CASE REPORT

Non-Extraction Treatment of Skeletal Class II Adult Patient with Total Maxillary Arch Distalization

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ABSTRACT

In this case report, we present an extraction-prescribed Class II division 1 adult patient’s non-extraction treatment by distalization of the total maxillary arch with miniscrews. The miniscrews were inserted into the mesial of the upper first molar roots as far as possible, and total arch distalization was started by a nitinol coil spring (200 g per side) extended from the miniscrew to a hook attached between the canine and lateral. The distalization amount was expected to be the distance between the miniscrew and the second premolar root per side. At the end of the treatment, 2 mm molar distalization with 3 degree tipping was achieved. Class II division I adult patients with moderate overjet can be treated without extraction using these mechanics.

Keywords: Miniscrew, total arch distalization, Cl II malocclusion

INTRODUCTION

The treatment alternatives for adult skeletal Class II patients are camouflage treatment and surgical correction.¹ In camouflage treatment, the premolars are extracted to solve crowding, retract the incisors, and provide Class I canine relationship. Another way of camouflage treatment is molar distalization. There have been many methods to distalize molars with intraoral or extraoral appliances, such as using a pendulum appliance, distal jet, or headgear.²,³ Some disadvantages of these appliances are distal tipping, the need for overcorrection of the molars to the Class III position, forward movement of the maxillary premolars and incisors, anchorage loss at the reactive part, protrusion of the lower anterior teeth, rotation of the mandibular plane, and the requirement for patient cooperation.¹,⁴,⁵

The use of orthodontic miniscrews can overcome many of these problems, regardless of whether a single tooth or the entire dental arch is being moved. With skeletal anchorage, the disadvantages are minimized, no patient cooperation is required, and the incisor positions and facial profile can be successfully controlled.⁶,⁷

Distal retraction of the whole dental arch using miniscrews was recently published and showed good treatment results.⁶,⁸,⁹ The distalization force is usually applied to the canines or hooks attached on the archwire from miniscrews placed between the roots of the posterior teeth.

In this case report, we present an extraction-prescribed Class II division 1 adult patient’s non-extraction treatment by distalization of the total maxillary arch with miniscrews.

CASE PRESENTATION

A 22-year-old female patient admitted to our clinic with complaints of protrusive teeth. Her facial form was ovoid and symmetric, with a harmonious orthognathic profile. Dentally, she had an Angle Class II malocclusion, a 5 mm overjet, and a 2 mm overbite, and arch length discrepancies were present in the maxillary and mandibular arches (-5 and -4.5 mm, respectively). All her third molars were congenitally absent. No pathology was noted on her intraoral and facial photographs (Figure 1). Her pre-treatment panoramic and lateral cephalometric radiographs are shown in Figure 2, 3.
Pre-treatment cephalometric analysis showed the following: SNA, 79°; SNB, 74°; ANB, 5°; SN-GoGn, 33°; U1-SN, 103°; nasolabial angle, 106°; VertT-U6C, 28 mm; overjet, 5 mm; and SN-GoGn, 33° (Table 1).

Treatment Objectives
The primary treatment objectives for this patient were to achieve a Class I canine/molar relationship bilaterally, relieve crowding, correct interincisal relationship, establish good functional occlusion, and plan an appropriate retention protocol.

Treatment Alternatives
The treatment plan involved a non-extraction treatment protocol. Another option would have been to extract all her first premolars but the patient refused this option.

Treatment Progress
The patient underwent orthodontic treatment with a 0.022-inch slot Damon Q bracket system (Ormco, Glendora, California, USA). Following the leveling process, 0.017 x 0.025 stainless steel archwire was placed to the upper arch and hooks attached between the lateral and canines. In the same appointment, miniscrews were inserted into the mesial of the upper first molar roots as far as possible (1.6 mm diameter and 10 mm length; Jeil Medical Corporation, Seoul, Korea). At this stage, all the arch distal-
Distalization was started by using a nitinol coil spring (200 g per side) extended from the miniscrew to the hook, and the distalization amount was expected to be the distance between the miniscrew and the second premolar root (Figure 4a). After eliminating a portion of the total overjet with this set of mechanics in 6 months, the miniscrews were moved to mesial of the lower first molar and Class II elastics was initiated. Also, an accentuated curve of Spee was performed to the upper archwire (Figure 4b). Thus, the overbite was increased and the remaining overjet was optimized in 3 months. After the debonding process, Essix retainers were placed in both the mandible and maxilla to maintain the orthodontic correction.

Cephalometric Analysis

The cephalometric analysis was based on a reference system consisting of two perpendicular lines traced through stable basicranial structures.10

Stable basicranial line (SBL): A line through the most superior point of the anterior wall of the sella turcica at the junction with the tuberculum sellae (Point T) and the fronto-maxillo-nasal suture was identified as the most anterior point of the lamina cribrosa of the ethmoidal bone. The SBL was traced through a structure that did not undergo remodeling from the age of 4 or 5 years11 and was relatively easy to identify on lateral cephalograms.

Vertical T (VertT): A line perpendicular to the SBL and passing through Point T.

A cephalometric analysis based on this reference system comprised the following measurements (Figure 5):

- Angular measurements for assessment of the skeletal sagittal relationship: SNA, SNB, and ANB.
- Linear measurements for assessment of the dental vertical relationships: SBL-U1C and SBL-U6C (C: Centroid point of the molar and incisor crown).
Angular measurements for assessment of the skeletal vertical relationships: SN-GoGn.

Angular measurements for assessment of soft tissue: Nasolabial Angle.

Linear measurements for assessment of soft tissue: UL-E-line and LL-E-line.

RESULTS

The active treatment period was 18 months. At the end of the treatment, Class I molar and canine relationships with ideal overjet and overbite and a more esthetic facial profile were achieved (Figure 6). The post-treatment panoramic and lateral cephalometric radiographs are shown in Figure 7, 8. Post-treatment cephalometric analysis showed results of: SNA, 78°; SNB, 74°; ANB, 4°; U1-SN, 105°; nasolabial angle, 115°; VertT-U6C, 26 mm; overjet, 2 mm; and SN-GoGn, 33°. The maxillary molar and incisors were distalized 2 mm and intruded 2 mm and 1.5 mm, respectively. The maxillary molar angulations were decreased 3°. The upper and lower lips were moved back very little (Table 1). The vertical dimension was not changed in spite of the significant maxillary molar distalization, as seen in the superimposition (Figure 9). After a 1-year re-
tention period, the occlusal relationship was stable, and there was no relapse (Figure 10).

**DISCUSSION**

In the literature, there are many publications about the relationship between anterior tooth movement and the position of point A.12,13 Chen et al.14 reported that point A moved 1.24 mm backward, while the apex of the maxillary incisors moved 2.95 mm posterior movement of the apex resulted in a 1.7 mm posterior movement of point A. Coincident with these reports, in our case, the SNA angle decreased 1° while the upper incisor root apex moved 3 mm backward (Table 1).

The upper and lower lips relative to the E-line moved distally after distal retraction by 1 and 0.5 mm, respectively. Also, the nazorabial angle was increased from 106° to 115° (Table 1). The initial arch length discrepancies of -5 mm in the maxilla and -4.5 mm in the mandible were resolved. This means that the posterior teeth were distalized sufficiently to resolve crowding as well as to obtain a better profile after distal movement of the anterior teeth.

Oh et al.15 reported that the force from the microimplants to the canine brackets is backward and in an apical direction. With these forces, the teeth might experience distal movement and intrusion. When distal force is applied to the canines, they might tip distally, and this exerts an intrusion force on the posterior teeth by a thick stainless steel archwire. They found that the maxillary and mandibular second molars were intruded by 1.12 and 1.07 mm, respectively. In our case, we applied the force to a hook instead of the canine brackets and 2 mm molar and 1.5 mm incisor intrusions were obtained. This result suggests that, although the full dentition of the maxilla was distalized, the intrusion of the posterior teeth prevented the wedging effect and SN-GoGn angle remained stable (Table 1).

Ngantung et al.22 reported that the mean treatment time was 25.7±3.9 months to complete treatment with the distal jet appliance with fixed appliance therapy. Chiu et al.23 reported that the treatment time for the pendulum appliance was 31 months, consisting of 10 months for distalization of the molars and 18 months for the second phase of fixed appliance treatment. The treatment time for the pendulum appliance was 31 months, consisting of 7 months for distalization of the molars and another 24 months for fixed appliance therapy. In the present case, the total treatment time was 18 months. It was much shorter than the other intraoral distalizing methods.24,25 This might be because, conventional methods follow a step-by-step treatment consisting of molar distalization and incisor retraction. However, with Park et al.6 reported that during distalization of the total maxillary dentition, the contact of the teeth on the crown acted as a resistance to movement, which created a counterclockwise moment on the anterior teeth. As a result, the crown of the upper anterior teeth showed distal movement, whereas the roots showed more distal movement. Coincident with this, in our case, the U1-SN angle was increased 2° although incisor retraction was obtained (Table 1).

With their distal jet appliance, Ghosh and Nanda17 showed distal tipping of the maxillary first and second molars by 8.36° and 11.99°, respectively, during distalization. It was stated that the molar key could be corrected by a tipping movement of the molar, but the retention would be doubtful during distal retraction of the incisors. The molar distalizing appliances anchored by screws also showed distal tipping of the distalized maxillary first molars by 8.8°18 and 10.9°19. In our case, the maxillary first molar tipped distally by 3°; this was very small compared to previous reports.16,17 This might be explained by the fact that we used a rigid main archwire, so tipping of the teeth might have been prevented. Because of the distalizing of the posterior teeth with bodily movement, the treatment results remained stable even after one year post-treatment (Figure 10).
miniscrew sliding mechanics, total maxillary or mandibulary
dentition can be distalized at the same time.

The interradicular space between molars may limit the amount
of en masse retraction. Recent computed tomography imaging
studies showed that twenty-four, twenty-five the average amount of mesiodistal bone
between the first molar and second premolar is 3.3 mm. Thus, if
we consider that a 1.6 diameter miniscrew is used in this case,
the potential extent of molar distalization is minimal, even if tip-
ing and occlusal plane rotation contribute to the need for addi-
tional distalization of the upper dentition. Therefore, a thinner
miniscrew could be used in this case. To gain additional space for
distal movement, we angulated the miniscrews thirty to forty degrees
superiorly to the perpendicular of a plane tangent to the buccal cortical
bone. Twenty-seven Paik et al. Twenty-one reported that about three millimeters of upper-first-mo-
lar distalization can be expected. Bechtold et al. Twenty-eight reported that interradicular miniscrews for the correction of a full cusp Class
II relationship will inevitably need to be removed and reinserted
during treatment, which could be cumbersome for both the operator and patient. Hence, this technique could well be
indicated for the correction of end-to-end Class II, rather than full cusp Class II. It has been shown that the damage to the root
surface by the titanium miniscrew during tooth movement is
reversible. Therefore, distalization using interradicular minis-
crews, once placed in appropriate positions, may be regarded as relatively safe.

CONCLUSION

At the end of the treatment, 2 mm molar distalization with three degrees tipping was obtained. Class II division I adult patients with moderate overjet can be treated without extraction by using these mechanics. In the presence of third molars, to enhance distal movement of the dentition, they can be extracted just before applying the distal force.

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