



Clinician's Corner

Moderate to severe anterior open-bite cases treated using zygomatic anchorage

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ABSTRACT

Anterior open bite is often characterized by excessive vertical development of the posterior maxilla and by excessive eruption of the posterior teeth. Intrusion of the over-erupted molar teeth by traditional orthodontic methods is hardly possible; it requires orthognathic surgery or an absolute skeletal anchorage. These three case reports demonstrate the impaction of the upper molars by using zygomatic miniplates and fixed orthodontic treatment. After treatment, in all cases, the upper molar intrusions and significant correction of open bite were achieved by using zygomatic anchorage, and reduction of vertical dimensions enhanced facial aesthetics.

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1. Introduction

Open bite is commonly one of the main symptoms of an overall dentofacial deformity [1]. Anterior open bite is often characterized by excessive vertical development of the posterior maxilla and by excessive eruption of the posterior teeth [1,2]. The morphologic pattern in anterior open bite is characterized by longer vertical dimensions, an increase in development of the maxillary posterior dentoalveolar structure, and a steep mandibular plane [1,3].

Intrusion of the over-erupted molar teeth by traditional orthodontic methods is hardly possible; there is, therefore, no real alternative to a combined orthodontic and surgical approach [2], especially in adults. The surgical correction of skeletal open bite often requires maxillary impaction to achieve counterclockwise rotation of the mandible and subsequent reduction of anterior facial height [4]. The complexity, the risks, and the cost factor of surgical treatment have initiated a search for alternative clinical procedures [5].

Other treatment alternatives include the use of bite blocks [6], high-pull headgear [7], extraction therapy [8], multiple loop edgewise archwire therapy [9], intermaxillary elastics [10], titanium miniplates [11], and miniscrews [12]. Skeletal anchorage has recently been proposed for the orthodontic movement of teeth [2].

In anterior open bite cases, it is difficult to establish absolute anchorage for molar intrusion by traditional orthodontic mechanics [13]. Titanium miniplates implanted in the zygomatic buttress area can serve as the absolute anchorage for maxillary molar intrusion [2].

Recently, Erverdi et al. [11,14] introduced a new-generation posterior intrusion appliance using zygomatic anchorage, which enables en masse impaction of the posterior segment without any side effects such as labial flaring. The present case reports demonstrate the usefulness of zygomatic anchorage to intrude the maxillary posterior segment in a adolescent and two adult patients with moderate to severe skeletal anterior open bite. All cases underwent intrusion of the posterior dentoalveolar segment using an open bite appliance, which is supported by bilateral zygomatic miniplates and basically exerts vertical intrusive force to this area.

2. Case 1

A 13-year-old male patient was referred with a complaint of chewing and aesthetic problems. Extraoral examination revealed a slightly convex profile. There was excessive gingival appearance in the posterior region of the maxilla and buccal corridors due to palatally inclined posterior upper teeth and transversal insufficiency of the maxilla during smiling. Also, the tongue was observed between the upper and lower teeth. In the intraoral examination, a severe anterior open bite with an overbite of –4 mm and an overjet of 0 mm were present. A slight Class II molar relationship was present in the left side. In the right side, the lower first molar

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Fig. 1. Initial extraoral and intraoral photographs of case 1.

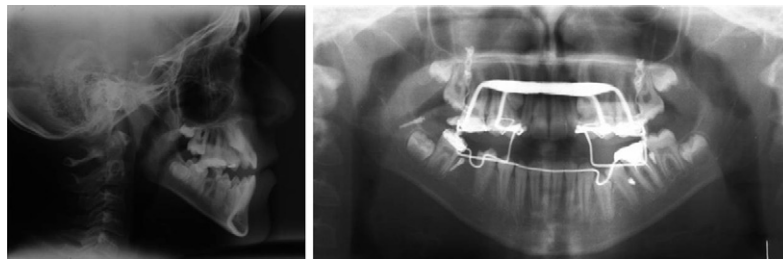


Fig. 2. Initial cephalometric and progress panoramic radiographs of case 1.

was absent, so the classification of the molar relationship could not be done. The patient's upper midline was on with the face whereas his lower midline was deviated 2.3 mm toward the left relative to the upper (Fig. 1). In model cast analysis, it was determined that there was 14-mm space requirement in the maxilla and 0 mm in the mandible.

Lateral cephalometric radiograph pointed to a mild skeletal Class III relationship due to mandibular prognathie with an A point, nasion, B point (ANB) angle of -2.1° and a sella nasion point B angle of 77.7° . The mandibular plane angle of 46° and facial height measurements indicated increased vertical dimensions. The panoramic radiograph showed the impacted upper canines, ongoing upper second molars, the absence of the right lower first molar, the left lower first molar with a poor prognosis, and developing third molars (Fig. 2).

Orthodontic treatment objectives included closing of the anterior open bite by intruding the posterior segment of the maxilla and



Fig. 3. Posterior intrusion appliance.

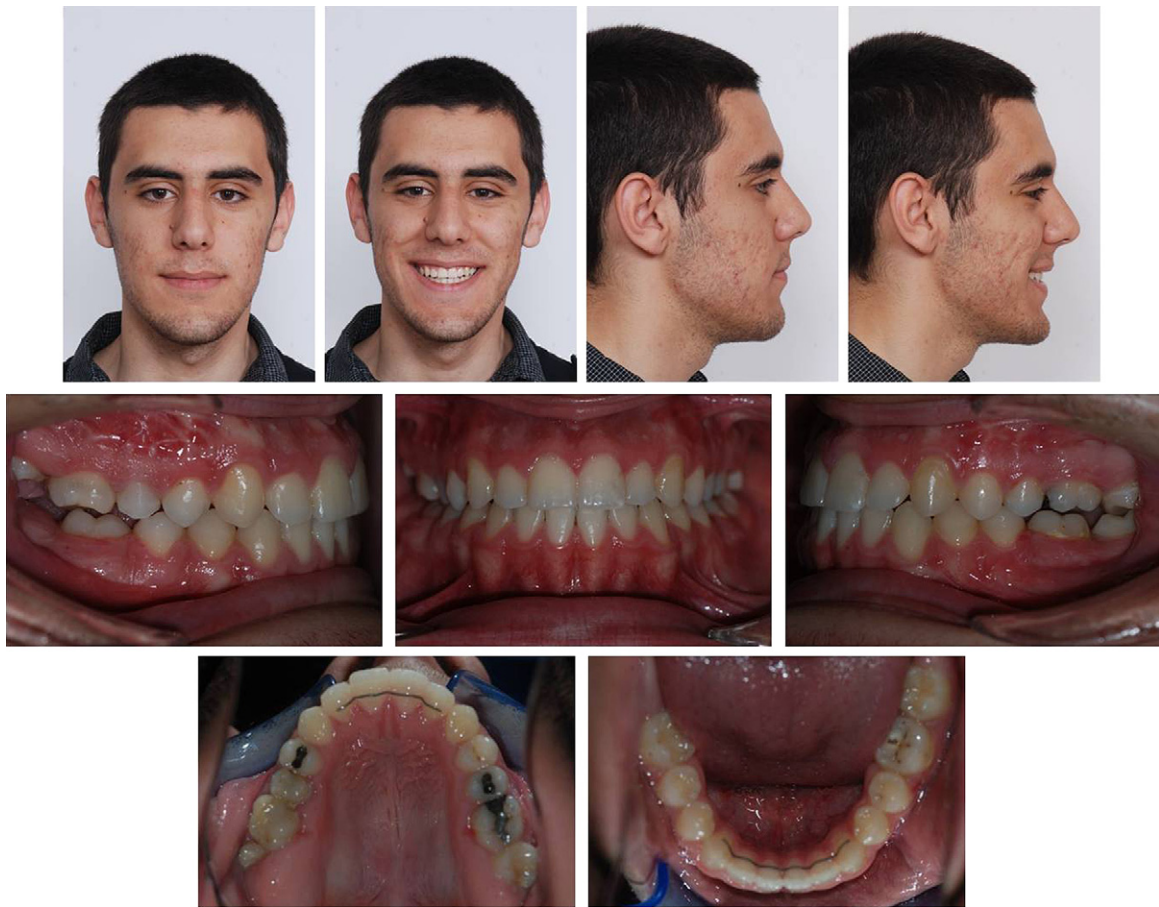


Fig. 4. Extraoral and intraoral photographs of case 1 after the orthodontic treatment.

mandible, obtaining ideal overbite and overjet, and establishment of Class I canine and molar relationship.

Two I-shaped multipurpose zygomatic miniplates (Tasarim Med, Istanbul, Turkey) were placed on the lower contours of each zygomatic process and fixed by two or three bone screws under local infiltrative anesthesia. The tip of the exposed miniplate is used to attach coil springs for intrusion. The intrusion appliance (Fig. 3) was cemented after allowing a week for wound healing. The bite blocks of the intrusion appliance were connected to two heavy palatal arches and wire attachments on each buccal side, which were used for force application. The bite blocks covered all teeth that needed to be intruded (Fig. 3). Two or three NiTi coil springs (G&H Wire Company, Franklin, IN) were placed bilaterally between the tip of the miniplate and the outer wire, which created an intrusive force of 400g totally. At the same time, four miniscrews

were applied in the lower posterior segment to provide the impaction or inhibit the eruption of lower molars. After completion of the impaction, fixed appliance therapy was initiated. The impaction achieved was maintained with wire ligation between the miniplate and the molar tubes throughout the treatment. Lingual retainers were put on, and the patient was instructed to wear a Hawley appliance and night-time positioners.

At the end of treatment, a Class I canine and molar relationship and correction of the anterior open bite were achieved through the impaction of maxillary posterior dentoalveolar segment and eruption and uprighting of the upper incisors. The mandibular plane showed a counterclockwise autorotation of 2° (Figs. 4–7). No significant vertical relapse was noticed after a deep look, as seen in the photographs, but longer follow-up records are needed to ensure the stabilization.

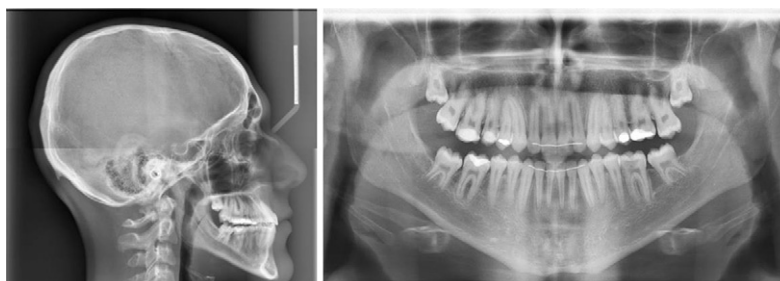


Fig. 5. Cephalometric and panoramic radiographs of case 1 after orthodontic treatment.

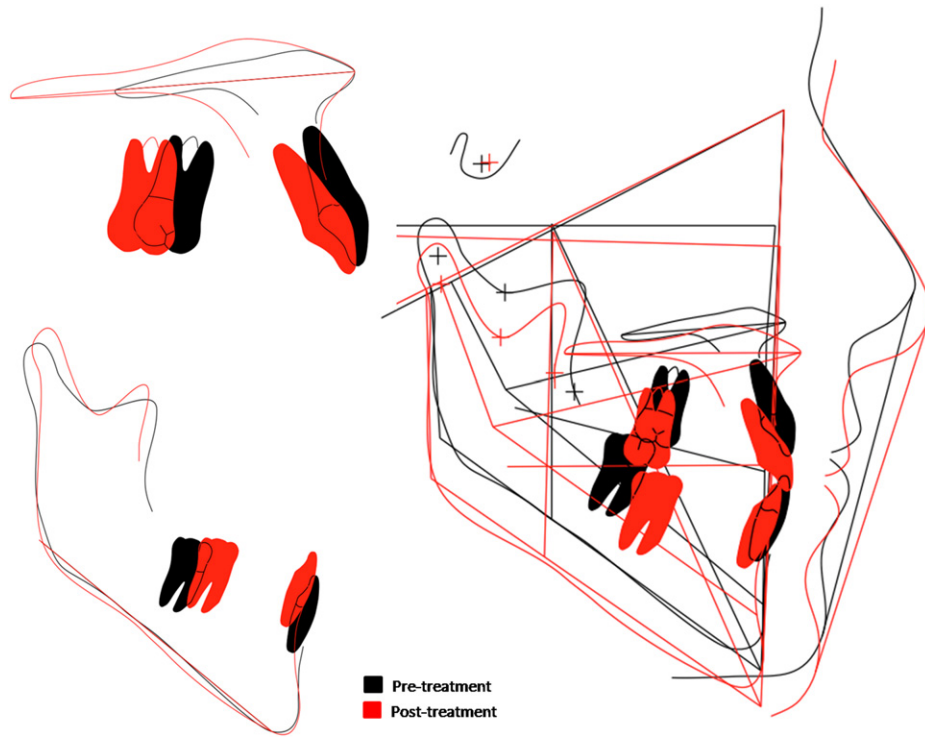


Fig. 6. Partial (maxilla and mandible) and total superimpositions of case 1.



Fig. 7. Six-month follow-up photographs of case 1 after treatment.



Fig. 8. Initial extraoral and intraoral photographs of case 2.

3. Case 2

A 20-year-old female patient was admitted to our clinic because of aesthetic concerns. Extraoral examination revealed a slightly convex profile and asymmetry in the nasal dorsum. Upon intraoral examination, upper lateral incisors in palatoversions, upper canines in vestibule versions, anterior crowding in both arches, Class I molar and Class II canine relationships were revealed, and moderate anterior open bite was observed (Fig. 8). Although she had a slight maxillary constriction, there was no significant posterior crossbite because of compensation between upper and lower arches. In addition, two distinct occlusal planes were present in the upper arch, because of overeruption of the posterior maxillary teeth.

In model cast analysis, it was determined that there was a 9.5-mm space requirement in the maxilla and 5.7 mm in the mandible. Overjet was 2.5 mm, and overbite was -2.6 mm.

The patient had a skeletal Class I relationship with increased vertical dimensions. Lateral cephalometric radiograph illustrated an ANB angle of 2° and a mandibular plane angle of 37.7° . On panoramic radiographic evaluation, it was observed that all teeth, including third molars, were erupted (Fig. 9).

Initially, zygomatic miniplates were placed, and then upper molar intrusion was begun by activating the NiTi coils as described in Case 1. After impaction, the fixed orthodontic treatment with extraction of four premolars was performed. At the end of treatment, anterior open bite was corrected by the impaction of the upper molars of 2.3 mm, and a Class I canine and molar relationship was achieved (Figs. 10–12).

4. Case 3

A 20.1-year-old female patient had a convex profile and angle Class II malocclusion with 6.5-mm overjet. Intraoral examination

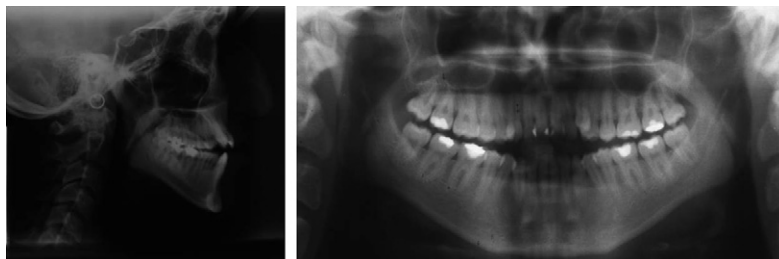


Fig. 9. Initial cephalometric and panoramic radiographs of case 2.



Fig. 10. Extraoral and intraoral photographs of case 2 after the orthodontic treatment.

revealed an anterior open bite with 3-mm overbite (Fig. 13). According to lateral cephalometric radiographic evaluation, she had a skeletal Class II relationship (ANB 7.1°) due to downward and backward rotation of the mandible (the mandibular plane angle was 48.8°) and proclined upper and lower incisors (Fig. 14).

The treatment plan was to intrude the molars using zygomatic plates as described in Case 1, and then extracting the upper first premolars and the lower left incisor. As a result of treatment, 2-mm overbite, Class I canine, and Class II molar relationships were obtained. The mandibular plane angle decreased 1° . Total treatment time was 3 years. Lingual retainers were made for retention (Figs. 15–17).

5. Discussion

Impaction of the molars should be the goal in the treatment of patients with high-angle growth pattern, excessive posterior

growth, and anterior open bite to improve the aesthetics and achieve stable results [11]. However, the molar intrusion requires an absolute skeletal anchorage.

Several methods to acquire bone anchorage have been reported. Dental implants are strong enough to resist the counteraction of orthodontic tooth movement, but they require complicated surgery for both placement and replacement [15]. Although titanium miniscrews have the advantages of lower medical costs and easier placement surgery and have gradually come to be used for absolute anchorage for various tooth movements [12], they may not provide more adequate anchorage for molar intrusion when compared with the miniplates that were placed on zygomatic process. Titanium miniscrews can cause also gingival inflammation when they are inserted in the zygomatic process of the maxilla. In anterior open bite cases, several studies showed the usefulness of the miniplate as a skeletal anchorage and for closure of the bite without extrusion of the anterior teeth [11,14].



Fig. 11. Cephalometric and panoramic radiographs of case 2 after orthodontic treatment.

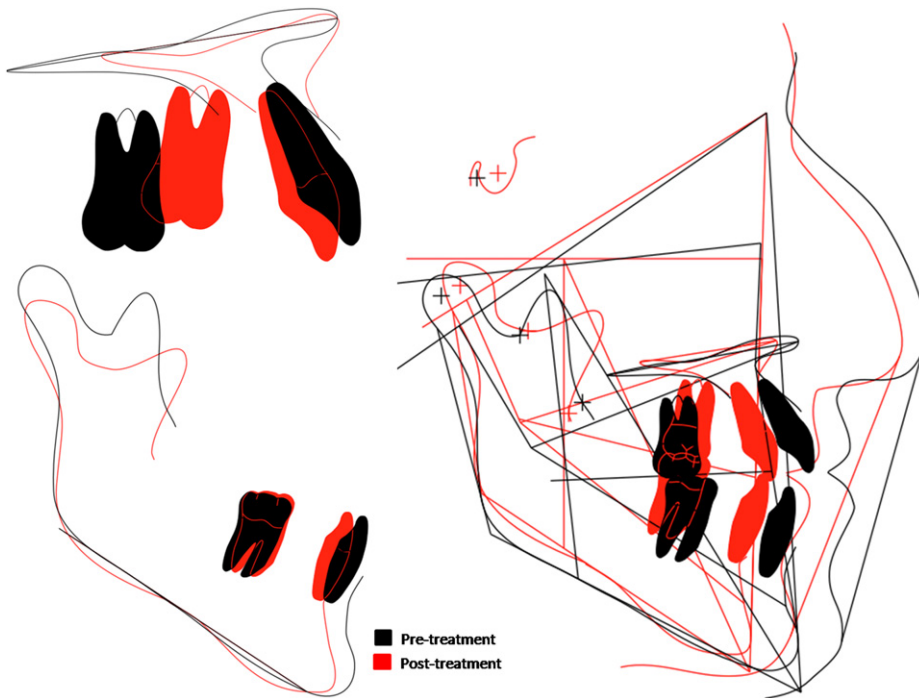


Fig. 12. Partial (maxilla and mandible) and total superimpositions of case 2.



Fig. 13. Initial extraoral and intraoral photographs of case 3.

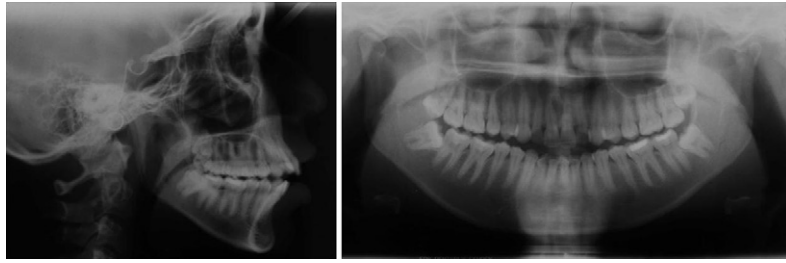


Fig. 14. Initial cephalometric and panoramic radiographs of case 3.



Fig. 15. Extraoral and intraoral photographs of case 3 after the orthodontic treatment.



Fig. 16. Cephalometric and panoramic radiographs of case 3 after orthodontic treatment.

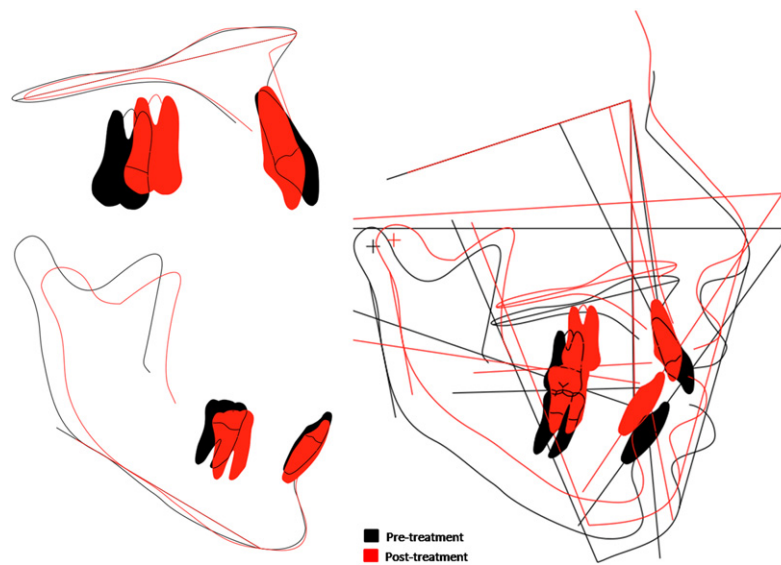


Fig. 17. Partial (maxilla and mandible) and total superimpositions of case 3.

Erverdi et al. [11] evaluated the dentoalveolar effects of an open bite appliance that is anchored to two miniplates placed in the zygomatic buttress in the treatment of these subjects. They directly used the bone anchorage in this area. The cases reported here present the clinical results of using this appliance.

As described in previous studies [11,14], two miniplates were fixed with two or three miniscrews in the inferior border of the zygomatic process of the maxilla, so it provided adequate retention for immediate loading. The zygomatic buttress was selected as the anchorage site because this area has a solid bone structure and is located at a safe distance from the roots of the upper molars.

For the insertion technique, a short flap opening was required to visualize the operation field. This was a noninvasive technique, and there was only minor edema and pain postoperatively. However, it is mandatory that the patient maintain an optimum oral hygiene regimen to avoid inflammation during the entire treatment.

In the present cases, as a result of intrusion of the upper and lower molars, the mandible rotated counterclockwise, and the severe anterior open bite was improved. Rotation of the mandible caused advancement of the chin approximately 10 mm at pogonion and improved the retrognathic appearance of the facial profile, especially in case 3 (Fig. 17). The anterior facial height was significantly reduced, and straining of the circumoral musculature during lip closure disappeared. By preventing the anterior extrusion, an aesthetic smile was achieved.

A slight posterior open bite occurred after impaction, and this was caused by the bite blocks of the appliance. Especially, case 1 was finished in slight infraocclusion. This open bite was closed by the extrusion of the lower molars, because the upper molars were fixed to the miniplate with a wire ligation to maintain the impaction achieved. However, these patients may face some relapse over time, and for proper long-term stabilization, some infraocclusion may have positive effects as a part of the over-correction procedure.

Although this treatment method is effective to intrude the posterior segment of the maxilla, vertical forces on the roots of teeth can cause root resorption. Although a previous study [16] found some moderate root resorption in an animal model,

another study [17] reported no significantly higher resorption with this method when compared with conventional fixed orthodontic mechanics. In these cases, the impactions did not cause root resorption.

6. Conclusions

In all cases, the upper molar intrusions and significant correction of open bite were achieved by using zygomatic anchorage, and reduction of vertical dimensions enhanced facial aesthetics.

These cases demonstrate that zygomatic anchorage can be used effectively for molar intrusion and anchorage maintenance. Zygomatic miniplates can provide en masse intrusion for posterior teeth, and in some cases, this treatment procedure can eliminate the need for orthognathic surgery.

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