CLINICAL

Treatment of an Adult Patient with Vertical Maxillary Excess Using Miniscrew Fixation

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Abstract
Several methods of controlling molar eruption in patients with vertical maxillary excess have been employed in the past. However, they have not been very effective due to inadequate dental anchorage. To provide stationary skeletal anchorages, endosseous implants of various materials and designs have been developed. This article deals with the use of miniscrew implants to intrude maxillary molars in an adult patient with vertical maxillary excess.

Keywords
Vertical maxillary excess, miniscrew implants, vertical molar control.

Conventional methods of controlling molar eruption in patients with vertical maxillary excess, such as high-pull headgear, vertical chin cups and removable and fixed appliances, cannot effectively intrude posterior teeth because of inadequate dental anchorage. To provide stationary skeletal anchorages, endosseous implants of various materials and designs have been developed. Kanomi used mini-implants to intrude lower anterior teeth, and also illustrated their application for molar intrusion. Costa and colleagues placed miniscrews in the infrasygomatic ridge as orthodontic anchorage for intrusion of upper molars, and Umemori and colleagues demonstrated intrusion of lower posterior teeth in skeletal open-bite patients using titanium miniplates for anchorage. Several studies have demonstrated the stability of implants in the midpalatal area. These reports led us to use palatal implants as anchorage for intrusion of posterior teeth, as the present case illustrates.

Diagnosis
A 26-year-old female presented with a skeletal Class II malocclusion and three missing second premolars, which had been extracted a few weeks earlier. Severe lip protrusion, mentalis strain, and an overjet of 6.7mm were found on clinical examination. Cephalometric analysis revealed a retrognathic mandible, excess dentoalveolar height of the incisors and molars, and a vertically hyperdivergent mandible (Table 1), all of which are common characteristics of vertical maxillary excess.

Orthodontic Treatment
Our primary treatment objective was to achieve maximum retraction of the anterior teeth without increasing the vertical dimension. The remaining lower right second premolar and the lower left third molar
Changes in the chin contour was with movement in the antero posterior and vertical directions. Considerable improvement was noted in the nose-lip-chin relationship, due to a 2.5mm reduction in lower anterior facial height. A more esthetic appearance of the chin contour was also apparent, along with autorotation of the mandible and 4.9mm of lower incisor intrusion. The lower molars showed minimal movement in the anteroposterior and vertical directions. Changes in the SNB and ANB angles were also small, with SNP increasing 1.1 (Table 1). Because of the significant amount of tooth movement and intrusion, minor root resorption of the upper and lower incisor root apices could be seen in the posttreatment panoramic radiograph.

Discussion
Control of the extrusion of posterior teeth is critical in treating patients with vertical maxillary excess. In non-growing patients, however, it is uncertain whether orthodontics alone can intrude the posterior teeth enough to achieve optimal facial balance. Studies of active biteblock therapy with or without repelling magnets have reported mandibular autorotation and a concomitant reduction in anterior facial height, but patient compliance with these bulky appliances can be problematic.

This case report indicates that posterior intrusion using miniscrews as anchorage is a viable treatment option.
Figure 1: 26-year-old female with skeletal Class II malocclusion and three extracted second premolars before treatment.

Figure 2 A: Lower buccal interdental miniscrews initially placed in interdental septal bone between first and second molars. After showing mobility, lower right miniscrew was removed, and new screw was placed between lower first premolar and first molar. B. Miniscrew placed in posterior midpalatal area. Elastic force applied from soldered hooks on transpalatal arch to midpalatal screw for upper molar intrusion.
Figure 3 A: After 27 months of treatment.  
B. Superimpositions of pre- and post-treatment cephalometric tracings, showing significant upper molar intrusion, autorotation of mandible, and reduction of anterior facial height.
The amount of molar intrusion and associated mandibular autorotation achieved was similar to that of LeFort I maxillary osteotomies. Although the treatment was primarily designed to control the vertical dimension, it also produced a favorable response in the anteroposterior relationship, as the chin displaced anteriorly and superiorly. Because these facial results are comparable to those seen in maxillary impaction surgery, we call the procedure "slow impaction". In fact, we had initially recommended reduction and advancement genioplasty after orthodontic treatment for this patient because of her severe lip protrusion and retrognathic mandible, but that proved not to be necessary.

Available bone thickness and density and the proximity of anatomical structures dictate the location of intraoral implants. The midpalatal area provides adequate retention in adult patients due to its bone density and the height of the crestal nasalis of the palatal bone. As in this patient, we have seen some mobility of miniscrews that were placed in the more cancellous maxillary buccal alveolar bone. Unlike other authors, we placed the midpalatal screw posteriorly, which reduces the possibility of penetrating critical anatomical structures such as dental roots, the incisive canal nerve, and palatal arteries. An anteroposterior location between the first and second molars is ideal for both intrusion of the upper buccal segments and anterior retraction (Fig. 2B). The soft tissue in this area is also much thinner than in the more anterior midpalatal region, allowing the use of shorter miniscrews.

Because of the limited bone height in the posterior midpalate, however, bone thickness should still be measured on the lateral cephalogram prior to implant insertion. It has been reported that the actual vertical bone support of the palate is at least 2mm thicker than is apparent on a cephalogram. A slightly oblique orientation of the miniscrew, with its head oriented posteriorly and its end oriented anteriorly, is preferable over a vertical orientation to ensure maximal bone contact of the screw. This not only improves retention, but also permits easier attachment of elastic chain.

The diameter and length of the miniscrews selected for treatment also depend on bone quality, bone thickness, and nearby anatomical structures. Generally, the longer and wider the screw, the more stable the anchorage it provides. We have used self-drilling and self-tapping screws that are 1.6mm wide and 8mm long. Narrower or longer screws require predrilled pilot holes. Compared to subperiosteal onplants, mini-screws are placed directly through the soft tissue without surgical flaps, thus allowing immediate loading. They are much less invasive of the soft tissue than onplants, at a fraction of the cost.

Several authors have suggested that a transpalatal arch can prevent molar extrusion or even cause molar intrusion, due to the force exerted by the tongue. In the present case, we placed a conventional transpalatal arch to create a molar-to-screw-to-opposite-molar anchorage unit, soldering a hook in the middle of the loop for attachment of elastic chain. For molar intrusion, it is advisable to solder extra hooks to the palatal bars (Fig. 2B). We kept the central loop 5mm away from the palatal tissue, although such a low transpalatal arch usually causes temporary tongue irritation and speech disturbance.

Optimum force values for intrusion of posterior teeth have not yet been established. Karla and colleagues used 90g of force to intrude posterior teeth in growing patients, but Melsen applied only 25-50g. Chun and colleagues used 50g of force to intrude a single overerupted upper molar. We applied 150-200g of intrusive force per screw in this case because we felt that bilateral intrusion of the entire buccal segments would require heavier forces. At these force levels, midpalatal miniscrews remain stable for the entire treatment period in our patients.

Conclusion

Our initial clinical experience with miniscrews has been promising. Vertical corrections that were once thought difficult to achieve with orthodontics alone may be possible with the adjunctive use of these screws, offering an alternative to orthognathic surgery for some patients. Further study of the long-term stability of these vertical effects is warranted.

References