Correction of a mutilated dentition with mini-implants as anchorage

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The patient was an adolescent boy, aged 15.6 years, with a mutilated dentition. He had extrusion of the maxillary left first molar because of loss of the mandibular first molar and lingual tilting and rotation of the mandibular second molars. Both left and right second molars were in scissors-bite that was more severe on the left side. By using mini-implants and a TPA with hooks, a 3-mm intrusion was successfully made on the maxillary left first molar. This provided room for mesial movement of the mandibular left second molar. The second molar was protracted into the space of the missing first molar, and the mandibular left third molar was positioned in place of the second molar. The second molars scissors-bite was corrected. Active treatment took 45 months, and the treatment result remained stable 2 years after debonding. (Am J Orthod Dentofacial Orthop 2010;138:656-65)

Maxillary molar intrusion, scissors-bite correction, and mandibular molar protraction have been previously recognized as difficult. Putting an intrusive force on a tooth invariably results in an opposing reaction from the anchoring tooth.1,2 To minimize this undesirable effect, orthodontists use complex appliances that often lead to increased discomfort for patients and longer treatment times.3,4 The protraction of mandibular molars is complicated by dense cortical bone located buccally as well as wide buccolingual mandibular roots.5

The introduction of skeletal anchorage with mini-implants has made it possible for orthodontists to move molars without unwanted side effects.6,7 Mini-implants offer many advantages, including a simpler, shorter, less-invasive, and more-economic procedure.8 This case report presents the successful treatment (with 2 years of retention) of a patient who needed maxillary molar intrusion, scissors-bite correction, and mandibular molar protraction with mini-implants for anchorage.

DIAGNOSIS AND ETIOLOGY

The patient, an adolescent boy aged 15.6 years, complained of a missing mandibular left first molar.

Pretreatment facial photographs showed a convex profile with lip protrusion, a retrusive chin, and a relatively long lower anterior facial height (Fig 1). The pretreatment intraoral photographs (Fig 2) and dental casts (Fig 3) demonstrated a Class I molar relationship and extrusion of the maxillary left first molar as well as lingual tilting and rotation of the mandibular second molars. Both the left and right second molars exhibited scissors-bite, with greater severity on the left side. In the maxillary arch, only minor crowding was noted, and the maxillary and mandibular midlines were coincident (Figs 2 and 3). Overjet was 5.2 mm, and overbite was 2.0 mm.

The panoramic radiograph (Fig 4) showed an overerupted maxillary left first molar resulting from the missing mandibular left first molar with only root remnants remaining. The mandibular left second molar was not mesially tilted, and the third molar was present. A radiopaque mass was found below the mandibular right first premolar, but, because it had no clinical evidence of bony pathology, it was left for observation.

Cephalometric analysis (Fig 4, Table) showed a Class II skeletal relationship (ANB angle, 5.8°) with a large FMA angle (34.4°) and long anterior face height (145.5 mm) suggesting a hyperdivergent pattern. The maxillary incisor inclination was in the normal range (U1 to SN, 104.2°), whereas the mandibular incisors were slightly labially inclined (IMPA, 99.2°).

TREATMENT OBJECTIVES

The main treatment objectives included obtaining a functional occlusion, correcting the scissors-bite of the second molars, intruding the maxillary left first molar, and creating room for closure of the mandibular left first molar space by mesial movement of the second
molar. Improvement of the protrusive facial profile was planned by using the retraction of the anterior teeth to extract the 3 first premolars and the remaining root of the mandibular left first molar. Other goals during treatment included prevention of further opening of the mandibular plane (SN-GoMe, 47.0°; FMA, 34.4°) and maintenance of the maxillary incisor inclination in the normal range after space closure.

**TREATMENT ALTERNATIVES**

Two treatment options were proposed to the patient and his parents, both involving extraction of the maxillary first premolars, the mandibular right first premolar, and the remaining root of the mandibular left first molar. For the first option, protraction of the mandibular left second molar was planned with mini-implant anchorage. Despite the lengthy time for closing a mandibular first molar extraction space, the age of the patient and the cost of the implant prosthesis were factors for selection of protraction of the mandibular left second molar instead of the implant prosthesis. The shape of the mandibular left third molar appeared to make it useful as a second molar (Fig 4).

An alternative treatment would reserve space for prosthetic treatment until the patient had finished growth. This space could then be treated with an implant or another restorative alternative.

**TREATMENT PROGRESS**

The maxillary first premolars, the mandibular right first premolar, and the root remnants of the mandibular
left first molar were extracted before treatment. The maxillary arch was bonded with .022-in slot brackets (MBT, 3M Unitek, Monrovia, Calif). For intrusion of the maxillary left first molar, 2 mini-implants (1.4 × 10 mm, OsteoMed, Addison, Tex) were palatally placed, mesially and distally to the maxillary left first molar (Fig 5). An intrusive force was applied by using elastic modules from the mini-implants to a lingual button bonded to the palatal surface of the molar. A relatively heavy force (200 g per tooth) was used to intrude the posterior teeth. A transpalatal arch (TPA) was placed in the maxillary arch from second premolar to second premolar, and an arm was welded buccally on the left side. With this device, buccal activation took place by applying elastic thread from this buccal arm to a lingual button bonded to the buccal surface of the molar. After 3 months, approximately 3 mm of intrusion occurred (Fig 5). The scissors-bite of the right side was corrected by simple leveling.

The next step involved aligning the mandibular left second molar with the correction of the second molar scissors-bite. The tooth was banded, and a nickel-titanium wire was ligated. A power chain was placed lingually from the second molar to the second premolar to correct the rotation. To relieve the scissors-bite of the left second molars, a modified TPA was used to facilitate palatal tipping and intrusion (Fig 6). To prevent occlusal interlocking during the scissors-bite correction, the bite was opened with bonding resins on the occlusal surfaces of the mandibular right first molar and the left second premolar (Fig 6). After 9 months of leveling, a beta-titanium alloy T-loop was used to protract the mandibular left second molar with slight crown tipping for 3 months.

A 1.4 × 6-mm mini-implant (OsteoMed) was placed between the roots of the mandibular left first and second premolars under local anesthesia (Fig 7). This was used as an anchorage point for protracting the second molar root mesially forward. A hook of rectangular stainless steel wire (.019 × .025 in) was placed into the auxiliary tube of the second molar and bent downward toward the sulcus where force application to the approximate center of resistance near the bifurcations of the second molars would take place. One power chain with a force of 350 g was applied from the mini-implant to the hook. The other power chain was applied to the lingual side. All extraction spaces were closed with sliding mechanics (Fig 7).

During the protraction of the mandibular left second molar, the third molars erupted and spontaneously drifted forward (Fig 7). After the eruption of the mandibular third molars, the left third molar showed lingual tipping. To adjust the left third molar into an upright position, a stainless steel wire segment (.019 × .025
in) with a hook was placed into the auxiliary slot of the mandibular left second molar, uprighting the third molar buccally and simultaneously exerting an intrusive force (Fig 8). This process took place by attaching a power chain to a lingual button attached on the lingual side of the third molar and extending this across the occlusal surface of the tooth onto the buccal hook. For complete scissors-bite correction, the intrusion and palatal movement of the maxillary left second molar was completed by using a TPA with an arm extended posteriorly for power-chain activation. A semifixed biteplate was used for a month to create room for the teeth to settle into the upright position (Fig 8).

The brackets and bands were removed after 45 months of active treatment. Fixed retainers made of twisted wire (.0215 in) were attached to the lingual surface of the anterior segments of both arches immediately after debonding. A circumferential maxillary retainer was also placed the day after debonding.

TREATMENT RESULTS

The patient’s facial profile improved (Fig 9), with satisfactory anterior and posterior occlusion (Figs 10 and 11). The treatment concluded with a Class II molar relationship on the left and a Class I molar relationship on the right. The canines were finished in a Class I relationship with canine guidance. The maxillary and mandibular midlines were coincident with each other and also with the facial midline. The mandibular left second molar was protracted well into the space of the first molar, and the mandibular left third molar was erupted and positioned in place of the

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T1, Pretreatment records (age, 15 years 7 months; Fig 4); T2, posttreatment records (age, 19 years 4 months; Fig 12); T3, 2-year postretention records (age, 21 years 4 months).
second molar. A 3-mm intrusion was successful for the maxillary left first molar (Fig 12), allowing room for the mesial movement of the mandibular left second molar. The scissors-bite of all second molars was corrected (Figs 10 and 11).

The final panoramic radiograph showed good root parallelism without significant root resorption. The radiopaque mass below the mandibular right premolar showed no specific changes (Fig 12).

Superimposition of the initial and final cephalograms showed good bodily retraction of the maxillary incisors, thus maintaining the inclination in the normal range. Retraction of the incisors was accompanied with retraction of the lips to provide a more esthetically pleasing profile. This was aided by growth of the mandible during the treatment period that helped to enhance the tip of the chin. Furthermore, the initial convex profile improved, the mandibular plane angle was maintained, and the FMA angle decreased from 34.4° to 32.6°.

Fixed retainers were attached to the lingual surfaces of the anterior teeth of both arches. The patient also
wore a circumferential maxillary retainer 24 hours a day for the first year, followed by another year of nighttime wear. The maxillary and mandibular lingual fixed retainers were kept for 2 years. No apparent changes were noted in the occlusion during this period. Occlusal settling was improved, and the 2-year posttreatment stability was good (Figs 13 and 14). Comparison of the posttreatment and 2-year retention cephalometric measurements showed no significant dental or skeletal changes (Table).

DISCUSSION

OsteoMed bone screws for orthopedic fixation were used because the patient had been treated before the development and manufacture of specially designed orthodontic mini-implants. Two screws (diameter, 1.4 mm; length, 10 mm) were placed in the palate for intrusion of the maxillary first molar (Fig 5), but the buccal interradicular spaces were too narrow to safely position the mini-implants. Maxillary molar intrusion was done by using a combination of mini-implants and a TPA.
with hooks. On the palatal side, the first molar was intruded by using 2 mini-implants and power chains. On the buccal side, however, a TPA with hooks was used to apply an intrusive force with a power chain. With these intruding mechanics, the first molar was controlled buccolingually (Fig 5).

A relatively heavy force (200-300 g per tooth) was used as the intruding force, which was checked and reactivated every 6 weeks. During intrusion, periodontal problems, buccal or palatal tilt, and root resorption were monitored. There were no periodontal problems, including deepening of the periodontal sulcus or shortening of the clinical crown, until the intrusion of the maxillary first molar was complete.

To avoid occlusal interlocking during the scissors-bite correction, the bite was opened by bonding resins on the occlusal surfaces of the mandibular posterior teeth (Fig 6). Interlocking might prevent buccolingual tooth movement. These occlusal resin blocks can also provide an intruding force, because uprighting procedures usually accompany extrusion, and intrusive forces are necessary. By using the mechanics outlined here, the scissors-bite was corrected without opening the mandibular plane (Fig 12, Table).

To reduce mesial tipping during protraction of the mandibular second molar, a protraction arm was used to apply force from the tooth’s center of resistance (Fig 7). Even with a protraction arm, mesial
Fig 11. Posttreatment dental casts.

Fig 12. Posttreatment radiographs and superimposition. Red, posttreatment; black, pretreatment.
tipping can still occur.\textsuperscript{13} To prevent rotation, a protraction force was also applied from the lingual side with a power chain.

The patient had a dolichofacial skeletal pattern and a large mandibular plane angle. It was important to prevent further opening of the bite during treatment. At the end of treatment, however, the mandibular plane angle had closed by nearly 2°. This could be attributed to the intrusion of the maxillary left first molar and the meticulous correction of the scissors-bite with the concurrent intrusion of these teeth. Closure of the mandibular plane angle could be partially attributed to the patient’s growth.

The total active treatment was 45 months. This relatively long treatment time can be attributed to the 10 months necessary for space closure and the forward protraction of the mandibular left second molar into dense cortical bone, as well as the waiting period for eruption of the mandibular third molars.

**CONCLUSIONS**

This patient had a mutilated dentition with scissors-bite, missing mandibular first molar, and extrusion of the occluding molar. These were treated successfully by using screws through maxillary molar intrusion, mandibular molar protraction, and scissors-bite correction. The space of the missing mandibular first molar closed nicely. Good alignment and occlusion were maintained 2 years after appliance removal.

Fig 13. Postretention facial photographs (2 year later).

Fig 14. Postretention intraoral photographs.

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REFERENCES