Treatment of a Class II Division 1 malocclusion with miniscrew anchorage

Ning Zhang, a Yuxing Bai, b and Song Li b
Beijing, China

This case report describes the treatment of a 30-year-old woman with a Class II Division 1 malocclusion, characterized by a large overjet, a deep overbite, and a V-shaped maxillary dental arch. She had a convex profile with a retrognathic mandible and marked lip protrusion. Treatment involved extraction of 4 first premolars and miniscrew implant anchorage for space closure. The total treatment time was about 20 months. Ideal overjet and overbite relationships were established, and the facial profile was improved substantially. The 2-year follow-up records show a morphologically and functionally stable result. (Am J Orthod Dentofacial Orthop 2012;141:e85-e93)

Class II malocclusion is the most frequent treatment problem seen in an orthodontic practice. Facial esthetics is a major concern of many orthodontic patients. A convex facial profile with marked lip protrusion often affects the psychological health of patients. In such circumstances, the major orthodontic treatment goals are to reduce the proclination of the maxillary incisors and improve the facial profile. Therefore, the treatment plan often includes extraction of 2 or 4 premolars, followed by retraction of the anterior teeth by using maximum anchorage.1-3 Anchorage control in severe skeletal Class II patients is a difficult problem in orthodontic treatment. To reinforce anchorage, various auxiliaries can be used, including headgear, lingual arch, transpalatal arch, holding arch, and intermaxillary elastics.4 However, these appliances require the patient’s cooperation to be effective. To obtain absolute anchorage without patient cooperation, dental implants,5,6 screws,7,8 and miniplates9,10 have been used for skeletal anchorage. Screws have many advantages—eg, ease of implantation and removal, low cost, possible immediate loading, and possible placement in most areas of the alveolar bone.11,12 Incisor retraction with miniscrew anchorage is a new strategy for treating skeletal Class II patients.

Our objective in this case report is to demonstrate the advantages of treatment with miniscrew anchorage for incisor retraction in a patient with an Angle Class II Division 1 malocclusion.

DIAGNOSIS AND ETIOLOGY

The patient was a 30-year-old woman, whose chief complaint was her convex facial profile with marked lip protrusion. She had a Class II malocclusion with a 10-mm anterior overjet. Her father had a similar malocclusion. Her periodontal health was good, and her temporomandibular joints were asymptomatic.

The facial photographs showed a convex facial appearance, a protruded upper lip, overexposure of the maxillary incisors, and a gummy smile (Fig 1). The dental casts showed severe maxillary protrusion with a large overjet, deep overbite, and transverse deficiency with narrow dental arches (Fig 2). The molar relationship was Angle Class II on both sides. The amounts of crowding were 0.5 mm in the maxillary arch and 5.5 mm in the mandibular arch. The panoramic radiograph (Fig 3) showed that she had mandibular third molars. Cephalometric analysis indicated a skeletal Class II jaw deformity (Fig 3). The ANB angle was 5.8°, and the Wits appraisal was 5.7 mm. The SNA angle of 80.9° reflected a normally positioned maxilla, and the SNB angle of 75.1° indicated mandibular deficiency. The U1-NA angle of 34.7° indicated that she had significant proclination of her maxillary incisors.

TREATMENT OBJECTIVES

The treatment objectives were to (1) align and level the teeth in both arches and establish functional occlusion, (2) normalize the overjet and overbite relationships, and (3) obtain a balanced facial profile with improved smile esthetics.
TREATMENT ALTERNATIVES

To accomplish these objectives, we identified 3 treatment alternatives. All 3 called for extraction of the mandibular third molars to facilitate mandibular molar uprighting. The first option consisted of correcting the Class II malocclusion with a combination of surgery and orthodontic treatment. This protocol would provide a better esthetic result, but the risks and treatment expenses would be high. The parents did not want this treatment option.

The second alternative was to extract the maxillary first premolars, correcting the excessive overjet by retracting the maxillary incisors and leaving the posterior occlusion with a Class II molar relationship. This option would correct the incisor proclination, but the treatment would be difficult, because of the excessive overbite and overjet, which often require more effort when retracting the canines and the incisors.

The third alternative was orthodontic treatment with extraction of the 4 first premolars, with miniscrews for implant anchorage. We believed that the miniscrew implant could provide absolute anchorage in the retraction of the maxillary anterior teeth and improve the patient’s facial profile. This option was selected.

TREATMENT PROGRESS

After extraction of the maxillary and mandibular first premolars and the mandibular third molars, fixed appliances were placed in both arches. Maxillary posterior miniscrew implants (diameter, 1.2 mm; length, 8 mm; Absoanchor AX12-108; Dentos, Taegu, South Korea) were inserted into the buccal alveolar bone between the maxillary second premolars and the first molars (Fig 4).

After initial leveling and alignment, rectangular 0.019 x 0.025-in stainless steel archwires were used to close the extraction spaces with sliding mechanics. Class II elastics (3/16 in, 3.5 oz; 3M Unitek, Monrovia, Calif) were added to retract the maxillary incisors and establish a Class I molar relationship (Fig 5).

After final arch coordination and minimal occlusal equilibration, all appliances were debonded.
Fig 2. Pretreatment dental casts.

Fig 3. Pretreatment cephalometric and panoramic radiographs and tracing.
miniscrew implants were removed without anesthesia. After 20 months of treatment, proper overjet and overbite were achieved. For retention, the patient was instructed to wear removable retainers for 24 hours a day for the first year and then at night only for the next year.

TREATMENT RESULTS

The posttreatment facial photographs (Fig 6) show improvement in the facial profile. The intraoral photographs and dental casts (Figs 6 and 7) show satisfactory dental alignment, bilateral Class I canine and molar relationships, and normal overjet and overbite. The cephalometric analysis (Fig 8) shows that the ANB angle was 4.2°. The Wits appraisal was 0.9 mm, and the U1-NA angle was 20.1° (Table). All these demonstrate the changes from a skeletal Class II pattern to a skeletal Class I pattern. The panoramic radiograph (Fig 8) showed that all extraction spaces were closed, and the roots had been paralleled. No obvious root resorption had occurred. The sella-nasion superimposition indicated that the maxillary incisors were retracted, and the facial profile was improved. The patient’s 2-year follow-up records showed good stability with no obvious relapse (Figs 9-11). The occlusion was stable, and the improved facial harmony had been retained.

DISCUSSION

The treatment of a Class II Division 1 malocclusion can be accomplished with several methods. The choice of treatment should consider the patient’s facial profile, skeletal pattern, growth potential, and severity of the malocclusion. The treatment protocol and the malocclusion severity can influence the efficiency of orthodontic treatment. It has been shown that extraction of 2 maxillary premolars has greater treatment success than nonextraction or 4-premolar extraction treatment of Class II malocclusions. In Class II malocclusions, obtaining a Class I molar relationship by using the nonextraction or the 4-premolar extraction protocol requires more anchorage reinforcement and greater patient compliance than does a 2-maxillary-premolar extraction protocol. Treatment time is also shorter with the 2-maxillary-premolar protocol, because there is no need to alter the Class II molar relationship. Efficiency is defined as the capacity to produce the best results in the least amount of time. In our patient, a significant Angle Class II Division 1 malocclusion was successfully treated with extraction of 4 first premolars and miniscrew implant anchorage. The total treatment duration was 20 months, and acceptable treatment results were achieved. This is considered to be efficient treatment.

Nevertheless, in addition to a successful outcome, a treatment protocol should also provide good long-term stability of the dental relationships. Studies comparing the stability of Class II malocclusion treatment with either nonextraction, 2-maxillary-premolar extraction, or 4-premolar extraction protocols have shown no significant differences between these protocols. A study by Little showed that long-term changes in
Fig 6. Posttreatment facial and intraoral photographs.

Fig 7. Posttreatment dental casts.
tooth alignment can occur. Berg suggested that it is not appropriate to make a final evaluation of the treatment results immediately after removal of the fixed appliances. Several studies have evaluated treatment outcomes in Class II Division 1 malocclusions at varying times after appliance removal and found increases in overjet and overbite after treatment. Other studies have also examined the effect of overjet reduction on the facial profile. In our case, the 2-year follow-up records showed good stability with no obvious relapse. The occlusion was stable, and good facial harmony had been maintained.

The importance of anchorage in orthodontic tooth movement is highly significant. Anchorage is considered the most critical factor when correcting a Class II Division 1 malocclusion. In adults, treatment of a severe skeletal Class II Division 1 malocclusion often requires premolar extractions and maximum anchorage. Maximum anchorage to prevent forward movement of the maxillary posterior teeth during closure of extraction space can be provided with various approaches,

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>2-year follow-up</th>
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<tr>
<td>SNA (°)</td>
<td>80.9</td>
<td>80.2</td>
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<td>SNB (°)</td>
<td>75.1</td>
<td>76</td>
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<td>ANB (°)</td>
<td>5.8</td>
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<td>U1-NA (mm)</td>
<td>9.2</td>
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<td>L1-NA (°)</td>
<td>34.7</td>
<td>20.1</td>
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<tr>
<td>L1-NB (mm)</td>
<td>6.3</td>
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<td>Wits (mm)</td>
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<td>APDI (°)</td>
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<td>ODI (°)</td>
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<td>Lower lip to E-plane (mm)</td>
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APDI, Antero-posterior dysplasia indicator; ODI, overbite depth indicator.
including headgear, lingual arch, transpalatal arch, holding arch, and intermaxillary elastics. However, improvement can be minimal, because these appliances require patient cooperation, and it is difficult to establish absolute anchorage for incisor retraction. For example, extraoral headgear appliances are commonly used to reinforce posterior anchorage during anterior tooth retraction or are directly applied to retract the anterior teeth. However, wearing headgear full time is too demanding for most patients, and thus some anchorage loss and mesial movement of the maxillary molars are usually observed. Furthermore, extraoral appliances are often rejected by adults for social reasons.

Recently, dental implants, screws, and miniplates have been developed to obtain absolute anchorage without patient cooperation. Mini-implants can provide stable bony anchorage and overcome problems of anchorage loss during extraction space closure. They can provide stable and reliable anchorage when simultaneously used with various orthodontic techniques, such as sliding mechanics, frictionless loop mechanics, and lingual orthodontic appliances. Application of bony anchorage also makes teeth move more efficiently, without depending on patient cooperation and thereby reducing treatment duration. Many studies have shown that mini-implant anchorage achieves better control in both the anteroposterior and vertical directions than does traditional extraoral anchorage during treatment of maxillary dentoalveolar protrusion. Greater retraction of the maxillary incisors, less anchorage loss of the maxillary first molars, and the possibility of counterclockwise mandibular rotation all facilitated the correction of a Class II malocclusion. In this case, overjet was decreased from 10 to 1.5 mm, the U1-NA angle was decreased from 34.7° to 20.1°, and the sella-nasion superimposition indicated that the position of the maxillary molars remained unchanged. All of these changes showed that miniscrew implants provided absolute anchorage in the retraction of the maxillary incisors, and the facial profile of the patient improved remarkably.

Fig 9. Two-year follow-up facial and intraoral photographs.
CONCLUSIONS

This case report describes the treatment of a 30-year-old woman with a Class II Division 1 malocclusion treated by extraction of 4 first premolars and the use of miniscrew implant anchorage. The treatment lasted for 20 months. The occlusion and the profile were effectively improved, with good posttreatment stability.

REFERENCES