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CLINICAL SECTION

Skeletal class III malocclusion treated using a non-surgical approach supplemented with mini-implants: a case report

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We describe a 28-year-old man who sought orthodontic treatment complaining about the esthetics of his smile and difficulties associated with masticatory function. The patient had a straight facial profile, skeletal and dental class III relationship, anterior open bite and posterior crossbite. He refused orthognathic surgery and was therefore treated with camouflage orthodontics supplemented with the placement of one mini-implant in each side of the mandible to facilitate movement of the lower dentition distally, tooth-by-tooth. At the end of treatment, a class I molar relationship was obtained, with an ideal overjet and overbite and excellent intercuspation. Furthermore, the open bite and crossbite were corrected. Analysis 2 years after treatment revealed good stability of treatment outcome.

Key words: Class III malocclusion, non-surgical treatment, mini-implants

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Introduction

An Angle class III malocclusion has a low incidence among patients who seek orthodontic treatment in Western countries.[1] However, these few cases can represent the greatest challenge for the orthodontist, because of the complexity of treatment and high tendency for relapse.[2] When associated with skeletal features, a class III malocclusion becomes more difficult to treat.[2] Severe skeletal discrepancies in adults usually require orthodontic treatment and orthognathic surgery; however, mild-to-moderate discrepancies can sometimes be compensated using non-surgical orthodontic treatment alone.[1,3–5] In this context, skeletal anchorage with mini-plates or mini-implants has improved the success of compensating treatments.[3,5–9] Mini-plates are the more invasive option, and are required when large discrepancies are diagnosed and therefore, greater dental adjustments are needed and more anchorage is necessary.[3,6,10] Mini-implants are less invasive for skeletal anchorage and may be used for mild discrepancies; they are the treatment of choice when movements will be small or when the patient refuses mini-plates owing to the extent of the surgical procedure.[5,11–13] This manuscript describes the treatment of a 28-year-old man with a skeletal class III malocclusion associated with anterior open bite and posterior crossbite, treated by orthodontic camouflage with one mini-implant placed in each side of the mandible.

Case report

Facial analysis revealed that the patient had a straight profile; the lower facial third was enlarged and smile esthetics was impaired because of the class III relationship and anterior open bite (Figure 1). Intraoral analysis revealed a class III malocclusion, anterior open bite, posterior crossbite on the left side, a slight deviation of the upper midline to the right and mild crowding of the anterior region in the lower arch (Figure 2). Panoramic radiography showed good parallelism among the roots and small roots associated with the lower second premolars, while cephalometric analysis confirmed the skeletal class III malocclusion and accentuated lower anterior facial height (Figure 3).

Treatment objectives were to achieve class I molar and canine relationships, eliminate the posterior crossbite and anterior open bite and establish and ideal overjet and overbite. The facial appearance should be improved because of the retraction of the lower incisors and

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Figure 1 Pre-treatment extra-oral facial photographs

elimination of the crossbite and edge-to-edge posterior relationship, producing a counterclockwise rotation of the mandible. However, this was largely a secondary objective of treatment because the patient elected to avoid orthognathic surgery and had no major complaints about his facial appearance.

A number of treatment options were considered for this patient. The first was a combined orthodontic–surgical approach with maxillary advancement, posterior impaction and mandibular counterclockwise rotation to close the open bite and reduce the LAFH. Orthognathic surgery was rejected by the patient. The

Figure 2 Pre-treatment intra-oral photographs

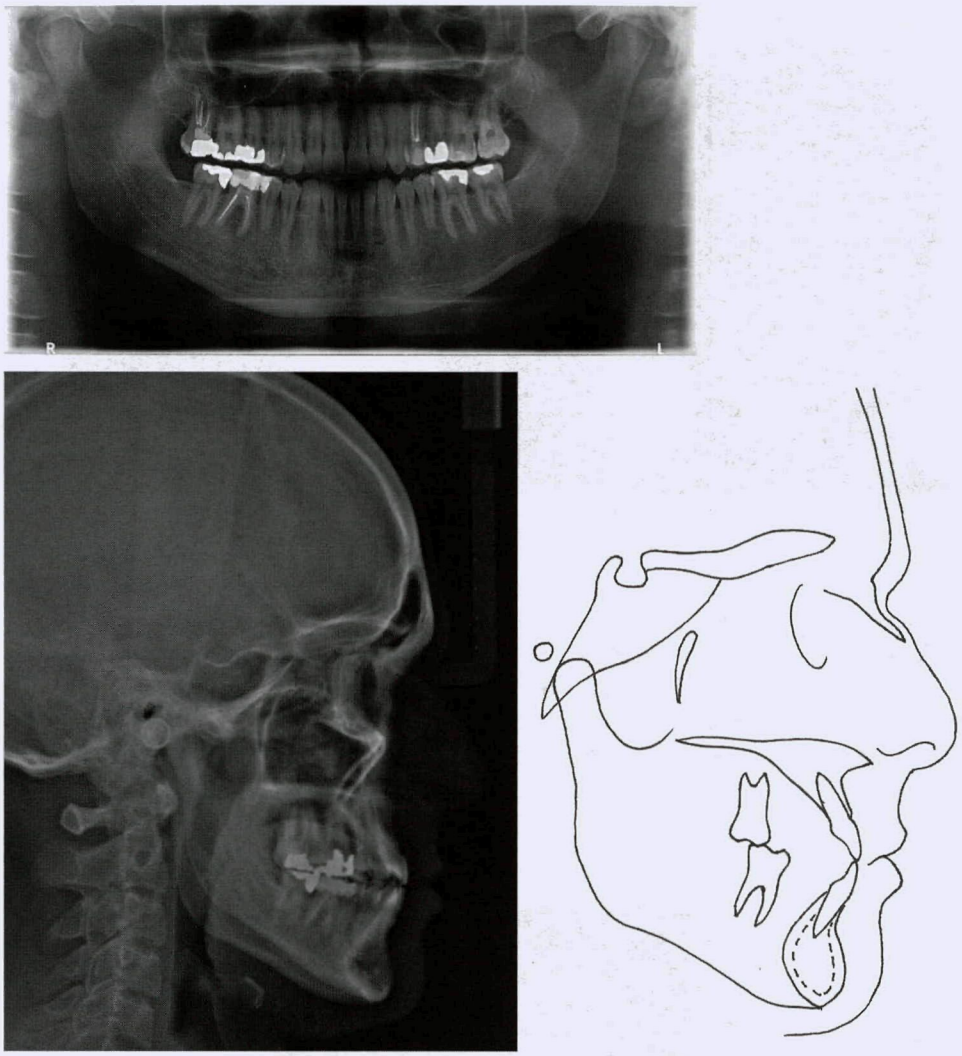

Figure 3 Pre-treatment panoramic and cephalometric radiographs

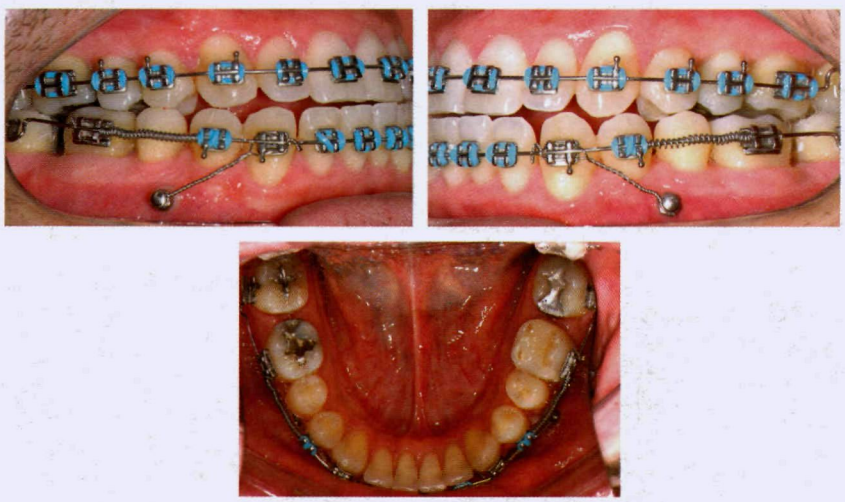

Figure 4 Treatment progress. Folowing implant placement, the lower second molars have been moved distally before lower first molar distal movement

Figure 5 Post-treatment extra- and intra-oral photographs

second option was a non-surgical approach using elastics and a sliding jig on the lower arch to obtain distal movement of the lower dentition, tooth-by-tooth. This option was considered disadvantageous because of the possibility of upper molar extrusion using the class III elastics, increasing the LAFH and impairing closure of the anterior open bite; consequently, this option was also disregarded. A third option considered extraction of a lower incisor to provide space for lower incisor retraction and orthodontic camouflage. The final option, involved the use of mini-implants in the lower arch to provide anchorage for moving the lower teeth distally, avoiding the collateral effects of elastics and invasive procedures such as the orthognatic surgery, extractions or mini-plate insertion. It was decided to proceed with this treatment plan.

Initially, 0.022×0.028-inch standard edgewise brackets were bonded to the upper and lower arches. Alignment and leveling was achieved using 0.012-inch nickel–titanium arch wires to 0.020-inch stainless steel arch wires in the lower arch and up to a full size 0.022×0.028-inch stainless steel arch wire on the upper arch. At this point, one mini-implant (Neodent, Curitiba, PR, Brazil) of 1.6-mm diameter and 9.0-mm length was inserted buccally between the first and second premolars on each side of the mandible. The mini-implants were connected to canines using stainless steel 0.012-inch ligatures to establish an indirect

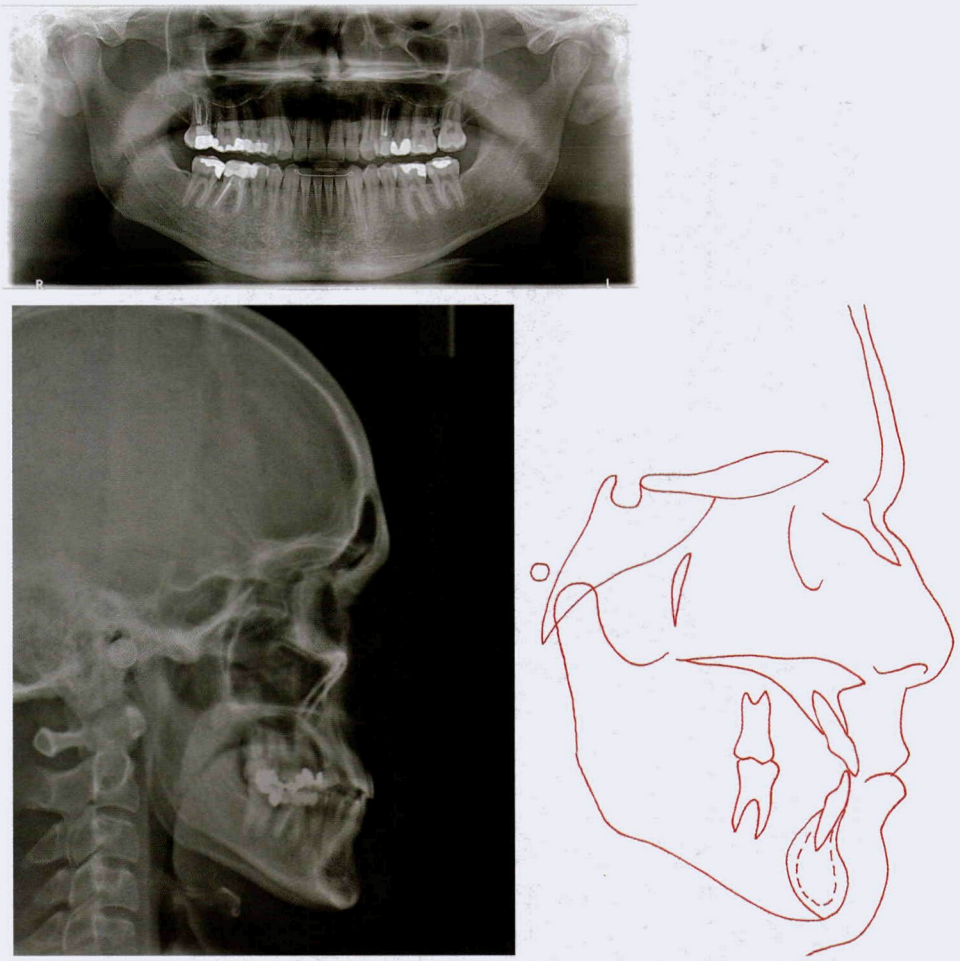

Figure 6 Post-treatment panoramic and cephalometric radiographs

anchorage for distal movement of the molars. The brackets of the second premolars were removed and two nickel–titanium open coil springs inserted on each side (Figure 4). After the second molar had been moved 2-mm distally, a new arch wire was fabricated with an omega-loop close to the tube, to avoid any relapse. Then, the first molar was also moved distally; subsequently, the second premolar again received a bracket and was moved. At this point, the mini-implants were removed, and the first premolar and canines were moved distally with elastic chains connected directly to the posterior teeth. Lower incisors were retracted with a 0.018×0.025-inch arch wire with bull loops. On the upper arch, the rectangular arch wire of 0.022×0.028 inches was expanded and made with accentuated buccal torque of the roots to correct the posterior crossbite. The total time of treatment was 28 months.

At the end of the treatment, an acceptable facial appearance associated with a class I molar and canine relationship was achieved, as well as excellent intercuspation, with an ideal overjet and overbite. Further, the posterior crossbite was corrected with upper-arch expansion and lower arch contraction and distal movement (Figure 5). Panoramic and cephalometric radiography demonstrated good parallelism among the roots without any significant resorption (Figure 6). Cephalometric superimposition showed that the lower first molar had been uprighted and moved distally, the lower incisors retroclined and the mandible rotated slightly in a counterclockwise direction (Figure 7 and Table 1). Two years after treatment, stability of these treatment outcomes had occurred (Figure 8).

Discussion

The development of skeletal anchorage represents the emergence of a new paradigm in orthodontics.[14] Certain skeletal malocclusions, which in the past were only treatable with orthognatic surgery, can now be treated

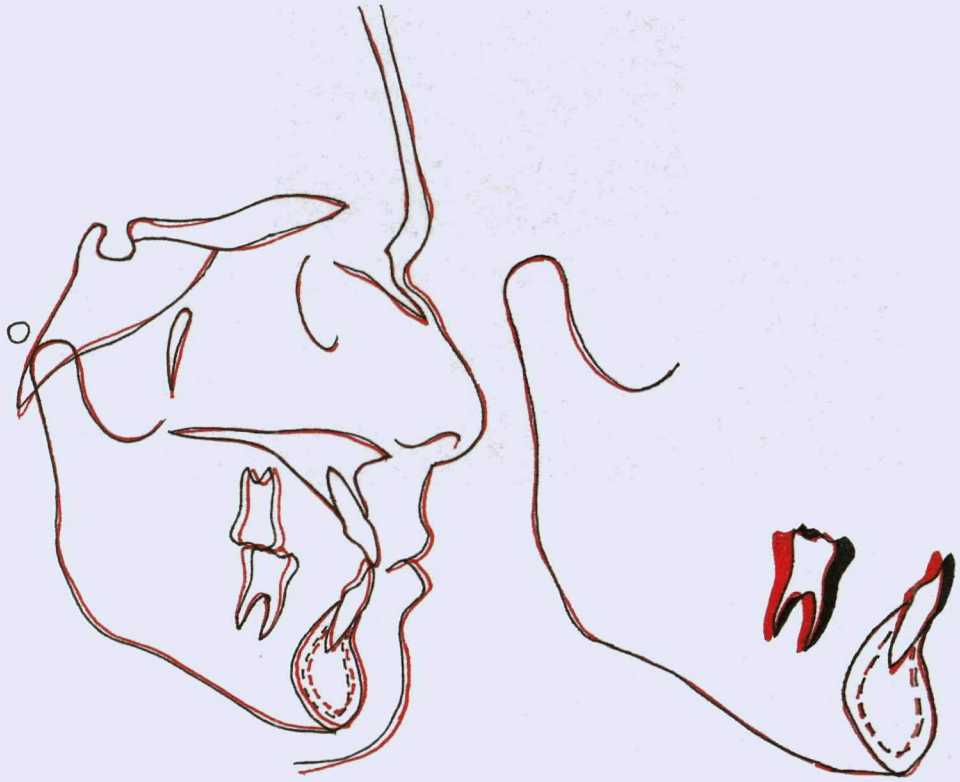

Figure 7 Cephalometric superimposition. Anterior cranial base registered on the inner countour of sella and mandible registered on the inner cortical structure of the symphysis

with orthodontics alone.[5,13,15] Several skeletal discrepancies are still best treated with orthognatic surgery, which serves as the best option to solve either esthetic or functional problems.[4,15] However, moderate skeletal problems, such as the case described in this manuscript, can now be successfully treated with anchorage facilitated by mini-implants and/or mini-plates.

Table 1 Cephalometric measurements.

Measurements	Norms (SD)	Initial	Final
SNA	82° (3)	82°	83°
SNB	80° (3)	84.5°	86°
ANB	2° (2)	−2.5°	−3°
Facial convexity (NA.APog)	0° (2)	−11°	−11°
Facial angle (PoOr.NPog)	87° (3)	92°	93°
Y-axis	59° (6)	56°	55°
SN.GoGn	32° (3)	20°	19°
1-NA (°)	22°	32°	34°
1-NA (mm)	5 mm	8 mm	9 mm
1-NB (°)	25°	24°	20°
1-NB (mm)	5 mm	4.5 mm	2 mm
Inter-incisal angle	131° (5)	128°	132°
Ul-S line	0 mm (2)	−2 mm	−1 mm
Ll-S line	0 mm (2)	0	1 mm
IMPA	90° (4)	96°	90°
FMA	25° (3)	16°	15°
FMIA	65° (4)	68°	75°

Potential treatment options for the compensation or camouflage of the malocclusion described here include the use of elastics, a protraction facemask, cervical headgear on the lower arch, or even a lingual arch to improve anchorage and develop class III mechanics.[3,6,16,17] The use of class III elastics, even with rectangular arch wires, causes the extrusion of upper molars, provoking clockwise rotation of the mandible, increasing the LAFH and opening the anterior bite.[16] Consequently, as this patient already had an accentuated LAFH, this option was contraindicated. Extra-oral anchorage with a protraction facemask or headgear was dismissed as possibilities; those devices are usually refused by adult patients and require strict compliance to be successful. Mini-plates are obviously the best anchorage unit for orthodontic mechanics and allow the movement of a large number of teeth and sometimes, even the whole arch may be moved at once with mini-plates.[3,10,18] Nevertheless, the installation and removal of mini-plates both entail invasive surgical procedures, which sometimes discourage the patient and leads to them opting instead for mini-implants.[5,11–13] In

Figure 8 Intra-oral photographs two years post-treatment

the case presented here, we needed a medium rate of distal movement and, therefore, we offered the choice of one mini-implant or mini-plate in each side of the mandible. The patient chose the less invasive option, despite knowing that this course of treatment would take more time.

The treatment achieved an ideal overjet and overbite, which remained evident at 2-year follow up after treatment. The establishment of good intercuspation, overjet and overbite are especially important for maintaining the stability of the occlusion, mainly in cases of class III malocclusion. The total superimposition yielded a small improvement on the facial profile, because of the slight mandibular counterclockwise shift. Further improvement may be conditional depending upon the elimination of the edge-to-edge contact on the right side and the crossbite on the left side. Furthermore, the distal movement and uprighting of the lower molars was achieved without extrusion. Superimposition also revealed mesial migration of the upper first molar, which was caused by expansion on the upper arch, and facilitated easier correction of the class III relationship.

Conclusion

The use of a single mini-implant in each side of the mandible to move the lower teeth distally proved to be efficient in the treatment of moderate skeletal class III malocclusion.

References

1. Moullas AT, Palomo JM, Gass JR, Amberman BD, White J, Gustovich D. Nonsurgical treatment of a patient with a Class III malocclusion. *Am J Orthod Dentofacial Orthop* 2006; **129**: S111–18.
2. Kuroda Y, Kuroda S, Alexander RG, Tanaka E. Adult Class III treatment using a J-hook headgear to the mandibular arch. *Angle Orthod* 2010; **80**: 336–43.
3. Sugawara Y, Kuroda S, Tamamura N, Takano-Yamamoto T. Adult patient with mandibular protrusion and unstable occlusion treated with titanium screw anchorage. *Am J Orthod Dentofacial Orthop* 2008; **133**: 102–11.
4. Lin J, Gu Y. Preliminary investigation of nonsurgical treatment of severe skeletal Class III malocclusion in the permanent dentition. *Angle Orthod* 2003; **73**: 401–10.
5. Kuroda S, Tanaka E. Application of temporary anchorage devices for the treatment of adult Class III malocclusions. *Semin Orthod* 2011; **17**: 91–97.
6. Sugawara J, Daimaruya T, Umemori M, Nagasaka H, Takahashi I, Kawamura H, *et al.* Distal movement of mandibular molars in adult patients with the skeletal anchorage system. *Am J Orthod Dentofacial Orthop* 2004; **125**: 130–38.
7. Kuroda S, Sugawara Y, Yamashita K, Mano T, Takano-Yamamoto T. Skeletal Class III oligodontia patient treated with titanium screw anchorage and orthognathic surgery. *Am J Orthod Dentofacial Orthop* 2005; **127**: 730–38.
8. Chung K, Kim SH, Kook Y. C-orthodontic microimplant for distalization of mandibular dentition in Class III correction. *Angle Orthod* 2005; **75**: 119–28.
9. Chung KR, Kim SH, Choo H, Kook YA, Cope JB. Distalization of the mandibular dentition with mini-implants to correct a Class III malocclusion with a midline deviation. *Am J Orthod Dentofacial Orthop* 2010; **137**: 135–46.
10. Fukunaga T, Kuroda S, Kurosaka H, Takano-Yamamoto T. Skeletal anchorage for orthodontic correction of maxillary protrusion with adult periodontitis. *Angle Orthod* 2006; **76**: 148–55.

11. Freire-Maia B, Pereira TJ, Ribeiro MP. Distalization of impacted mandibular second molar using miniplates for skeletal anchorage: case report. *Dent Press J Orthod* 2011; **16**: 132–36.
12. Kuroda S, Sugawara Y, Deguchi T, Kyung HM, Takano-Yamamoto T. Clinical use of miniscrew implants as orthodontic anchorage: success rates and postoperative discomfort. *Am J Orthod Dentofacial Orthop* 2007; **131**: 9–15.
13. Park HS, Kwon TG, Sung JH. Nonextraction treatment with microscrew implants. *Angle Orthod* 2004; **74**: 539–49.
14. Monnerat C, Restle L, Mucha JN. Tomographic mapping of mandibular interradicular spaces for placement of orthodontic mini-implants. *Am J Orthod Dentofacial Orthop* 2009; **135**: 428.e1–9; discussion 428–29.
15. Sakai Y, Kuroda S, Murshid SA, Takano-Yamamoto T. Skeletal Class III severe openbite treatment using implant anchorage. *Angle Orthod* 2008; **78**: 157–66.
16. Saito I, Yamaki M, Hanada K. Nonsurgical treatment of adult open bite using edgewise appliance combined with high-pull headgear and class III elastics. *Angle Orthod* 2005; **75**: 277–83.
17. Baek SH, Yang IH, Kim KW, Ahn HW. Treatment of Class III malocclusions using miniplate and mini-implant anchorage. *Semin Orthod* 2011; **17**: 98–107.
18. Sugawara J, Baik UB, Umemori M, Takahashi I, Nagasaka H, Kawamura H, *et al.* Treatment and posttreatment dentoalveolar changes following intrusion of mandibular molars with application of a skeletal anchorage system (SAS) for open bite correction. *Int J Adult Orthodon Orthognath Surg* 2002; **17**: 243–53.