CASE REPORT

Correction of Anterior Open Bite Using Maxillary Third Molar Anchorage

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The use of skeletal anchorage in orthodontic treatment has increased exponentially in recent years. One advantage of temporary anchorage devices (TADs) is that they apply orthodontic force without discernable clinical side effects. This article offers an alternative approach, in which an expendable tooth intended for future extraction is used as the anchor unit.

In an article on the Multiloop Edgewise Archwire (MEAW) technique, Kim and colleagues stated that clockwise rotation of the maxillary occlusal plane was necessary for stable correction of an open bite.[1] Skeletal anchorage can facilitate such rotation by delivering a force distal to the center of resistance of the posterior buccal segment, resulting in intrusion of the most posterior molar and clockwise rotation of the occlusal plane.[2] Occlusal plane rotation can also be accomplished by using the third molar as the anchor instead of a TAD. This approach requires a different mechanical strategy, however, because significant extrusion of the third molars would be expected before any noticeable intrusion of the first or second molars.

The following case report describes a two-phase procedure: first, a two-couple system for clockwise rotation of the maxillary occlusal plane; second, a one-couple system applied to the maxillary third molar to deliver a directional extrusive force on the incisors.[3,4]

Diagnosis

A 44-year-old male presented with the chief complaint of difficulty chewing. In the frontal view, there was no incisor display at rest and about 70% incisor display on smiling; the smile arc was reversed relative to the arc of the lower lip (Fig. 1). All teeth were present except for the mandibular right third molar. Numerous small restorations were observed, root-canal therapy had been performed on the maxillary left second premolar, and a porcelain-fused-to-metal crown was present on the maxillary left first premolar. The maxillary incisors showed moderate wear, which was more pronounced on the mesial aspects.

The patient had a Class II

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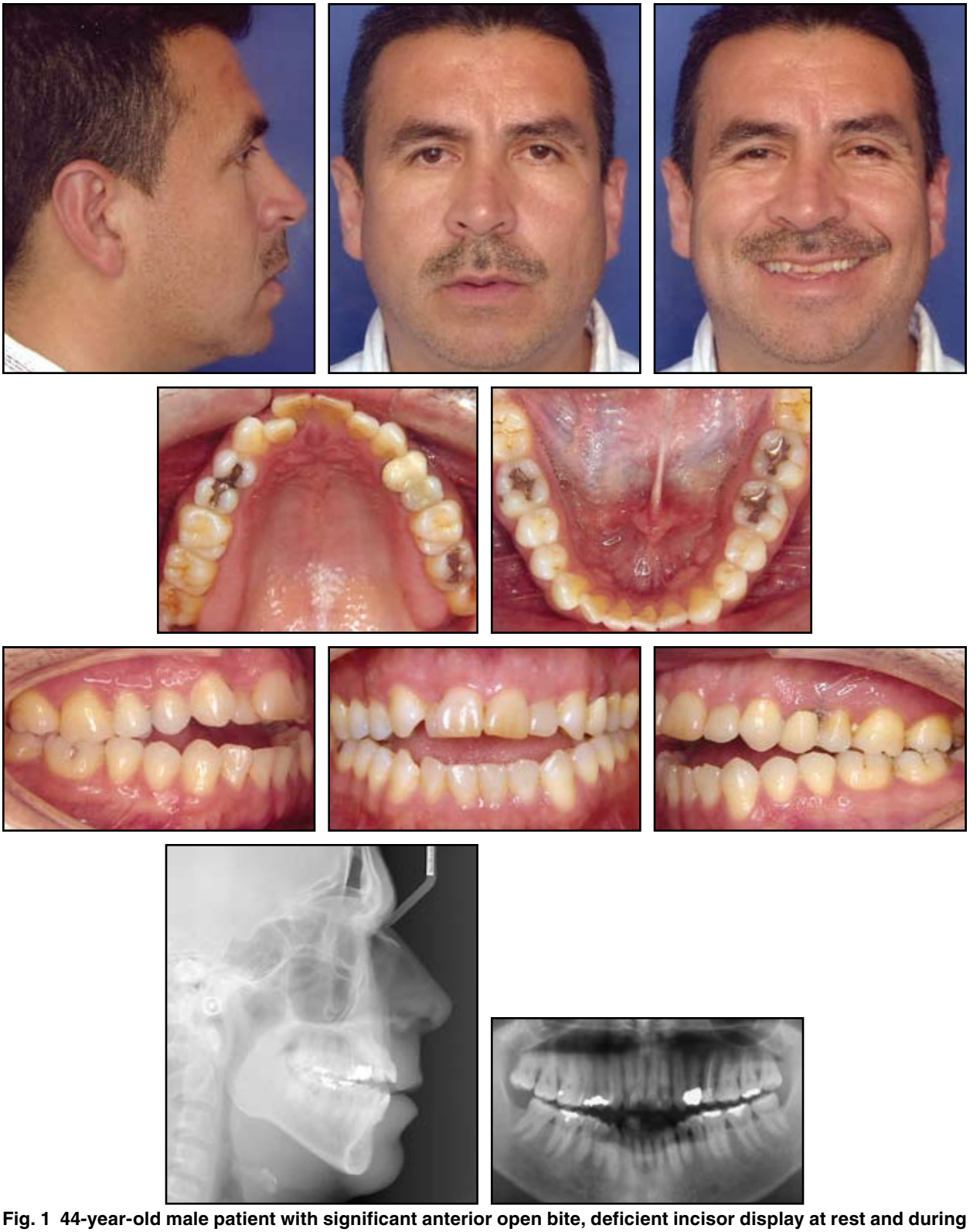

Fig. 1 44-year-old male patient with significant anterior open bite, deficient incisor display at rest and during smile, and divergent occlusal planes anterior to first molar.

subdivision right malocclusion with moderate crowding in the upper arch, mild crowding in the lower arch, and a 4mm anterior open bite. The transverse dimension showed an edge-to-edge tendency, which was accentuated in the premolar regions. Two pronounced occlusal planes diverged anteriorly from the second premolars.

The lateral cephalogram revealed an orthognathic hard- and soft-tissue profile with excessive lower facial height and a steep mandibular plane angle. The incisal edges were about 3mm below the upper lip.

Treatment Plan

The skeletofacial objective of treatment was to maintain the hard- and soft-tissue convexity. The occlusal objective was to achieve a Class I canine occlusion with a Class II molar occlusion on the right. Esthetic objectives were closely related to the occlusal objectives in the vertical dimension: extrude the maxillary incisors 3-4mm to improve the incisor display at rest and in smiling, correct the anterior open bite, and extrude the mandibular incisors by about 1mm. Extraction of the maxillary right first premolar would be required to resolve the maxillary anterior crowding.

A surgical approach was considered initially because of the severity of the open bite. A downfracture of the maxilla accompanied by clockwise rotation would achieve the vertical objectives of treatment. Another option would have been to use skeletal anchorage to intrude the posterior teeth, thus reducing the lower facial height and correcting the anterior open bite. To meet the esthetic objectives, however, the maxillary incisors needed to be extruded, rather than intruding the posterior teeth. Skeletal anchorage could still have been used as an adjunct to extrude the incisors, minimizing side effects on the posterior teeth.

Since the patient was reluctant to undergo orthognathic surgery or even TAD insertion, a purely orthodontic approach was designed. The maxillary third molars would be used as anchorage to close the anterior open bite and to rotate the buccal segments clockwise while avoiding undesirable side effects.

Treatment Progress

After extraction of the maxillary right first premolar, an .022" preadjusted appliance was bonded in the maxillary arch. The first molars were banded, and ceramic brackets were bonded from the left to the right second premolars, bypassing the right lateral incisor. Once initial alignment was achieved, an .016" × .022" nickel titanium main archwire was placed, with an auxiliary intrusion arch tied over the base archwire to maintain anchorage during retraction of the right canine (Fig. 2).

After nine weeks of treatment, the lower arch was bonded, and an .018" stainless steel archwire was placed. When maxillary space closure was complete, after 20 weeks, an .017" × .025" stainless steel archwire was sectioned into an anterior segment (the incisors) and two posterior segments (from the canines to the second molars). The maxillary third molars were bonded, and an .017" × .025" beta titanium segment extending anteriorly, distal to the canines, was used to engage a vertical tube soldered to the stainless steel wire segment on each side (Fig. 3). An anterior off-cen-

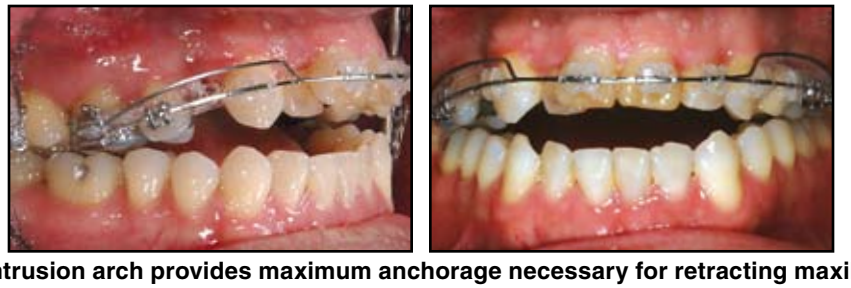

Fig. 2 Auxiliary intrusion arch provides maximum anchorage necessary for retracting maxillary right canine into Class I occlusion.

Fig. 3 Differential moment delivered from third molars to buccal segments. V-bends on archwire, just anterior to halfway between third molar brackets and anterior double-cross brackets, deliver extrusive forces and clockwise-rotating moments to maxillary buccal segments with inconsequential side effects (intrusion and tipback of third molars) and no effect on occlusion.

Fig. 4 Extrusion arch from third molars extrudes incisors into positive overbite, with side effects of intrusion and counterclockwise rotation of third molars.

ter V-bend was added, creating a Class V geometry that would rotate the posterior segment clockwise and extrude the anterior segment.[5,6] The effect on the third molars was a counterclockwise rotation moment and an intrusive force.

After the occlusal planes converged, these segments were maintained in close approximation using intermaxillary elastics. The remaining anterior open bite was closed using an extrusion arch extending from the third molars to the maxillary incisor region (Fig. 4). The effects of this force system were extrusion of the incisors and a concomitant tipback and intrusion of the third molars.

The case was finished with .017" × .025" beta titanium archwires, with intermaxillary elastics worn to maintain the correction. After a total of 26 months of treatment, the fixed appliances were debonded, and vacuum-formed clear retainers were delivered, with small composite buttons bonded to the cervical portions of the incisors to enhance the stability of the anterior open-bite correction (Fig. 5). The retainers were worn full-time for six months and then at night only.

The patient was referred to a periodontist for crown-lengthening procedures on all four maxillary incisors to make the gingival heights consistent and more esthetic. Composite was added to the worn edges of the maxillary central and left lateral incisors (Fig. 6).

Discussion

Skeletal anchorage has improved the ability of orthodontists to treat anterior open bite, especially in patients who require intrusion of the posterior teeth. The diagnosis must clearly establish whether the incisors need to be erupted or the molars intruded, however, and appropriate treatment objectives must be defined. In the present patient, with no maxillary incisor display at rest, the primary objective was to improve the smile. Therefore, extrusion of the incisors was preferred over intrusion of the molars.

A secondary objective in this case was to eliminate the open bite by rotating the maxillary buccal segments and thus the

Fig. 5 Patient after 26 months of treatment, showing maxillary incisors extruded to level of upper lip, anterior open bite completely closed, and reverse smile line due to incisor wear. Composite buttons on maxillary incisors serve as stops for vacuum-formed retainer, enhancing stability of maxillary extrusion.

maxillary occlusal plane in a clockwise direction. This would also help extrude the incisors, achieve a positive overbite, and increase the probability of a stable treatment outcome. To achieve an occlusal plane rotation, a moment can be applied to the posterior occlusal planes from a maxillary miniscrew or miniplate; the miniplate is preferable because, with its two screws, it can resist the counterclockwise reactive moment that could cause a single miniscrew to fail.

Although extrusion of the incisors can also be accomplished using anchorage from the posterior teeth, such mechanics would have been undesirable in this patient because the reactive moment would have led to counterclockwise rotation, accentuating the posterior open bite.[4] On the other hand, if the third molars are used for anchorage, the counterclockwise rotation does not affect the occlusion. In fact, the reactive force on the third molars is intrusive, which is favorable because it prevents a wedging effect from extrusion of the molars.

Stability of open-bite correction has always been a significant problem, with relapse often occurring because of post-treatment intrusion of the incisors. Hawley or plastic retainers can resist these changes in the transverse dimension, but do not resist vertical changes. In the present case, several approaches were used to enhance treatment stability. Based on the technique used for active vertical movement of teeth with aligners, buttons were bonded to the incisors for engagement by vacuum-formed retainers. These composite buttons should be removed after one year, because they tend to discolor over time. The patient should be monitored for relapse tendencies and new attachments placed as needed.

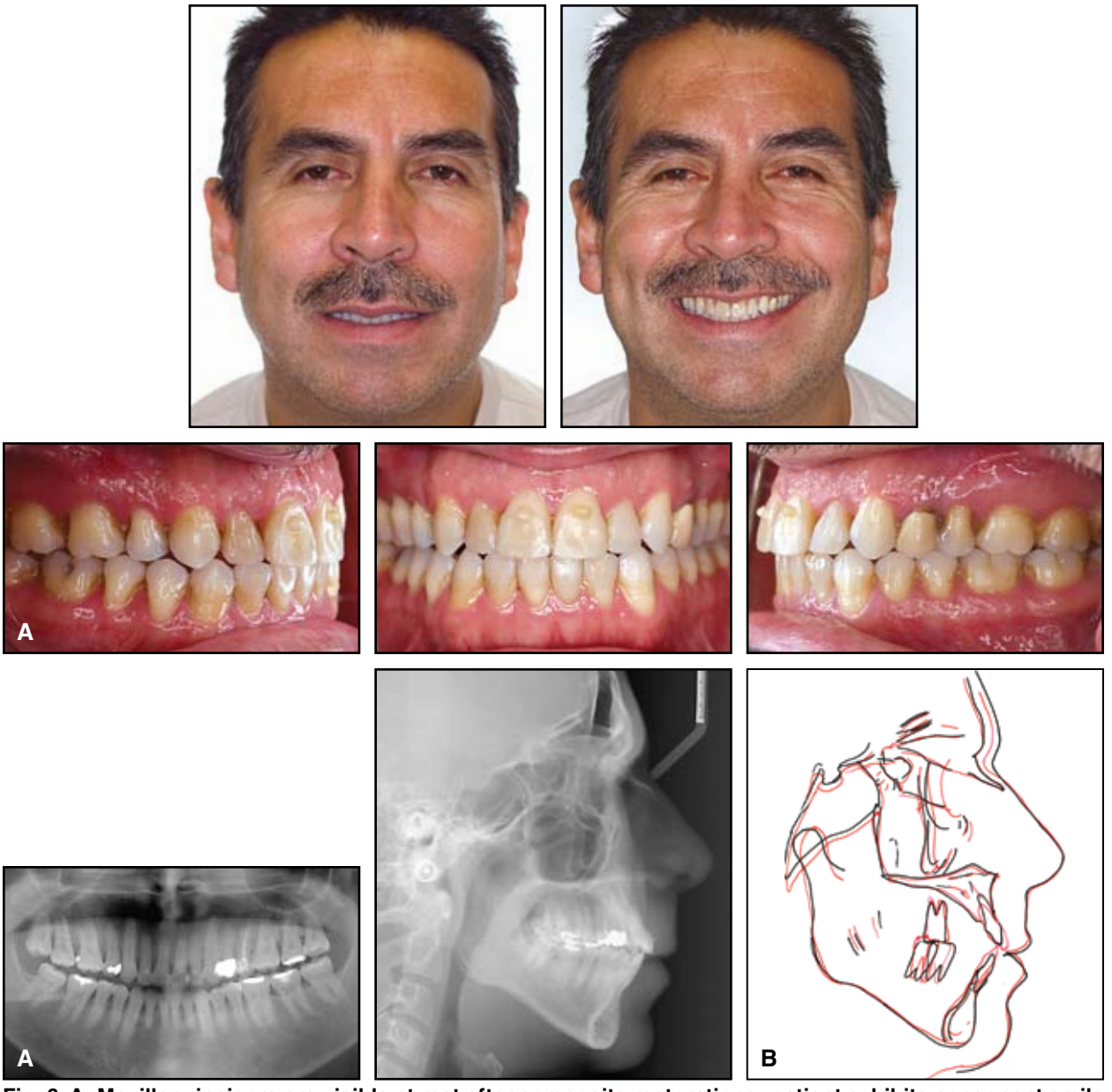

Fig. 6 A. Maxillary incisors are visible at rest after composite restorations; patient exhibits consonant smile with satisfactory incisor display. Gingivectomies were performed on maxillary incisors. B. Superimpositions of pre- and post-treatment cephalometric tracings show approximately 3mm of maxillary incisor extrusion.

Conclusion

Third molar anchorage provides an alternative for achieving difficult dental movements and provides a buffer that diverts reactive forces of the mechanics to teeth intended for extraction, thus preventing undesirable side effects in the permanent dentition.

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