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Nonsurgical Treatment of Anterior Open Bite Using Temporary Anchorage Device: A Case Report

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ABSTRACT

This case report aimed to present non-surgical treatment of an adult patient with anterior openbite (AOB), skeletal class II malocclusion, and hyperdivergent facial pattern via molar intrusion using temporary anchorage devices (TADs). Upper right first molar and upper left first premolar were extracted in order to relieve crowding. Full-arch maxillary and mandibular fixed appliances were placed. After alignment and leveling, miniscrews were inserted between the second premolars and molars on both right and left sides of the upper and lower arches. Elastomeric chains were passed under the 0.019×0.025-inches wire to the miniscrews in order to apply intrusive force. Counter-clockwise rotation of the mandible led to chin advancement, reduction in facial height, and to some degree relief of lip strain resulting in improvement in facial profile. This case report presented a successful treatment of an adult patient with AOB due to the counterclockwise rotation of the mandible in response to molar intrusion.

Keywords: Openbite; Miniscrew; Class II malocclusion; Hyperdivergent; Chin deficiency.

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Introduction

Anterior open bite (AOB) malocclusion is one of the most complicated cases to treat; Therefore, numerous studies focused on its etiology, treatment options, mechanics, and stability [1,2]. Overgrowth of the posterior dentoalveolar of the maxilla and resultant rotation of the mandible usually accompanies this malocclusion [3,4]. Traditionally, LeFort I and BSSO surgeries have long been used to correct skeletal AOB [5]. Generally, orthognathic surgeries are associated with several complications such as inferior alveolar nerve damage, bad split, infection, hemorrhage, and so on [6]. In addition, many patients refrain from orthognathic surgeries due to the costs, the care burden, and the general refusal of any surgery [7]. Recently, some more conservative approaches such as temporary anchorage devices (TADs) have expanded the treatment options in this regard. TADs help treat AOB cases mostly by the intrusion of molars and consequently counterclockwise rotation of the mandible [8]. The mechanism of the AOB correction with TADs is generally the same as the surgical method; therefore, it provides a non-invasive alternative in properly selected patients with skeletal AOB [9]. TADs offer an easy, atraumatic, safe, and less patient-cooperation-demanding approach with similar long-term stability compared to the surgical approach [10]. In this case report, we describe the outcome of AOB correction by molar intrusion using TADs in a 23-year-old female patient.

Case Presentation

History

A 23-year-old female patient was referred to the orthodontic department with chief complaints of crowding and anterior open bite. She disproved any medical complications.

Assessment

The facial analysis represented a convex profile, mild facial asymmetry due to the mandibular deviation to left, 1mm maxillary dental midline deviation to right, 0.5mm mandibular dental midline deviation to left, excessive lower facial height, obtuse nasolabial angle, incompetent lips, slightly everted lower lip, deep mentolabial sulcus, chin deficiency and obtuse chin-throat angle (Figure 1, a-d). Intraoral analysis revealed a 3.5 mm anterior open bite, non-consonant smile arch, 5 mm maxillary central incisors show at rest, palatal crossbite of the maxillary left side, class II canine relationship at right and left sides, and 2.5mm overjet (Figure 1, e-g). Radiographic evaluation depicted an over-erupted right second maxillary molar and a hopeless right first maxillary molar. The right second and left first mandibular molars had been extracted previously (Figure 2). Cephalometric analysis indicated skeletal class II relationship, mandibular retrognathism, chin retrusion, hyperdivergent facial pattern, protruded mandibular incisors, and retruded maxillary incisors. This patient was a high-angle subject; therefore, her Wits and ANB measures were not proportional. It's important to note that ANB is not necessarily a reliable measure in patients with a high vertical dimension (Figure 3 and Table 1).

Treatment

Treatment alternatives and plan

The following treatment options were considered:

1. Surgical fixed orthodontic treatment with extraction of maxillary right first molar, maxillary left first premolar, mandibular right and left first premolars. LeFort I maxillary osteotomy with differential posterior impaction, bilateral sagittal split osteotomy mandibular advancement, and evaluation for genioplasty.

2. Nonsurgical fixed orthodontic treatment with extraction of maxillary right first molar, maxillary left first premolar, and intrusion of the maxillary buccal segment by TADs.

The treatment options were explained and discussed with the patient. She refused the surgery knowing the influence of this treatment on the improvement of facial appearance and approved the second treatment option. Informed consent was obtained from the patient.

Treatment Progress

The patient was referred for extraction of maxillary right first molar and maxillary left first premolar. The first and second existing molars of the upper and lower arches were banded and other teeth were bonded with preadjusted edgewise MBT brackets. Alignment was performed by a wire sequence of nickel-titanium archwires of 0.14, 0.16, 0.18, and 0.019 × 0.025-inches. Two miniscrews (2 mm diameter, 8 mm length) were inserted under local anesthesia in the buccal inter-radicular space between the upper second premolar and first molar on the left side, as well as in the buccal area of the maxillary first molar extraction site. The same miniscrews were inserted in the mandible in order to prevent the eruption of mandibular molars following

the intrusion of maxillary molars. Additionally, the left mandibular miniscrew was used as an anchorage for correcting the angulation of the left mandibular second molar. A constricted stainless steel 0.019 × 0.025-inch upper archwire was placed. Both upper canines were retracted by sliding mechanics using elastomeric chains. Posterior intrusion was carried out by tying elastomeric chains around the wire and then inserting them into the miniscrews on both sides. A 0.014-inch overlay archwire was placed following the retraction of the canines to align the upper lateral incisors. In the left mandible side, a stainless steel 0.019 × 0.025-inch base archwire was bent down a few millimeters distal to the left second premolar, then bent again at a 90-degree angle, and passed through the hole in the head of the miniscrew to stabilize the teeth along the archwire.

A sectional nickel-titanium 0.016 × 0.022-inch was placed in the left mandibular second molar and its mesial hook was put on the base arch in order to upright the tilted molar. Following the uprighting of the lower left molar, a continuous stainless steel 0.017 × 0.025-inch wire with an inactive open coil was inserted between the left second premolar and molar in the lower arch. By 16 months of treatment, the anterior open bite was significantly improved (Figure 4). However, an edge-to-edge anterior occlusion was noted due to the autorotation of the mandible following maxillary molar intrusion. Therefore, the patient was instructed to wear full-time class III Orthodontic latex elastics, (1/4 medium) from lower canines to upper miniscrews, except for eating and brushing, and to change them every day to correct the edge-to-edge relationship and also improve overbite by the extrusion of the mandibular anterior teeth. After the CL I canine relationship, and normal overjet and overbite were achieved, the finishing phase was performed on stainless steel 0.016-inch wires. Finally, the bands and brackets were removed and retainers were placed on both arches.

Treatment results

The treatment took 39 months. Two of the screws failed once and were replaced. The final records are presented in Figures 5-7. The anterior open bite was corrected and acceptable occlusion was obtained. The patient's profile was improved following the orthodontic treatment, although the ideal profile could only be achieved by surgery. The post-treatment tracing showed a 2.5 mm advancement of Pog to NB. Favorable reductions in MP-SN and FMA were achieved by 3° and 2°, respectively. Soft tissue convexity was also decreased by 1.5° (Table 1). An improvement in the lower lip's position was noticeable (Figure 5). The patient was satisfied with the treatment results. Cephalometric superimposition is depicted in Figure 8.



Figure 1. Pre-treatment extraoral and intraoral photographs: a) Frontal view at rest b) Frontal view at smile c) Oblique view at rest d) Profile view at rest e) Right lateral view of occlusion f) Frontal view of occlusion g) Left lateral view of occlusion h) Occlusal view of maxillary arch i) Occlusal view of the mandibular arch.

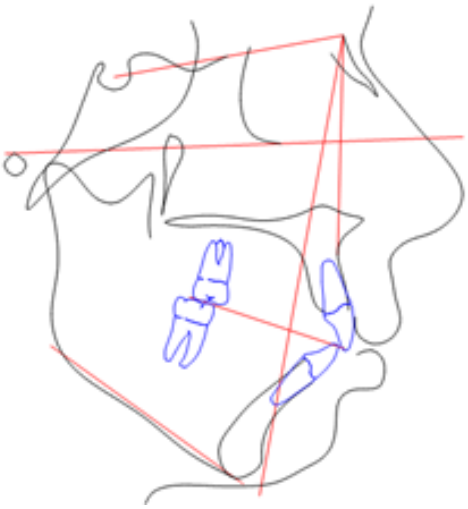


Figure 2. Pre-treatment panoramic radiograph.



Figure 3. Pre-treatment lateral cephalogram tracing.

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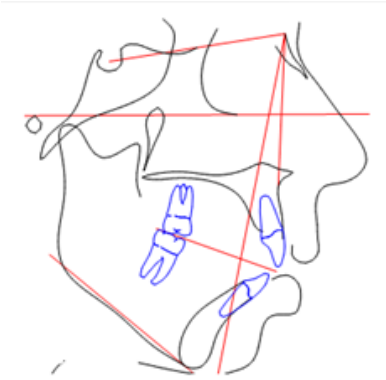


Figure 4. Progress of the treatment: a) Frontal view at rest b) Frontal view at smile c) Oblique view at rest d) Profile view at rest e) Right lateral view of occlusion f) Frontal view of occlusion g) Left lateral view of occlusion h) Occlusal view of maxillary arch i) Occlusal view of the mandibular arch.



Figure 5. Treatment results: a) Frontal view at rest b) Frontal view at smile c) Oblique view at rest d) Profile view at rest e) Right lateral view of occlusion f) Frontal view of occlusion g) Left lateral view of occlusion h) Occlusal view of the maxillary arch i) Occlusal view of the mandibular arch.



Figure 6. Post-treatment panoramic radiograph.

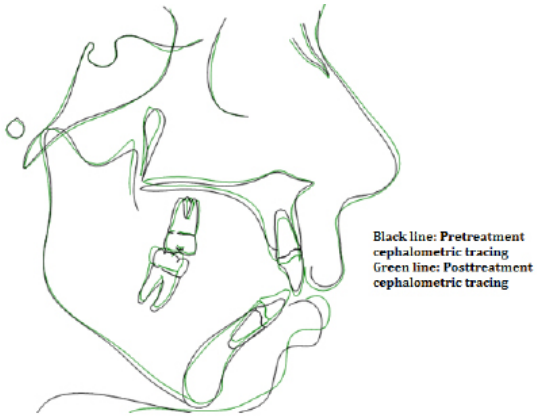


Figure 7. Post-treatment lateral cephalogram tracing.



Figure 8. Superimposition of pre-treatment (black) and post-treatment (green) cephalometric tracings.

Table 1. Cephalometric pre-treatment and post-treatment values.

	Pre-treatment	*Post-treatment*
SNA (°)	*78.5*	*78*
SNB (°)	*70*	*70*
ANB (°)	*8.5*	*8*
Occ plane to SN (°)	*24*	*27*
Palatal plane to SN (°)	*3*	*8*
Pog-NB (mm)	*-4.5*	*-2*
MP-SN	*49*	*46*
FMA (°)	*40*	*38*
Interincisal angle (U1-L1)	*120*	*120*
U1-SN (°)	*92*	*91*
IMPA (°)	*100*	*102*
Wits appraisal (mm)	*2*	*2.5*
Upper lip to E line (mm)	*1*	*1*
Lower lip to E line (mm)	*5*	*4*
Soft tissue convexity (°)	*120.5*	*119*
Overbite (mm)	*-3.5*	*1.5*
Overjet (mm)	*2.5*	*1.5*

Discussion

Overeruption of posterior teeth is a substantial contributor to AOB development. Therefore, molar intrusion may be considered as a treatment of choice in many cases which is more stable and usually more esthetic than extrusion of anterior teeth [11]. Various biomechanics have been suggested to correct the AOB in non-growing patients such as Multiloop edgewise appliance (MEAW) and elastics which require both patient compliance and clinician expertise. AOB is mainly closed by uprighting the posterior teeth, improving the occlusal planes' inclination, and extruding the anterior teeth in this technique [12,13]. Maxillary accentuated and mandibular reverse curved archwires with anterior elastics have also been used to improve AOB mostly by extrusion and retraction of anterior teeth [14]. Previously, orthognathic surgery was the only choice for more severe skeletal cases; the development of TADs has opened a new horizon for the treatment of those patients and expanded the envelope of discrepancy for nonsurgical treatment [1,15]. A long-term stable decrease in anterior facial height and closure of the AOB is achievable by both maxillary molar intrusion and maxillary surgical impaction in hyperdivergent adults. Therefore, molar intrusion by TADs is a perfect alternative to the surgical approach in adults with moderate skeletal AOB [16,17]. In this case report, a non-surgical approach of skeletal AOB correction by molar intrusion was presented in a 23-year-old female with skeletal class II malocclusion, mandibular retrognathism, chin deficiency, hyperdivergent facial pattern, and AOB. Although in this case, bimaxillary surgery was the best treatment modality, our patient refused orthognathic surgery, as many patients refrain from it due to surgery-associated side effects, care burden, cost, and so on [7]. If the patient had opted for surgery, it would have involved higher costs and risks, but the treatment would have concluded more quickly and achieved an ideal facial profile. Following a detailed discussion about the available treatment options with the patient, molar intrusion was selected to address the anterior open bite.

Miniscrews were placed apically between premolars and molars, and elastomeric chains were tied around the wire and inserted into the miniscrews. Two of the mini-screws that were placed in the mandible failed and had to be reinserted. The likely reason for this failure in the patient was the higher bone density in the mandible, particularly in the area where the first molar had been extracted. This increased bone density may have contributed to microdamage in the bone, ultimately leading to the failure of the mini-screw. The 0.019 × 0.025-inches wire of the upper arch was inserted in a constricted form to compensate for the expansion and buccal rotation of the molars. The intrusion of upper molars, while preventing the eruption of the lower mo-

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lars by mini-screws resulted in chin advancement, reduction of facial height, and to some degree relief of lip strain (Figures 5, 7). Decreased FMA degree, Pog to NP distance, and lower lip to E-line distance suggest mandibular autorotation. Although extraction was performed in the upper jaw, a slight change happened in the upper incisors' inclination (only a one-degree decrease) which indicates that the space was used to relieve crowding, and the openbite was not corrected by the incisor retrusion (Table 1). A constant upper lip position is another sign that the incisors are not retracted. Promising treatment results by TADs' mechanics were also revealed in several other reports. Kim et al. represented counterclockwise rotation of the mandible, improvement of chin position, and relief of mentalis tension by maxillary molar intrusion in hyperdivergent skeletal class II patients [18].

Iwasa et al. achieved an overbite of +2.5 mm following the intrusion of both upper and lower molars in an 18-year-old adult with -2mm openbite, increased facial height, and temporomandibular disorders. Treatment results showed 4.2° counterclockwise rotation of the mandible, 4mm advancement of pogonion, reduction of anterior facial height, and disappearance of lip strain which was stable in a 5-year follow-up [8]. The treatment lasted for a total of 39 months. Generally, utilizing TADs for molar intrusion extends the treatment time compared to surgical options [19]. Additionally, the patient missed her appointments for around six months during the treatment and debonded her brackets multiple times. These issues contributed to malalignment, necessitating returns to the initial aligning wires several times. At the one-year follow-up, the patient's profile, overbite, overjet, and occlusal relationships remained stable.

Conclusion

We presented a 23-year-old adult with skeletal AOB treated by molar intrusion using TADs. This case report indicated acceptable functional and esthetic results following the counterclockwise rotation of the mandible consequent to molar intrusion. Given the lengthy duration of orthodontic treatment that includes molar intrusion with miniscrews, as well as the potential complications associated with extended treatment—such as tooth decay and root resorption—we typically recommend surgical intervention in these cases. Surgery enables patients to return to their normal lifestyles more quickly and to achieve the desired treatment outcomes sooner. However, for patients who are unable to undergo surgery for any reason, using screw intrusion remains a practical alternative.

Conflict of Interest

There is no conflict of interest to declare.

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