OBJECTIVES

The patient had a medical history of 2 surgeries and previous orthodontic camouflage treatment, including the extraction of the maxillary first premolars, and was motivated to follow the proposed treatment plan, which included a combined surgical-orthodontic protocol.

Surgical disjunction to correct the maxillary atresia was conducted at a separate time, because of the large discrepancy, so that the patient would not be subjected to a long surgery (in a combined surgery) and to prevent the risk of maxillary segmentation, which would cause a more complex scarring process. A slight vestibular
torque was measured for the incisors, and increases in the intercanine and intermolar distances were observed.

Mandibular retrusion was corrected by orthognathic surgery (bilateral sagittal split osteotomy maintaining the vertical component). Intrusion of the anterior mandibular teeth was planned using segmented mechanics to correct the curve of Spee. The removal of the fixed mandibular bridge and the placement of an implant in the space for the mandibular right first molar was also planned.

**TREATMENT ALTERNATIVES**

A dental plan for the correction of the mandibular deficiency using dental compensation (orthodontic camouflage) had been attempted previously with little success. A surgical-orthodontic protocol for the correction of the Class II defects was considered to have the greatest likelihood of restoring the patient’s esthetics and correcting the dental malocclusion.

The cardiologist, an anesthesiologist, and an oral maxillofacial surgeon discussed the direction of the orthognathic surgery and preventive measures, and treatment decisions were made according to the cardiac risk stratification to ensure the safety of the procedure (<5% risk). These measures included control of arterial pressure and anxiety and the temporary discontinuation of the patient’s anticoagulant medications.

**TREATMENT PROGRESS**

A hyrax palatal expander was placed, and the patient underwent osteotomy surgery through the lateral maxillary wall and the median palatine suture, according to previous protocols.8 The protocol called for 1 complete turn of the expanding screw on the first day and subsequent quarter turns in the morning and at night after the second day (twice a day) for 10 days. Once expanded, the apparatus was left in place for passive retention for 4 months. The dental implant was

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**Fig 4.** Presurgical photographs.
placed in the space for the mandibular right first molar during the maxillary surgery to create a skeletal anchor, and the patient’s accentuated mandibular curve of Spee was corrected through the intrusion of the anterior mandibular teeth using the segmented-arch technique.

During the restraint phase of the disjunction, the mandibular dental arch was leveled with minimum proclination of the incisors; this is fundamental for mandibular advancement. The apparatus used had an MBT prescription and a 0.022 × 0.028-in slot.
The orthodontic leveling of the maxillary and mandibular arches was performed with nickel-titanium 0.014- and 0.016-in arches and stainless steel 0.016-, 0.018-, 0.020-, and 0.019 × 0.025-in archwires to prepare the dental arches.

Figures 4, 5, and 6 show the dental and facial modifications before surgery, the predictive tracing over the cephalometric radiograph, the surgical models mounted on a semiadjustable articulator, and the fabrication of the surgical splint.

A 12-mm surgical mandibular advancement was performed through a sagittal ramus osteotomy in which the mandible was placed anteriorly using a surgical splint and fixed screws.9-11 In the postsurgical phase, short intermaxillary 1/8-in double bilateral elastics were used for a total treatment time of 44 months, with several interruptions caused by changes in the patient’s general health.

The orthodontic apparatus was removed, and a removable circumferential retainer with a canine-to-canine fixed arch was placed (0.028 in, or 0.70 mm).

**TREATMENT RESULTS**

Analysis of the posttreatment records (Figs 7-9) shows that the treatment objectives were reached. A straight facial profile, labial seal at rest, and a harmonious smile with adequate exposure of the maxillary incisors were obtained. The final intraoral photos showed harmonious maxillary and mandibular arches, with correction of the maxillary atresia and hygienic fixed mandibular retention. The occlusal photos show the correct anteroposterior relationship between the dental arches and the canines at the points of occlusion. The slight mandibular midline deviation that remained was due to the loss of the mandibular right first and second molars; this produced a shift of the mandibular midline. In the
skeletal context, the data in Table 1 show that the anteroposterior and vertical positions were maintained and the transverse position was improved, with correction of the atresia, as shown by the 3-mm increases in the intercanine and intermolar distances. The mandible exhibited significant anterior modification, as shown by the $5^\circ$ increase in the SNB angle (from $66^\circ$ to $71^\circ$) and complete correction of the ANB angle (from $8.5^\circ$ to $2^\circ$). The convexity angle of $1.5^\circ$ shows that the osseous profile was harmonious after
the mandibular advancement (Table I; Fig 9). The maxillary and mandibular incisors showed correct vestibular inclination after treatment (1-NA, 21.5°; and 1-NB, 25.5°, respectively), indicating that the overbite had been corrected, although the incisors were protruded slightly (1-NA, 6.5 mm; 1-NB, 6.5 mm). The final IMPA angle of 84.5° also confirms good inclination of the mandibular incisors, enabling the mandibular advancement to be maintained. The posttreatment panoramic radiograph demonstrates the distal angulation of the maxillary canines from the use of the Roth technique, which promotes these artistic positioning. The root resorption observed near the maxillary incisors was compatible with the mechanics used and caused no risks to the teeth.

Five years later, the same facial equilibrium was observed as at the end of treatment: the facial profile was straight, and the labial musculature was well-adapted to the mandibular advancement (Fig 10). The occlusion was maintained without recurrence of overjet, and the canine contacts were stabilized in Class I, similar to the final treatment period (Figs 10 and 11). A comparison of the cephalometric values measured in the posttreatment phase and at the 5-year follow-up (Table I; Fig 12) indicated no skeletal changes in the maxilla and the mandible, reflecting the balance of the facial soft tissues and the maintenance of the straight profile. A comparison of the dental measurements showed positional stability across treatment phases, consistent with the correct sagittal relationship between the dental arches and the correct overjet, as well as alignment of the maxillary and mandibular teeth. The slight midline deviation persisted, but it was restricted to the mandibular arch and was attributed to the loss of the mandibular right first and second molars. Therefore, it was not related to the orthodontic treatment, and it did not compromise the smile esthetics.

Figure 13 shows the cephalometric superimpositions between the initial and final phases of treatment, and between the end of the treatment and 5 years posttreatment.

**DISCUSSION**

The risk evaluation for dental treatment in patients with ischemic cardiopathology involves 3 factors: the seriousness of the illness, the type and extent of the dental procedure, and the patient’s stability and blood supply. The American College of Cardiology and the American Heart Association have published risk stratification guidelines for patients with various types of cardiopathologies undergoing different noncardiac surgical procedures (Table II). Two recent myocardial infarction (within the last 7-30 days) and unstable angina are clinical predictors of a higher risk for perioperative complications. Stable angina (light) and a previous history of myocardial infarction are intermediate risk factors for perioperative complications. The type and extent of the planned procedure should be considered, along with the perioperative risk associated with the illness itself. Using these guidelines, most dental procedures, including minor oral surgery and periodontal surgery, are considered low risk, in the category of “superficial procedures,” with a risk of less than 1%. Nonsurgical dental procedures might have an even lower risk than surgical procedures. More extensive maxillofacial and oral surgical procedures, and perhaps more extensive periodontal surgical procedures, could fall under the category of intermediate cardiac risk under “head and neck procedures” (<5% risk). The procedures with the greatest risks include major emergency surgery in elderly patients, aortic or vascular surgery, and peripheral vascular surgery. These procedures are performed with the patient under general anesthesia and are associated with the possibility of significant blood and plasma loss, resulting in adverse hemodynamic effects.

In orthodontic camouflage, it is expected that the maxillary incisors will be retracted and the mandibular incisors will be proclined toward the labial aspect; this would correct the overjet and compensate for the Class II malocclusion. One study stated that the main risks of orthodontic camouflage are the possibilities of severe resorption of the roots of the maxillary incisors and the clinical failure to control the torque of the

**Table I. Cephalometric measurements**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normal</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
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<tbody>
<tr>
<td>SNA (°)</td>
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<td>74.5</td>
<td>72.5</td>
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<td>SNB (°)</td>
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<td>Y-axis (°)</td>
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<td>66</td>
<td>65</td>
<td>63.5</td>
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<tr>
<td>Facial angle (°)</td>
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<td>80</td>
<td>80.5</td>
<td>84</td>
<td>84</td>
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<tr>
<td>SN-GoGn (°)</td>
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<td>49.5</td>
<td>47.5</td>
<td>48.5</td>
<td>47.5</td>
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<tr>
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<td>37</td>
<td>35.5</td>
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<td>IMPA (°)</td>
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<td>24</td>
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<td>1-NA (mm)</td>
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<td>8.5</td>
<td>6.5</td>
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<tr>
<td>1-NB (°)</td>
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<td>1-NB (mm)</td>
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<td>1.5</td>
<td>−1</td>
<td>−0.5</td>
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</table>

T1, Pretreatment; T2, presurgery; T3, posttreatment; T4, 5 years posttreatment.
maxillary incisors; these would result in considerable lingual inclination.

The important clinical questions are whether camouflage has been successful (ie, esthetically acceptable) and whether further improvements would be worth the high costs and risks of orthognathic surgery. For this assessment, the esthetic classification of patients before treatment is of the utmost importance to prevent esthetically damaging effects. Our patient had a Class II malocclusion with a significant mandibular deficiency. Her overjet was not corrected by the camouflage procedure, and her facial esthetics remained poor after treatment; therefore, a further surgical orthodontic protocol was chosen. We suggest that camouflage treatment might be more effective for patients who already have reasonably good facial esthetics before treatment.

The development of the bilateral sagittal split osteotomy enabled mandibular advancement, providing an integrated surgical orthodontic protocol for the treatment of maxillomandibular disharmonies. A stability and predictability hierarchy based on the extensive database of orthognathic surgical results obtained at the University of North Carolina showed that mandibular advancement was the second most stable orthognathic procedure, surpassed only by superior repositioning of the maxilla. In this case report, from the presurgical phase to the posttreatment phase, the SNB angle increased by 4.5°, and the ANB angle was positively modified from 6° to 2°, thus bringing the sagittal maxillomandibular relationship into harmony. The patient’s mandible was stable over the long term; the mandibular relationship with the base of the skull (SNB) and the maxillomandibular (ANB) values did not change between the end of treatment and 5 years later. The maxillary and mandibular incisors also maintained their positions, and overjet and overbite were normal.

Fig 10. Facial and intraoral photographs at 5 years posttreatment.
The major goals of the second phase of treatment were to achieve adequate occlusal function and facial esthetics, as desired by the patient, despite her 2 heart surgeries. The desire to move beyond an unfavorable prior orthodontic experience (camouflaging) and acceptance of the proposed surgical orthodontic protocol demonstrated great motivation on the patient’s part, as well as a good understanding of the correct treatment plan. Patients should always be properly informed of their treatment options throughout the diagnostic process and in their follow-up visits so that they can consider the limitations of the protocols.
recommended by professionals. Therefore, all relevant information must be given to patients so that they have confidence in their treatment decisions.

CONCLUSIONS

With the increased likelihood that orthodontists will encounter patients with cardiopathologies, this article provides tools for the safe stratification of cardiac risks. Our therapeutic protocol combined orthognathic surgery and orthodontics to produce satisfactory long-term results, and this treatment for Class II malocclusion allowed for the harmonization of the patient’s bone bases and facial profile. The treatment also improved her self-esteem and psychosocial behavior.

We thank the oral maxillofacial surgeon, Luiz Carlos Ferreira da Silva, for his important contributions to the cardiac risk section of this article and Edvaldo Dória Anjos for performing the surgery.

REFERENCES


