Non-surgical treatment of severe maxillary dentoalveolar hyperplasia with miniscrews

ABSTRACT
A 37-year-old man presented with protrusive upper lip and a 3-mm gummy smile, Angle Class I malocclusion complicated with increased overjet of 8 mm, increased curve of Spee, and crowding in both upper and lower arches. Treatment plan involved extraction of the upper first premolars and lower second premolars, with the aid of miniscrews as anchorage in the maxilla for both intrusion and retraction of the upper front teeth. The severe overjet and gummy smile were both successfully corrected without comprehensive orthognathic surgery.

Key words: Alveolar process; Hyperplasia; Malocclusion

Introduction
Gummy smile is a common esthetic alteration characterized by excessive exhibition of gums during smiling. The etiology can be: (1) dentogingival, connected to an abnormal dental eruption, which is revealed by a short clinical crown; (2) muscular, caused by hyperactivity of the elevator muscle of the upper lip or short upper lip length; (3) dentoalveolar, due to an excessive protuberance or vertical growth of the jaw bone; and (4) mixed nature, in the presence of more than one of the above described factors.

In the case of a severe gummy smile caused by dentoalveolar hyperplasia, conventional treatment protocol would be combined surgical and orthodontic treatment with upward impaction of the excessive maxillary complex. An alternative treatment option would be orthodontic treatment using miniscrews as anchorage to provide an intrusive and retraction force to the upper anterior teeth, so as to reduce the gingival exposure.

Case report
A 37-year-old man was referred by a general dental practitioner for treatment of severe maxillary protrusion and gummy smile. Clinically, the patient presented with a convex facial profile, normal upper lip length, protrusive upper lip, and a 3-mm gummy smile (Fig 1a). Angle Class I malocclusion was complicated by increased overjet of 8 mm (Fig 1b). Lateral cephalogram showed that the patient had anterior maxillary dentoalveolar hyperplasia in the anteroposterior and vertical dimensions on a Class I basal relationship (Fig 1c).
Treatment objectives

The treatment objectives were to normalize the overjet by retraction and control tipping of the upper incisors, level the curve of Spee in the mandibular arch, align the teeth and harmonize the occlusion, and reduce the gingival exposure by intrusion of the upper anterior teeth so as to improve the facial esthetics.

Treatment alternatives

Combined surgical and orthodontic treatment option was fully discussed with the patient. However, this approach was refused by the patient due to the additional cost and

Figure 1  (a) Patient’s smiling appearance, (b) frontal view, and (c) lateral cephalogram before treatment

Figure 2  During treatment, with force applied from the miniscrew to the maxillary front teeth

Figure 3  (a) Patient’s smiling appearance, (b) frontal view, (c) panoramic radiograph, and (d) lateral cephalogram after treatment
risk. Therefore, orthodontic camouflage treatment with miniscrews as direct anchorage in the maxilla for retraction and intrusion of the upper anterior teeth was proposed.

Treatment approach

Orthodontic treatment involved extraction of the upper first premolars and lower second premolars so as to provide space for retraction of the maxillary anterior segments and relieve crowding in the mandibular arch, respectively.

Preadjusted 0.022-inch esthetic brackets were fully bonded. Initial alignment was started from 0.014-inch nickel-titanium archwires. Sequential step-up of the archwires to 0.019 x 0.025-inch stainless steel archwires was performed to prepare for retraction of the upper anterior segment and to continue to level the curve of Spee in the mandibular arch.

The treatment plan was designed to place two self-drilling miniscrews (Osstem Orthodontic Screw [OSSTEM Implant Co., Ltd., Seoul, Korea]; diameter, 1.6 mm; length, 6.0 mm) in the upper left and right buccal segments between the upper second premolars and upper first molars at the mucogingival junction for retraction of the upper anterior segment. The procedure was performed under local anesthetic with Xylestesin-A (2% lidocaine plus epinephrine) 0.2 mL (3M ESPE, St. Paul [MN], USA) on each side. Two 8-mm DISCOpender 468 suspenders (BioMaterials Korea, Inc., Seoul, Korea) were placed on the archwire between the upper canines and the lateral incisors for attachment of power chains from the miniscrews. The long arm of the DISCOpender was used so that the force of application from the miniscrew could be applied close to the center of resistance of the maxillary teeth. Two power chains were also applied from the miniscrews to the upper canines for distalization (Fig 2).

Additional miniscrews were intended to be placed in the maxillary labial area to aid the intrusion of the upper incisors for correction of the gummy smile. However, during treatment, it was noted that the gummy smile and protrusive maxillary teeth had been corrected. Therefore, only two miniscrews were inserted and used during the treatment.

No inter-arch Class II elastics were used as this would cause extrusion of the upper anterior teeth and the lower molars, thus aggravating the gummy smile and causing clockwise rotation of the mandible, respectively. The total active treatment time was 34 months. In the retention phase, fixed lingual retainer made of 0.0175-inch multistrand stainless steel wire was placed from the lower left to the lower right canines, together with upper and lower modified Hawley retainers. The patient was then referred back to the dental practitioner for consultation on removal of the third molars and tooth whitening to improve the dental esthetics.

Treatment results

The facial esthetics were greatly improved by reducing the gingival exposure and correction of the protrusive maxillary incisor, as well as improving the incompetent lips (Fig 3a).

Class I molar, canine, and incisor relationships were achieved with good occlusal interdigitation (Fig 3b). Satisfactory root parallelism and no obvious root resorption were noted in the panoramic radiograph (Fig 3c).

Cephalometric analysis showed that the upper incisor angulation was improved by 25.5° and the upper lip to esthetic line was decreased by 4 mm (Table 5). Facial convexity was reduced (Fig 3d). Overall superimpositions showed that there was significant intrusion and retraction of the upper incisors (Fig 4 6,7).

Discussion

Correction of maxillary protrusion and gummy smile

Intrusion and retraction of the maxillary complex was successfully achieved by means of placement of the miniscrews sufficiently high and use of the long DISCOpender arm to allow the force to be applied close to the center of resistance of the maxillary complex for intrusive and retrusive force. This approach is supported by the finite element analysis by Sung et al. 8, which stated that for high mini-implant traction and an 8-mm anterior retraction hook, the retraction force vector was applied above the center of resistance for the six anterior teeth. However, during orthodontic treatment, clinical observation of the amount of gummy smile reduction is also important to evaluate the need for additional anterior miniscrews in the labial alveolus for additional vertical intrusive force.
Position of the miniscrews

Miniscrews were placed bilaterally high in the mucogingival junction in the buccal area between the upper molars and second premolars. This placement has several advantages, in that it prevents the unattached gingivae from covering the head of the miniscrew, which may cause infection and irritation; computed tomographic scan has shown this area with high bone density and sufficient inter-root distance for stable and safe insertion of the miniscrews; and it eliminates the need for repositioning of miniscrews during retraction of the anterior segment. An alternative position for the miniscrew insertion would be in the buccal area between the roots of the first and second premolars, which would increase the intrusive force vector. However, during retraction of the anterior teeth, miniscrews may need to be replaced to avoid the roots of the upper canines from touching the miniscrews.
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Torque control

Torque control is essential to the success of treatment. Since maximum retraction of the upper incisors may easily cause excessive retroclination, it is important to evaluate the patient during the treatment planning appointment for the feasibility of this treatment protocol. In the presence of an upright upper incisor before treatment, care must be taken to prevent excessive loss of torque, such as applying exaggerated labial crown torque on the upper anterior teeth.

Gingival and bone recontour surgery

In some severe skeletal-origin gummy smiles with a thick labial bone plate, after intrusion and retraction of the maxillary dentoalveolar complex, a crown-lengthening procedure may need to be performed to eliminate the excessive alveolar bone and recover pretreatment clinical crown height. However, this procedure was not indicated for this patient.

Conclusion

With the aid of miniscrews as anchorage, correction of gummy smile and protrusive profile can be achieved without extensive surgical treatment, provided suitable case selection, correct diagnosis, detailed treatment planning, and an explicit mechanical regimen are followed.

References

5. Cooke MS. Cephalometric analyses based on natural head posture of Chinese children in Hong Kong. Hong Kong: The University of Hong Kong; 1986.