Micro-Implant Anchorage for Orthodontic Treatment of Bialveolar Protrusion: A Case Report

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Abstract

Conventional methods of reinforcing orthodontic anchorage have several disadvantages, including complicated appliance design and the need for exceptional patient cooperation. Recently, Kanomi introduced the use of titanium microscrews and miniscrews for orthodontic anchorage. This case report demonstrates the use of microscrews or mini-implants in a 15-year-old female patient having a convex profile and a Class I skeletal pattern with bialveolar protrusion. Brackets were bonded after extraction of upper and lower first premolar teeth and initial aligning and leveling of teeth was carried out in both the arches. The micro-implants (4 in number) were then inserted buccally in the interdental space between the second premolar and the first molar in both upper and lower arches. For the upper arch 8 mm long and for the lower arch 6 mm long micro-implants [diameter of 1.2 mm] (Dentos Co., Taegu City, Korea) were used. Then en-masse retraction of six anterior teeth was carried out in both upper and lower arches on rectangular 19 × 25 stainless steel archwires with soldered hooks between lateral incisors and canines in each quadrant. Light forces (200 g) were used by applying power chains from the soldered hooks to the micro-implants in each quadrant for simultaneous upper and lower retraction. It was observed that micro-implant treatment had many advantages: As it does not depend on patient compliance with extraoral appliances, produces an early profile improvement giving the patient even more incentive to cooperate, shortens treatment time by retracting the six anterior teeth simultaneously and provides absolute anchorage for orthodontic tooth movement.

Keywords: Absolute anchorage; Bialveolar protrusion; Micro-implants

Introduction

Conventional methods of reinforcing orthodontic anchorage have several disadvantages, including complicated appliance design and the need for exceptional patient cooperation [1]. Kanomi [2] and Costa et al. [3] introduced the use of titanium microscrews and miniscrews for orthodontic anchorage. Microscrews are small enough to place in any area of the alveolar bone, easy to implant and remove, and inexpensive. In addition, orthodontic force application can begin almost immediately after implantation. In particular, microscrews have been shown to produce en masse retraction of the six anterior teeth [4]. So it was decided to use micro-implants to treat a patient having Class I bialveolar protrusion where anchorage demands are critical.

Case History

The patient, a 15-year-old female, had a convex profile and a Class I skeletal pattern with bialveolar protrusion (Figures 1 and 2). Cephalometric analysis showed an ANB angle of 4°, a mandibular plane angle (FMA) of 20° and facial angle of 88° (Table 1).

The overjet and overbite were 5 mm and 2.5 mm respectively. There were arch-length discrepancies of 12 mm in upper arch and 10 mm in the lower arch.

The canine and molar relationships were Class I, but the maxillary incisors and mandibular incisors were proclined (U1-SN 132°, IMPA 118°).

The treatment plan called for extraction of both the maxillary and mandibular first premolars, followed by fixed appliance (Roth prescription, 0.022 slot) treatment using maxillary and mandibular micro-implants for anchorage control.
Treatment Progress

Brackets were bonded after extraction of upper and lower first premolar teeth and initial aligning and leveling of teeth was carried out in both the arches. The micro-implants (4 in number) were then inserted buccally in the interdental space between the second premolar and the first molar in both upper and lower arches. For the upper arch 8 mm long and for the lower arch 6 mm long micro-implants [diameter of 1.2 mm] (Dentos Co., Taegu City, Korea) were used. Then en-masse retraction of six anterior teeth was carried out in both upper and lower arches on rectangular 19 × 25 stainless steel archwires with soldered hooks between lateral incisors and canines in each quadrant. Light forces (200 g) were used by applying power chains from the soldered hooks to the micro-implants in each quadrant for simultaneous upper and lower retraction (Figure 3).

After about seven months after microscrew implantation, a Class I canine relationship had been achieved (Figures 4 and 5). Total active treatment time was 18 months.

Results

The patient showed good Class I skeletal and dental relationships after 18 months of total treatment time. The facial profile was improved with the retraction of the upper and lower lips. The ANB angle was reduced from 4° to 2°, the mandibular plane angle decreased from 20° to 18° in conjunction with the decrease in anterior facial height (Table 1). The proclined mandibular incisors were uprighted by 18° (from 118° to 100°).

Cephalometric superimposition demonstrated a bodily

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Table 1: Cephalometric analysis.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre-treatment</th>
<th>Post-treatment</th>
</tr>
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<tbody>
<tr>
<td>SNA</td>
<td>84°</td>
<td>82°</td>
</tr>
<tr>
<td>SNB</td>
<td>80°</td>
<td>80°</td>
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<tr>
<td>ANB</td>
<td>4°</td>
<td>2°</td>
</tr>
<tr>
<td>FMA</td>
<td>20°</td>
<td>18°</td>
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<td>PFH/AFH</td>
<td>72.89%</td>
<td>74.54%</td>
</tr>
<tr>
<td>U1-SN</td>
<td>132°</td>
<td>111°</td>
</tr>
<tr>
<td>IMPA</td>
<td>118°</td>
<td>100°</td>
</tr>
<tr>
<td>Facial angle</td>
<td>88°</td>
<td>85°</td>
</tr>
<tr>
<td>Upper lip to E</td>
<td>1.5 mm</td>
<td>-2 mm</td>
</tr>
<tr>
<td>Lower lip to E</td>
<td>4 mm</td>
<td>0 mm</td>
</tr>
</tbody>
</table>

Figure 2: Intra-oral photographs (pre-treatment) (a) frontal view (b) right lateral and (c) left lateral.
retraction of the maxillary and mandibular anterior teeth. The maxillary posterior teeth moved slightly distally and showed a small amount of extrusion. The mandibular molars were uprighted and slightly intruded, causing the mandible to be rotated upward and forward (Figure 6).

Discussion

The microscrews used in this case were small enough to be implanted in the interseptal alveolar bone. To avoid any damage to the roots, however, the screws were implanted at a 30-40° angle between maxillary teeth and at a 20° angle for the mandibular teeth. Costa and colleagues confirmed that the buccal aspect of the alveolar process in the mandibular premolar and molar region is safe for miniscrew implantation [3]. There is no risk of root damage during the surgical procedure or from subsequent tooth movement.

Biomechanically, the maxillary force is applied near the center of resistance of the six anterior teeth, making it possible to achieve bodily intrusion and retraction.

Even though orthodontic force was applied just two weeks following implantation, none of the microscrews loosened during the treatment period. There is a possibility, however, of soft tissue impingement and inflammation around micro-implants. Such problems can be avoided by using a new micro-implant with a hook on its head for attaching elastics or a nickel titanium coil spring, and a smooth surface under the head where the screw contacts the soft tissue [5].

Conclusion

Micro-implant treatment has many advantages: As it does not depend on patient compliance with extraoral appliances, produces an early profile improvement giving the patient even more incentive to cooperate, shortens treatment time by retracting the six anterior teeth simultaneously and provides absolute anchorage for orthodontic tooth movement.
Figure 5: Intra-oral photographs (pre-debonding) (a) frontal view (b) right lateral and (c) left lateral.

Figure 6: Pre-treatment and post-treatment cephalometric superimposition.

References