CASE REPORT

Treatment of a Skeletal Class III Malocclusion with Mandibular Asymmetry Using a Single Miniscrew

STEPHEN M. WEISNER, DMD

Once a patient's growth is complete, a malocclusion caused by skeletal dysplasia of one or both jaws can be treated in one of two ways. The first option is to correct the skeletal deformity with a combination of orthodontics and orthognathic surgery; the other is to camouflage the malocclusion with orthodontic tooth movement.[1] The severity of the skeletal disharmony is a major factor in the decision, but such issues as the patient's chief complaint and desires, the potential risks and complications of orthognathic surgery, the cost and time involved, and the potential for relapse must also be carefully weighed.

This article describes orthodontic treatment of a patient with a skeletal Class III malocclusion using a single miniscrew.

Dr. Weisner is an ABO Diplomate and former instructor in clinical orthodontics, Division of Post-Doctoral Orthodontics, Harvard School of Dental Medicine, Boston. He is in the private practice of orthodontics at 555 Turnpike St., North Andover, MA 01845; e-mail: wiresbyweisner@aol.com.

Diagnosis

A 17-year-old male patient was referred to our office with the chief complaints of "an underbite and crowded lower teeth". He reported that his impacted maxillary and mandibular third molars had been removed within the preceding six months. Clinical examination revealed Class III molar and canine relationships on the left side and Class I relationships on the right (Fig. 1A, Table 1). The patient's mandibular dental midline was deviated to the right of his maxillary dental midline, which coincided with his facial midline. All permanent teeth were present except for the third molars and the mandibular left and right second premolars, which were congenitally missing. The mandibular second deciduous molars were still present.

Diagnostic casts demonstrated 3.5mm of mandibular crowding. The anterior maxilla was slightly narrow. The right canine and lateral incisor were in crossbite with the mandibular right first premolar, canine, and lateral incisor; the maxillary left lateral incisor and mandibular left canine were also in crossbite. The mandibular dental midline was deviated 3.5mm to the right of the maxillary dental midline.

Radiographic evaluation showed that the roots of the mandibular second deciduous molars were short, but intact. The extraction sites of the mandibular third molars had not completely ossified. A cursory evaluation of the frontal digital photograph according to the protocol described by Dahan[4] demonstrated a mild mandibular deviation to the patient's right (Fig. 1B). Cephalometrically, the patient exhibited a Class III skeletal tendency (ANB = 0°), regardless of whether norms for African Americans or the general population were used. A hand-wrist radiograph demonstrated that all epiphyses were closed and that the patient's growth was virtually complete (Fig. 2).

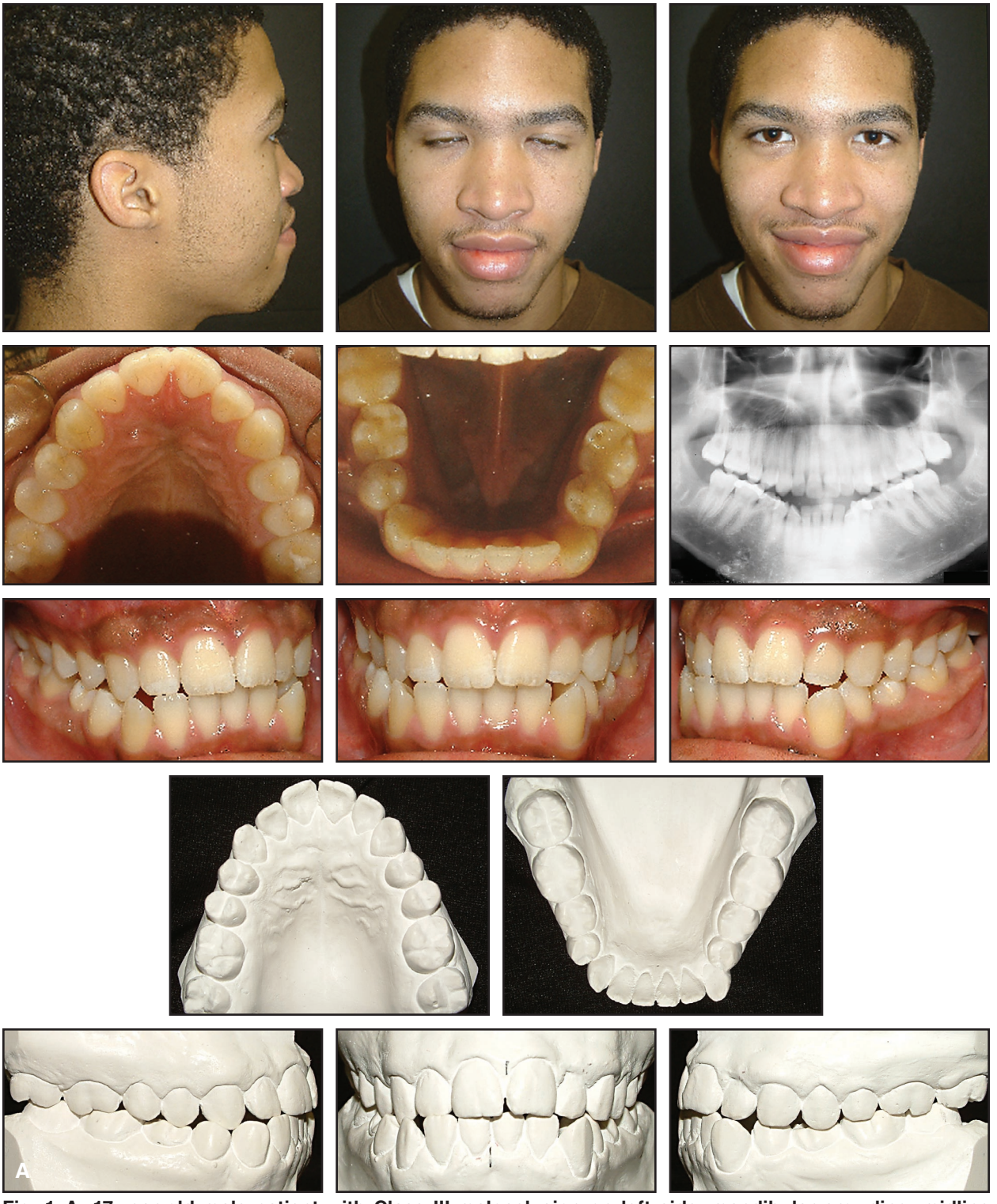

Fig. 1 A. 17-year-old male patient with Class III malocclusion on left side, mandibular crowding, midline deviation, and anterior crossbite (continued on next page).

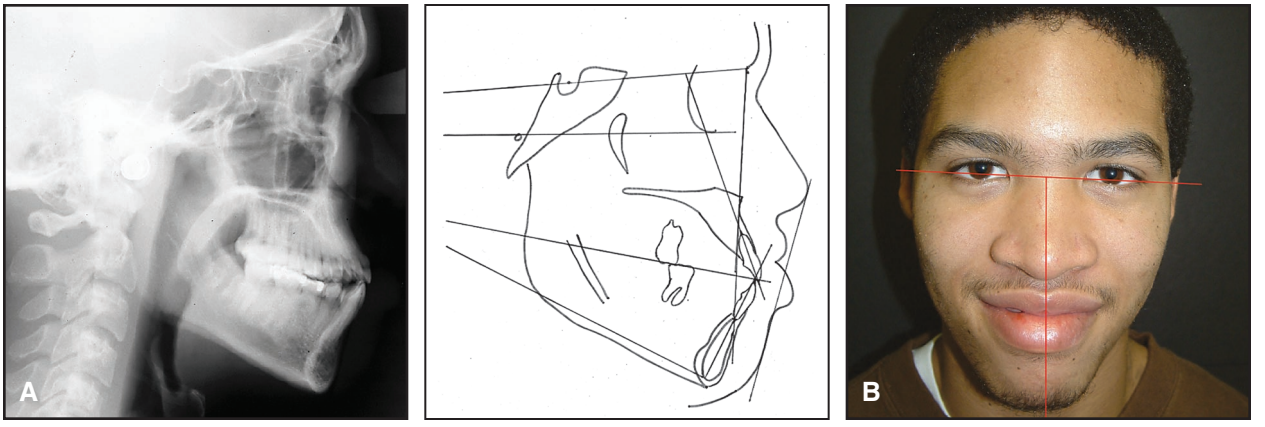

Fig. 1 A (cont.). 17-year-old male patient with Class III malocclusion on left side, mandibular crowding, midline deviation, and anterior crossbite. B. Facial asymmetry evaluated according to Dahan's protocol.[4]

TABLE 1
CEPHALOMETRIC DATA

	African-American Norm[2,3]	Pre-treatment	Post-Treatment
SNA	84.7°	82.5°	83.5°
SNB	79.2°	82.5°	84.5°
ANB	5.5°	0.0°	–1.0°
FMA	30.0°	27.0°	25.0°
GoGn-SN	38.2°	31.0°	29.0°
Occlusal plane-SN	—	14.0°	12.0°
U1-NA	7.4mm	10.0mm	10.5mm
U1-NA	24.1°	22.0°	23.0°
U1-SN	109.0°	104.0°	106.5°
L1-NB	11.4mm	8.0mm	6.0mm
L1-NB	36.7°	25.0°	16.5°
IMPA	100.0°	91.0°	83.5°
U1-L1	113.8°	127.0°	140.0°
Upper lip-E line	—	–2.0mm	–3.5mm
Lower lip-E line	—	6.0mm	3.0mm

Treatment Options

Two surgical procedures were considered: oblique osteotomies and sagittal osteotomies, both of which would involve a mandibular setback and rotation. Oblique osteotomies would carry a lower risk of alveolar nerve damage, but would require six weeks of intermaxillary fixation. Sagittal osteotomies would allow rigid fixation, but posed a greater risk to the inferior alveolar nerve. Either surgical intervention would correct the mild mandibular asymmetry and the malocclusion, and would also improve the contact between the mandibular left second molar and its maxillary antagonist. Dental implants would eventually be needed after exfoliation of the mandibular second deciduous molars.

The purely orthodontic treatment plan called for removal of the mandibular left second deciduous molar and placement of a temporary anchorage device (TAD) between the mandibular left first and second molars. Treatment goals would be to establish a Class I canine relationship on both sides, bring the mandibular dental midline into alignment with the maxillary midline, correct the anterior crossbite, and address the mandibular crowding. This approach would avoid the need for implant replacement of the congenitally missing left second premolar, but would not cor-

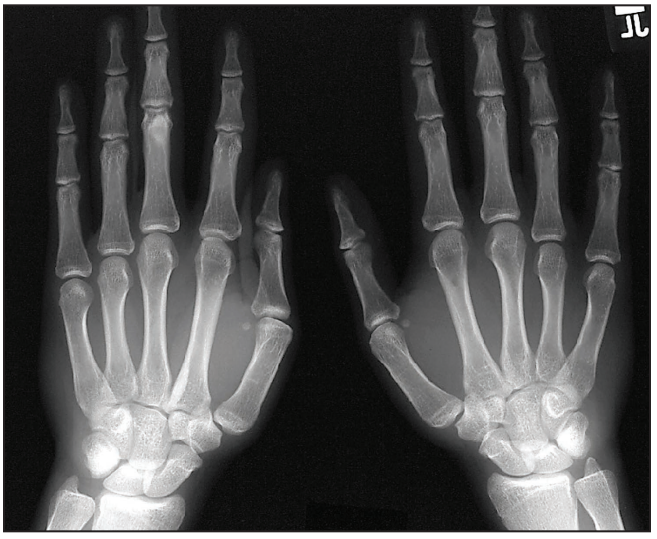

Fig. 2 Hand-wrist radiograph indicating closure of epiphyses and completion of growth.

rect the skeletal asymmetry or improve the contact of the left second molars. An implant would still be needed after exfoliation of the mandibular right second deciduous molar, and one might also be needed distal to the mandibular left second molar.

An alternative orthodontic approach would involve extraction of the mandibular right second deciduous molar, followed by mesial movement of the man-

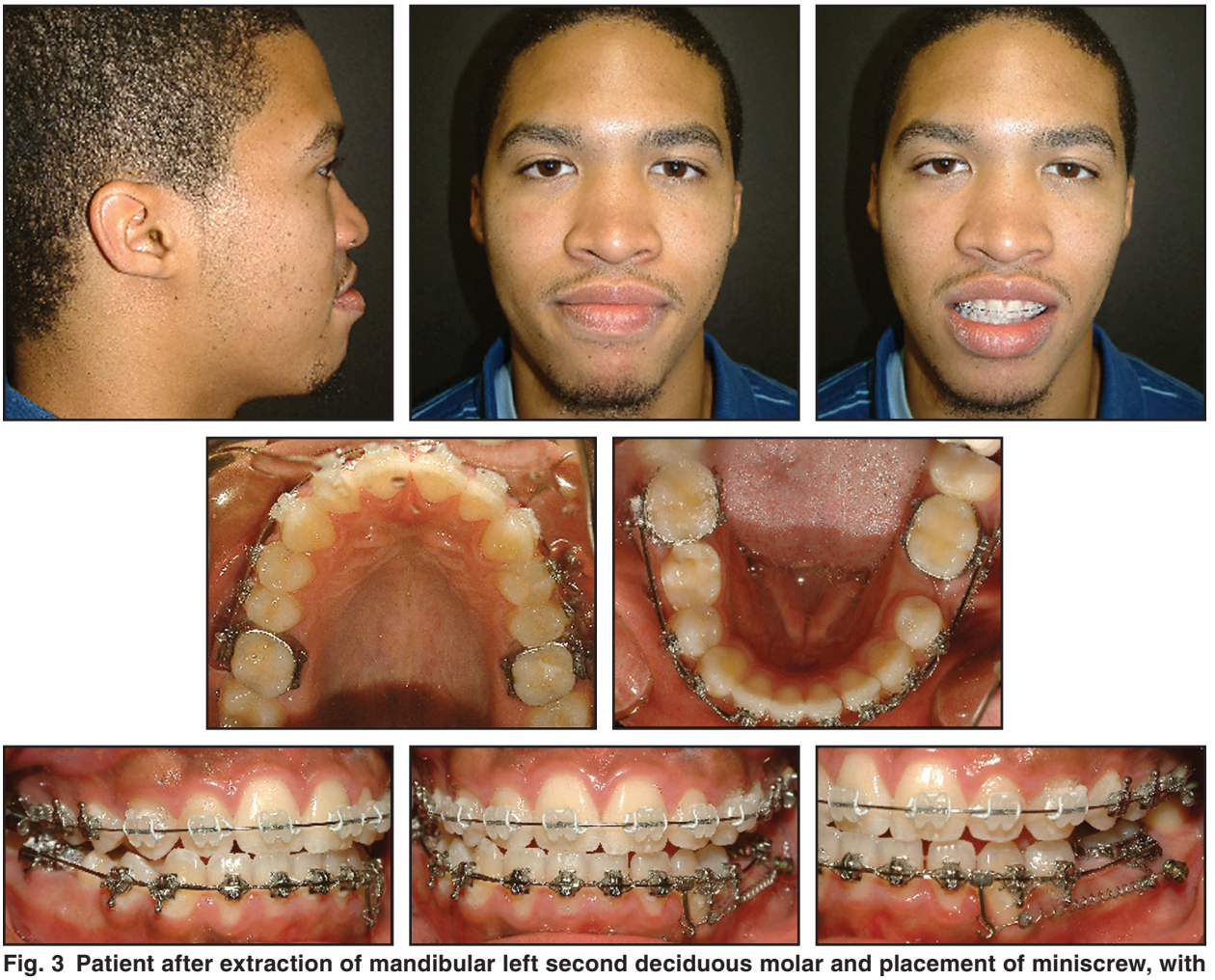

Fig. 3 Patient after extraction of mandibular left second deciduous molar and placement of miniscrew, with 150g Sentalloy* closed-coil spring attached to hook crimped onto .018" round archwire.**

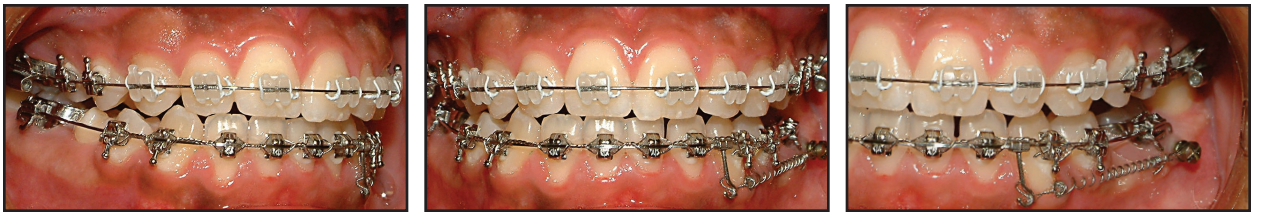

Fig. 4 Attachment of 200g Sentalloy closed-coil spring, six weeks after miniscrew placement.

dibular right first and second permanent molars. This could be accomplished with anchorage from a TAD in the extreme mesial portion of the extraction site. Although it would leave the Class I canine relationship on the right side intact, the molar movement would cause a loss of contact between the right second permanent molars, requiring a dental implant distal to the mandibular molar. In essence, this plan would exchange one implant for another; moreover, the additional mechanotherapy might jeopardize the occlusal relationship on the right side.

After careful consideration of the risks and complications of orthognathic surgery, the patient and parents chose the first orthodontic treatment plan.

Anchorage Evaluation

The mandibular left second deciduous molar had a mesiodistal dimension of 9mm. Establishing a Class I canine relationship on the left side would require the mandibular left canine to be distalized 6.5mm. Anchorage loss is affected by numerous factors, including the degree of crowding, the type of mechanics, the patient's age, the size of the extraction space, and the overjet.[5] Creekmore's "rule of thumb" states: "Ordinarily when mandibular second bicuspids [or, in this case, mandibular second deciduous molars] are extracted, you can expect the posterior teeth to come forward about half the extraction site."[6] Therefore, if the mandibular left second deciduous molar were extracted and conventional Class I space-closing mechanics used, 4.5mm of the extraction space would be lost through mesial movement of the mandibular left molars. Additional posterior anchorage loss would result from correcting the mandibular crowding and moving the mandibular midline 3.5mm to the patient's left. Although a Class III elastic worn on the left side would not tax the anchorage units, its vertical vector would cant the occlusal plane. In addition, the elastic would cause the maxillary midline to shift to the patient's right. Strategic placement of a miniscrew could avoid this anchorage loss and the undesirable side effects.

Treatment Progress

Brackets were bonded in both arches, and leveling and alignment were carried out with .016" round nickel titanium archwires. The archform was then developed with .018" stainless steel archwires.

Under local anesthesia, the mandibular left second deciduous molar was removed, and a miniscrew* (8mm long, 1.5mm in diameter) was inserted. Placement of a self-drilling screw in the attached gingiva avoided damage to the mucosa and eliminated the need for pilot drilling. The TAD was inserted at a right angle to the buccal cortical bone between the mandibular left first and second molars, close to the center of resistance of the teeth.

A 7mm crimpable hook** was placed on the archwire between the mandibular left canine and lateral incisor to allow application of a horizontal force vector from the hook to the miniscrew (Fig. 3). Vertical skewing forces were eliminated because the vector was parallel to the occlusal plane. The direction of force through the center of resistance of the teeth allowed bodily movement of the dentition and reduced frictional forces as the archwire moved through the mandibular left molar tube. The right side of the lower archwire was tied back to the mandibular right first molar, and the arch was coligated. The miniscrew was loaded immediately with a relatively light force to facilitate primary stabilization[7,8]; a 150g Sentalloy*** closed-coil spring was used to apply a constant and long-

*OrthoAnchor, trademark of KLS Martin, LP, P.O. Box 50249, Jacksonville, FL 32250; www.orthoanchor.com.

**Ortho Organizers, 1822 Aston Ave., Carlsbad, CA 92008; www.orthoorganizers.com.

***Registered trademark of GAC International, Inc., 355 Knickerbocker Ave., Bohemia, NY 11716; www.gacintl.com

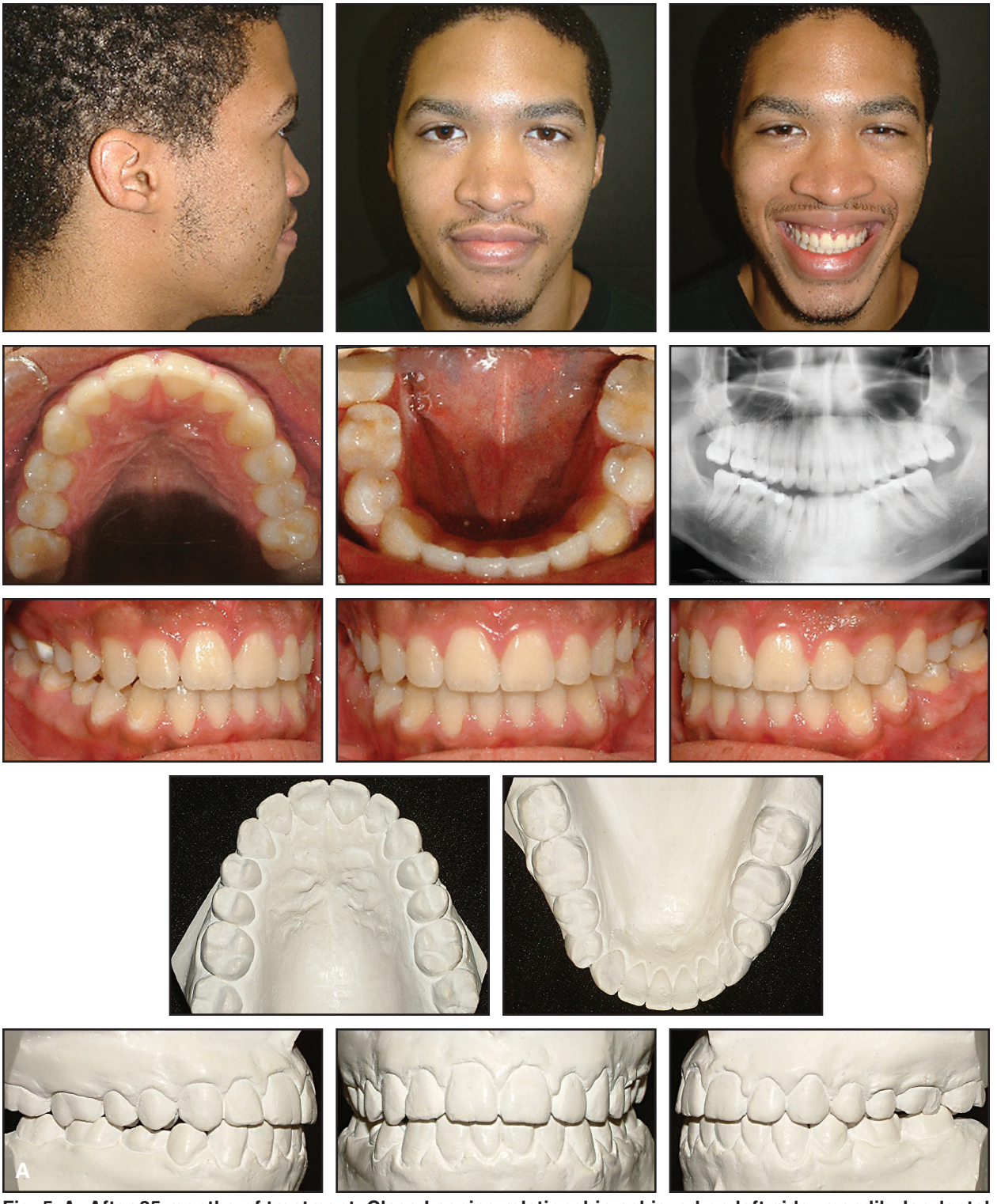

Fig. 5 A. After 25 months of treatment, Class I canine relationship achieved on left side; mandibular dental midline coincident with maxillary midline (continued on next page).

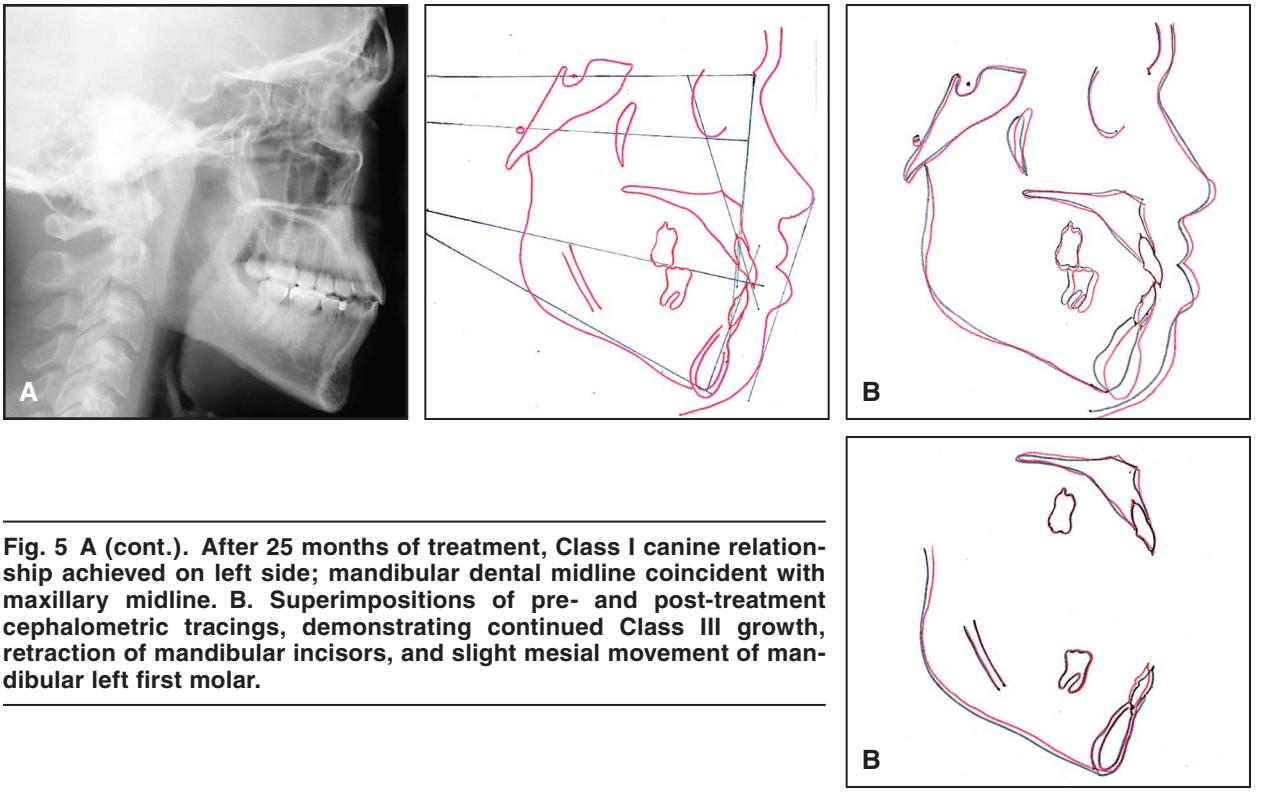

Fig. 5 A (cont.). After 25 months of treatment, Class I canine relationship achieved on left side; mandibular dental midline coincident with maxillary midline. B. Superimpositions of pre- and post-treatment cephalometric tracings, demonstrating continued Class III growth, retraction of mandibular incisors, and slight mesial movement of mandibular left first molar.

acting force.

Six weeks later, the mandibular archwire was replaced with an .016" × .022" stainless steel wire, and a 200g Sentalloy closed-coil spring was placed between the miniscrew and the archwire hook (Fig. 4). Correction of the canine and crossbite relationships took eight months. After the Class I canine relationship was established on the left side, only 1mm of extraction space remained to be closed with an elastic chain. Cephalometric analysis indicated that additional mandibular growth had occurred in a counterclockwise direction (Table 1); since the right side remained in a Class I relationship, the mandibular growth continued to be asymmetrical. This not only necessitated more canine and incisal retraction than originally anticipated, but also reduced the contact between the left second molars.

The brackets were debonded after 25 months of treatment, one week before the patient was to return to college (Fig. 5). A thermoformed maxillary retainer was fabricated to prevent supererruption of the maxillary left second molar and the maxillary right first and second premolars. When the patient returns home during a break from college, he will be evaluated for a composite build-up of the occlusal surface of the mandibular right second deciduous molar, along with an implant distal to the mandibular left second molar.

Conclusion

Miniscrew anchorage simplified the biomechanics involved in this case and led to a satisfactory outcome without the need for orthognathic surgery. The use of TADs allows the application of force vectors that were previously difficult or impossible to achieve. This enables the clinician to produce the desired dentoalveolar or skeletal changes without detrimental side effects.[7,9]

REFERENCES

1. Turpin, D.L.: Camouflage might not mean compromise, Am. J. Orthod. 123:241, 2003.
2. Drummond, R.A.: A determination of cephalometric norms for the Negro race, Am. J. Orthod. 54:670-682, 1968.
3. Alexander, T.L. and Hitchcock, H.P.: Cephalometric standards for American Negro children, Am. J. Orthod. 74:298-304, 1978.
4. Dahan, J.: A simple digital procedure to assess facial asymmetry, Am. J. Orthod. 122:110-116, 2002.
5. Geron, S.; Shpack, N.; Kandos, S.; Davidovitch, M.; and Vardimon, A.D.: Anchorage loss—a multifactorial response, Angle Orthod. 73:730-737, 2003.
6. Creekmore, T.D.: Where teeth should be positioned in the face and jaws and how to get them there, J. Clin. Orthod. 31:586-608, 1997.
7. Mah, J. and Bergstrand, F.: Temporary anchorage devices: A status report, J. Clin. Orthod. 39:132-136, 2005.
8. Melsen, B. and Costa, A.: Immediate loading of implants used for orthodontic anchorage, Clin. Orthod. Res. 3:23-28, 2000.
9. Carano, A.; Velo, S.; Leone, P.; and Siciliani, G.: Clinical applications of the Miniscrew Anchorage System, J. Clin. Orthod. 39:9-24, 2005.