A New Anchorage Site for the Treatment of Anterior Open Bite: Zygomatic Anchorage. Case Report

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Aim: *To assess the effectiveness of zygomatic anchorage for the intrusion of maxillary posterior teeth.* **Method:** *A male patient, 20 years 5 months of age, with 3-mm anterior open bite with excessive maxillary posterior growth, was accepted for treatment. Titanium miniplates were fixed bilaterally to the zygomatic buttress area and 200 g of force was applied unilaterally with 9-mm nickel-titanium coil springs between the vertical extension of the miniplate and the first molar buccal tube. Later, the zygomatic site was used for maxillary canine distalization.* **Results:** *The maxillary posterior teeth were intruded effectively and the canines were distalized bodily, without anchorage loss, with the help of zygomatic anchorage. The patient was advised to maintain good oral hygiene throughout the treatment. This noninvasive surgical procedure eased and reduced the operation time and did not require headgear wear nor anterior box elastics for anterior open bite correction.* **Conclusion:** *The zygomatic area was found to be a useful anchorage site for the intrusion of the molars over a short period of time. Long-term stability of the bite closure should be assessed in future studies.* World J Orthod 2002;3:147–153.

Anterior open bite is a difficult malocclusion to treat and maintain. Most anterior open bite cases are characterized by overeruption of the maxillary molars. Several treatment modalities have been carried out by different investigators; Nielsen[1] in 1991, Rinchuse[2] in 1994, Kim[3] in 1997, and Küçükkeleş et al[4] in 1999 used fixed mechanics and vertical elastics to treat the anterior open bite. In all of these treatment modalities, the correction was found to be achieved with the extrusion of the incisors. Dellinger and Dellinger[5] have shown considerable success with magnetic intrusion of posterior teeth, using rare earth magnets in removable maxillary and mandibular appliances. However, surgical impaction of the maxillary posterior segment has been considered the most efficient treatment option in nongrowing patients.[6]

Complexity and the risks of surgical treatment have forced investigators to search for alternative clinical procedures to treat anterior open bite by decreasing the posterior facial height. In recent years, studies have been directed toward the use of osseointegrated implants as an anchorage unit for orthodontic purposes.[7–11] However, patients who need orthodontic treatment generally have a full dentition, and there are no available sites for implant placement. Thus, alternative anatomic sites are required, and some investigators have used the retromolar area[12] or the palatal region.[13–17]

Ohmae et al,[18] in an animal model, and Umemori et al,[19] in humans, applied titanium miniplates to the mandibular corpus area and used them as anchorage for the intrusion of the mandibular posterior segment. They achieved effective intrusion of the mandibular posterior dentoalveolar segment and corrected the anterior open bite. This could be an effective treatment modality in patients with anterior open bite due to overerupted mandibular molars.

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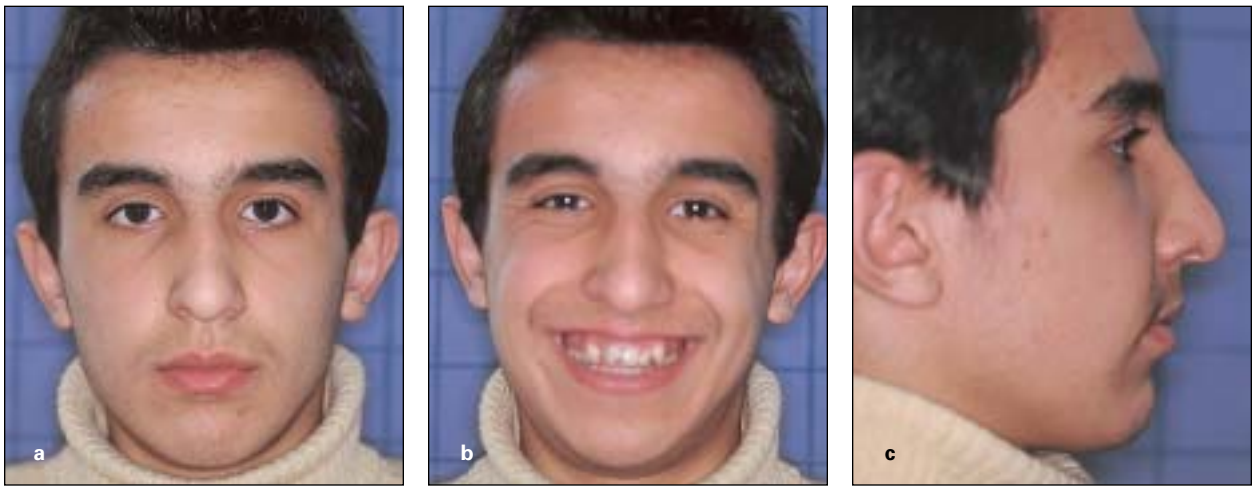


Fig 1 Initial extraoral views.

Fig 2 Initial intraoral views.

Alternatively, the zygomatic buttress area could be a valuable anchorage site to achieve effective intrusion of the maxillary posterior segment. In this article, the zygomatic buttress area was selected as an alternative anchorage site for intraoral anchorage and titanium miniplates were used as an alternative to dental implants.

SUBJECT AND METHODS

A male patient, 17 years 5 months of age, had 100% incisor display and a posterior gummy smile during smiling (Figs 1a to 1c). There was a Class II molar relationship on both sides, 8-mm maxillary crowding, ectopic maxillary canines, and 3-mm anterior open bite (Fig 2a). He exhibited maxillary constriction and excessive posterior eruption (Figs 2a to 2c).

Surgical method

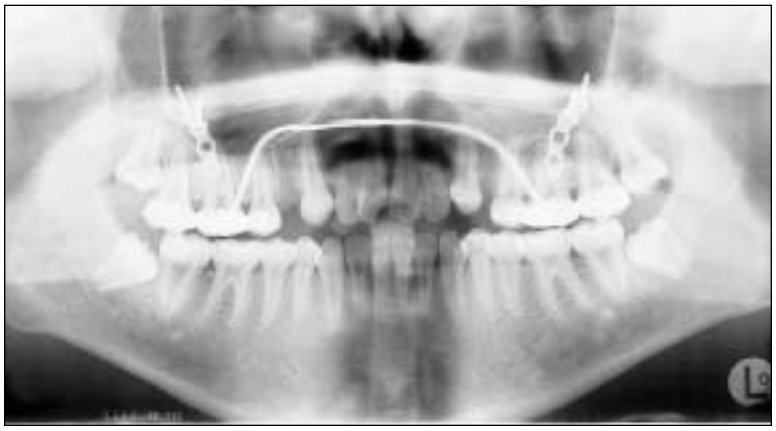
A local infiltrative anesthesia was delivered bilaterally to both zygomatic sites of the maxilla. A 1-cm-long horizontal incision was made, extending from second premolar to first molar at the sulcular depth region, over the attached gingiva. The mucoperiosteal flap was elevated to reach the zygomatic process of the maxilla. The lower aspect of the zygomatic process of the maxilla was totally exposed by blunt dissection. An I-shaped titanium miniplate (Leibinger, Mühlheim-Stelten, Germany) was adjusted to fit the contour of the lower face of each zygomatic process and fixed by two bone screws. The long arm of the miniplate was extended into the oral cavity from the incised wound. The hole at the tip of the exposed plate served to attach a coil spring for intrusion. After fixing the plate, the incision site was closed and sutured. The patient was advised to use antiseptic mouthwash for 1 week and to use proper oral hygiene during this healing period.

Cephalometric method

Anteroposterior (Fig 3), panoramic (Fig 4), and lateral cephalograms were taken. Five measurements were made from the lateral cephalograms and two measurements were made from the anteroposterior cephalograms (Fig 5).

Fig 3 *(left)* Anteroposterior cephalogram of the patient showing two titanium miniplates in the zygomatic areas and the transpalatal arch.

Fig 4 Panoral radiograph of the patient.



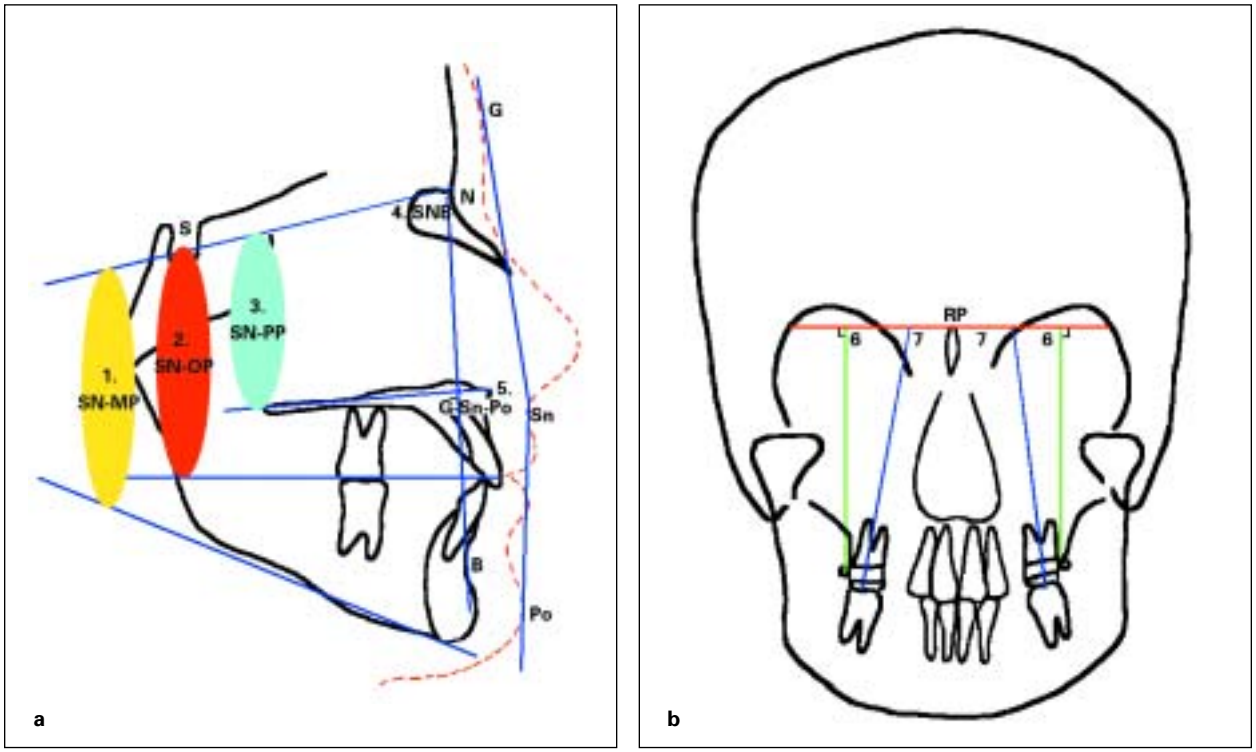


Fig 5 **(a)** Measurements on the lateral cephalogram. See Table 1 for key to abbreviations. **(b)** Measurements on anteroposterior radiograph. RP, reference plane; 6.U6-RP, perpendicular distance from the buccal tube of the maxillary first molar to the reference plane; 7.U6-RP, inner angle between the reference plane and the axial inclination of the maxillary first molars.

Fig 6 **(a)** Occlusal view after the transpalatal arch was cemented (passing 3 mm from the palate). **(b,c)** Ni-Ti coil springs were applied bilaterally between the hole of miniplate and the first molar buccal tube bilaterally.

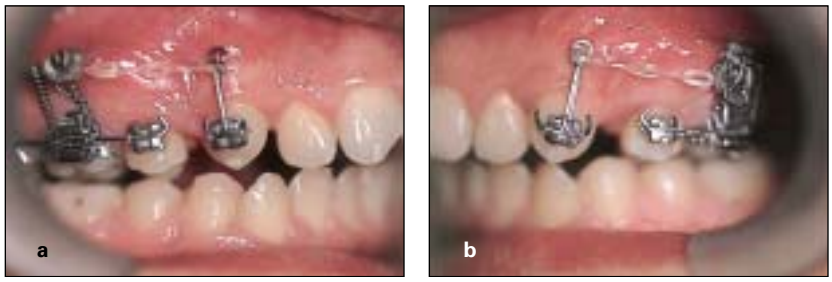


Fig 7 Bodily canine distalization with the help of zygomatic anchorage.

Fig 8 **(a)** Three millimeter anterior open bite closure. **(b,c)** Bodily canine distalization, without any anchorage loss and posterior intrusion. Note the decrease of the distance between the hole of the plate and the first molar tube.

Orthodontic treatment synopsis

Maxillary first premolars were then extracted. The maxillary first and second molars were banded and the first premolars were bonded. Segmental arches were constructed for the posterior teeth. A transpalatal arch was constructed from 1.5-mm stainless steel round wire and bent 3 mm apart from the palate (Fig 6a). 0.017 × 0.025-inch stainless steel segmental archwires were engaged to both sides, and 9-mm nickel-titanium (Ni-Ti) coil springs (Masel, Bristol, PA, USA) were placed bilaterally between the hole of miniplates and the first molar tubes (Figs 6b and 6c). Intrusive force of 200 g was applied. After 2 months, the maxillary canines were bonded and rigid 0.017 × 0.025-inch wire auxiliaries were ligated for canine distalization. Elastic thread was applied between the tip of the auxiliary and the hole of the miniplate (Fig 7). Distal force of 100 g was applied at the level of the center of resistance of the maxillary canines while intrusion mechanics was proceeding. Rapid bodily canine distalization was achieved without tipping and with no anchorage loss (Fig 8). The anterior open bite was corrected and a 1.5-mm anterior overbite was achieved. Molar intrusion was retained with wire ligation to the miniplates throughout the treatment (Fig 9). Full bonded and banded therapy continued for 7 months. The appliances were removed after a Class I canine relationship and an ideal overbite and overjet relationship were achieved (Fig 10). At the end of fixed orthodontic treatment, better interdigitation was achieved with 4 months of positioner wear (Figs 11 and 12).

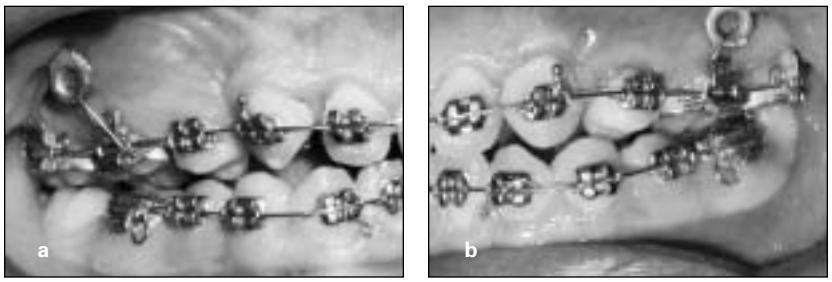


Fig 9 Retention of molar intrusion with ligature wires throughout the second stage of treatment.

Fig 10 **(a)** Intraoral frontal view at the end of treatment. Ideal overbite and overjet are shown. **(b,c)** Intraoral right and left views at the end of the treatment. Class I molars and canines are shown.

Fig 11 Final extraoral views. Note the improved smile and profile.

Fig 12 Intraoral views of the patient after 4 months in retention with a positioner.

Table 1 Radiographic evaluation of the patient

	Initial	Final	Difference
SN-GOMe (degrees)	38	36	2
SN-OP (degrees)	9	11	−2
SN-PP (degrees)	7	7	0
SNB (degrees)	78	80	−2
G-Sn-Pg (degrees)	156	161	−5
6.U6-RP (mm)	93	90	3
7.U6-RP (degrees)	110	117	−7

SN, sella-nasion; GoMe, gonion-menton; OP, occlusal plane; PP, palatal plane; B, point B; G, glabella; Sn, subnasale; Pg, pogonion; 6.U6-RP, perpendicular distance from the buccal tube of the maxillary first molar to the reference plane; 7.U6-RP, inner angle between the reference plane and the axial inclination of the maxillary first molars.

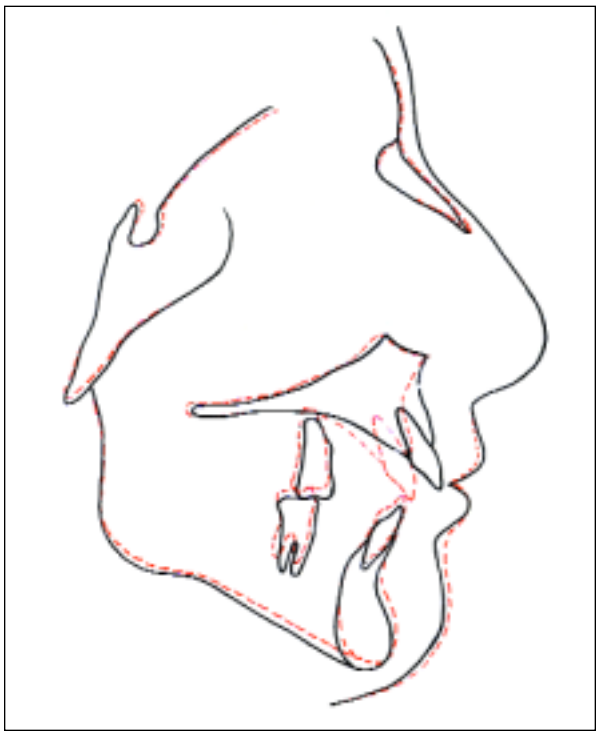


Fig 13 *(right)* Cephalometric superimposition of the patient.

The cephalometric measurements show that the maxillary molars had been intruded 3 mm and tipped buccally 7 degrees. The mandibular plane to SN angle decreased 2 degrees and the SNB angle increased 2 degrees. Cephalometric values and superimposition are shown in Table 1 and Fig 13.

At the end of fixed orthodontic treatment, the miniplates were easily removed by loosening the screws from the zygomatic buttress area. No difficulty was experienced during the removal process and the scar tissue healed quickly. The authors recommend maintaining the miniplates until the end of the fixed orthodontic treatment because after achieving effective molar intrusion in a few months, the intrusion was maintained and stabilized with ligature wire ligation between the molar bands and the miniplates.

DISCUSSION

Most of the time, open bite is due to overeruption of the maxillary posterior segment. An effective treatment approach to correct anterior open bite is the intrusion of maxillary posterior teeth and spontaneous autorotation of the mandible. This case report shows that maxillary posterior intrusion and canine distalization were achieved effectively with zygomatic anchorage.

Although the intrusion was successfully achieved, buccal tipping of the posterior teeth was observed, since the palatal bar was not sufficiently rigid to withstand the buccal force. Buccal tipping of the posterior teeth caused the elongation of the palatal cusps of the molars, and occlusal interferences limited the autorotation of the mandible. Instead of a transpalatal bar, the Hyrax appliance, with the screw fully open, can be used to prevent buccal tipping and, if it is necessary, the screw can be closed to counteract the buccal tipping of molars.

This case presented maximum anchorage. In the literature, headgear, Class II elastics, a Nance button, stopped archwires, and palatal implants have been used to preserve the anchorage. In this patient, zygomatic anchorage was used for canine distalization. The results showed that parallel distalization without anchorage loss was achieved.

As mentioned earlier, implants in different sites have been used for orthodontic anchorage by various investigators. The present treatment approach can be questioned because it requires a surgical procedure. However, the benefits of this treatment alternative, in comparison with conventional treatments using extraoral appliances[20,21] (headgear) and/or intraoral mechanics[1–4] (anterior box elastics), are significant. Molar intrusion, without extruding the incisors, and bodily canine distalization, without any anchorage loss, were achieved. At the end of the

active intrusion stage, intrusion was maintained with ligature wires until the end of the fixed orthodontic treatment (Fig 9). The simple fixation techniques (limited incision, reduced flap area, drilling with a hand instrument) were well tolerated by the patient. Patient acceptance of this treatment modality as an alternative to the conventional Le Fort I surgery was positive, and postoperative pain and discomfort were negligible. The insertion technique for the miniplates to the zygomatic buttress required a 1-cm flap opening to visualize the operation field. Drilling and screwing were done with hand instruments to provide minimum trauma to the bone and minimize overheating of the bone. Postoperative conditions, such as edema and pain, were minimal.

CONCLUSIONS

Contemporary orthodontic treatment requires a short treatment time, with minimal patient cooperation. Zygomatic anchorage can be used effectively for molar intrusion and anchorage maintenance. No compliance was required (no headgear, no anterior box elastics), with the exception of good oral hygiene. This noninvasive technique facilitates surgical procedures and reduces operation time.

In future studies, the number of the patients will be increased and long-term stability will be assessed.

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