MINI-SCREW APPLICATION FOR GUMMY SMILE CORRECTION

The patient was a 20-year-old girl who had an Angle Class II Division 2 malocclusion with a gummy smile. The treatment involved intrusion of the upper incisors with mini-screw implants as the orthodontic anchorage. After treatment, adequate overbite and overjet and a satisfactory maxillary gingival exposure in the smile were obtained. The mini-screw implant anchorage method is useful for correction of gummy smile in a deep-bite patient.

Hasta, dişeti gülümsemesi problemi ve Angle Sınıf II bölüm 2 malokluzyonu olan 20 yaşında bir bayandı. Tedavide ankraj amaçlı olarak kullanılan mini vidalar yardımlarıyla üst keser dişler intrüze edildi. Tedavinin ardından ideal bir overbite ve overjet ve gülümsemede tatmin edici bir dişeti görünümü elde edildi. Mini vida ankraj metodu derin kapanışı ve dişeti gülümsemesi olan hastaların tedavisinde yararı bir yöntemdir.

KEYWORDS
Deep bite, Mini-screw, Gummy smile

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Derin kapansı, Mini vida, Dişeti gülümsemesi
INTRODUCTION

Esthetic judgement is made by viewing the patient in rest position, normal conversation, and full smile. 2 mm or more of maxillary gingival exposure while full smiling may be defined as “gummy” smile.

In a study of the full smiles of 454 dental and dental hygiene students aged 20–30 years, Tjan and Miller divided the smile line into three types: a high smile line, revealing the complete vertical length of maxillary incisors and a contiguous band of the gingiva (%11 of this population); an average smile, revealing 75–100 % of the maxillary incisors (%69 of this population); and a low smile, revealing less than 75% of the maxillary incisors (%20 of this population).

The high smile line, defined as gummy smile commonly provokes strong concern from clinicians. Treatment alternatives of gummy smile include various combinations of periodontal, surgical and orthodontic therapy.

When the patients have excessive gingival margins, and short clinical crowns, simple gingivectomy or surgical crown lengthening with removal of crestal alveolar bone procedures are indicated. However, periodontal procedures are not enough for the correction of severe gummy smile. In openbite cases with severe vertical maxillary excess, maxillary superior repositioning by Le Fort I osteotomy is generally the treatment of choice.

Orthodontic intrusion of maxillary anterior teeth may eliminate the gummy smile in deepbite cases to some degree. Orthodontic tooth movement has always been limited because of insufficient anchorage control. Conventional orthodontic methods require complex intraoral appliances or extraoral appliances to reinforce anchorage. Effective intrusion of maxillary anterior teeth is not always possible with intraoral anchorage systems and extraoral appliances rely on excellent patient compliance.

Intraosseous anchorage systems do not require patient cooperation while obtaining pure intrusion. Among various intraosseous anchorage implants, mini-screws have the advantages of simpler insertion and immediate loading.

In this case report, intrusion of maxillary incisors and elimination of gummy smile using two mini-screws implants in an adult female patient is demonstrated.

Case presentation

A 20-year-old female patient was referred to our clinic for orthodontic treatment. Her chief complaint was an excessive overbite and gummy smile. Her medical history was not contributory.

The patient exhibited a straight facial profile with a slightly prominent upper lip. Maxillary gingival exposure in the smile or a “gummy smile” was noted (Figure 1A-C). Intraoral photographs showed complete overlapping of mandibular incisors by extruded maxillary incisors. Molar and canine relationship was Class I on the right side and Class II on the left side. The mandibular midline shifted 2 mm to the left side relative to the maxillary and facial midlines. The arch length discrepancy was -1.5 mm for the upper and lower dental arches. The upper central incisors and canines had mesial-in rotations (Figure 2A-E).

Panoramic radiographs revealed no missing teeth except the upper and lower right third molars. These teeth were extracted before the orthodontic treatment. The lower first molars were restored with fillings (Figure 3).
FIGURE 1 B
(B) Pre-treatment extraoral lateral photograph

FIGURE 1 C
(C) Pre-treatment smiling photograph

FIGURE 2 A-E
(A-E) Pre-treatment intraoral photographs
Lateral cephalometric analysis (Figure 4) showed a skeletal Class 2 Division 2 relationship, mandibular retrusion and slightly decreased mandibular plane angle (FMA angle: 23°).

The upper incisors inclined palatally at a 94° angle relative to the SN plane (U1-SN) and 108° angle relative to FH plane (U1-FH), and the lower incisors inclined lingually at an 81° angle relative to the mandibular plane (L1-MP) and a 76° angle relative to the FH plane (L1-FH). The positions of the upper incisors were extruded relative to the upper lip and functional occlusal plane. Overbite was 8 mm and overjet was 6 mm. The upper and lower lips both were -2 mm relative to the E-line (Figure 4, Table I).

A temporomandibular joint evaluation showed no signs of clicks or crepitation, and the facial and masticatory muscles were asymptomatic.

**Treatment objectives**

The treatment objectives included (1) intruding the upper incisors with mini-screw implants as the orthodontic anchorage (2) obtaining adequate overbite and overjet for a satisfactory maxillary gingival exposure in the smile and (3) obtaining Class I molar and canine relationships.

**Treatment**

Treatment started with a .016X.016 inch NiTi utility arch for alignment and leveling of upper incisors. After that, a segmental .016X.022 stainless steel (SS) archwire was fitted to the upper incisors with a surgical spur at the midpoint of the central incisors. Another day, two mini-screw implants were implanted in the alveolar bone between the roots of the central and lateral incisors bilaterally under local anesthesia. At the same appointment, an 18-mm-sentalloy coil-spring was placed from the implants to the surgical hook (Figure 5). Upper incisors were intruded with an 80 gr of force for 5 months. After intrusion of the incisors, a
utility arch was inserted and ligated to the implants for enhancing anchorage while aligning and leveling the posterior teeth with an .016 inch NiTi piggy-back archwire.

Alignment and leveling of the lower teeth were accomplished using .016 inch NiTi, .016 SS and .016X.022 inch SS archwires sequentially. At 12 months of orthodontic treatment, the mini-screw implants were removed. The removal of miniscrew implants was uneventful (Figure 6). The canine and molar relationships were Class II on the left side at that time. Prolonged use of Class II elastics were not effective. Thus, a Eureka Spring appliance was used to correct the Class II relationship on the left side. Three months after the insertion of the Eureka Spring, Class I molar and canine relationship were achieved (Figure 7). Total treatment time was 28 months. Upper and lower hawley appliances were worn for retention.

RESULTS

Upper incisors were intruded successfully and an improvement of the gummy smile could be observed in a posed smile (Figure 8A-C). Class I molar and canine relationships were obtained with adequate amounts of overbite and overjet (Figure 9A-E).

No root resorption occurred in the intruded upper incisor region, and root paralleling was achieved. Lower left third molar was extracted during orthodontic treatment (Figure 10).

The post-treatment lateral cephalometric analysis showed no skeletal changes but changes in incisor inclinations and lip positions. The maxillary incisor inclination was slightly decreased and the mandibular incisor inclination was increased to the normal value. An 8 mm of deep overbite and a 6 mm of overjet was corrected to 2 mm (Figure 11). Upper and lower lips were slightly retracted due to the changes in incisor positions. The significant intrusion of upper incisors was evident on superimpositions of pre- and post-treatment cephalometric films (Figure 12).

DISCUSSION

The extruded upper anterior teeth should be intruded during orthodontic treatment to improve occlusal relationship and obtain balanced facial esthetic and a beautiful smile. However, in-
FIGURE 8 A
Post-treatment extraoral facial photograph

FIGURE 8 B
Post-treatment extraoral lateral photograph

FIGURE 8 C
Post-treatment smiling photograph

FIGURE 9 A-E
(A-E) Post-treatment intraoral photographs
 intrusion of extruded upper incisors still has many limitations.

Before deciding to intrude the extruded incisors, correct diagnosis and case selection are essential. The marginal bone level of the upper incisors and the overall periodontal condition must be considered. The amount of intrusion needed, the treatment period and the patient’s general health are other factors to be considered.

When it is performed on nongrowing patients, it is commonly accepted that correction of deep bite by extrusion of posterior teeth is more difficult to accomplish and less stable\textsuperscript{16,17}. Therefore, it would be better to intrude incisors to achieve a proper gingival exposure\textsuperscript{18}. In this case, our evaluation led us to the conclusion that the deep bite and gummy smile would be improved by upper incisor intrusion.

Intrusion by conventional orthodontic methods such as segmental or continuous techniques, usually accompanies extrusion of the anchorage teeth. Some archwire systems such as utility arch\textsuperscript{19} or intrusion base arch\textsuperscript{20} systems are generally used for incisor intrusion. But these methods create a force to elongate the molars, based on the law of action and reaction. Extrusion of the anchorage molar teeth can cause clockwise rotation of the mandible, and, as a result retrusion of the chin can also occur. The J-hook headgear depends on anchorage on the head and is also used for incisor intrusion, but it requires excellent patient cooperation\textsuperscript{21}. Our purpose of using mini-screw implants as skeletal anchorage was to totally eliminate the need for patient compliance and minimize the side effects to the anchorage teeth.

Regarding the optimum force for intrusion, Burstone\textsuperscript{20} suggested 20 g of force for intruding
an anterior tooth and Gianelly and Goldman recommended 15 to 50 g of force for small teeth. In this case, an 80 gr of intrusion force was used on 4 upper incisors and 3 mm of true intrusion was obtained without notable root resorption or vitality problems during the active treatment period.

This case was noncompliant with the use of Class II elastic wear to correct the Class II molar relationship on the left side. The advantages of the Eureka Spring appliance for correction of sagittal tooth relationships have been reported. In this patient, with the unilateral wear of the spring, an effective and a rapid correction to Class I molar relationship was achieved. Eureka Spring was well tolerated by the patient.

CONCLUSIONS

The maxillary incisors achieved remarkable intrusion and alignment with the miniscrew implant anchorage without relying on patient cooperation. There were no side effects and no problems with patient cooperation. Moreover, there was no obvious root resorption, either. This case report demonstrated that the mini-screw implant anchorage method was useful for achieving an excellent improvement of a dental deep bite and gummy smile.

ACKNOWLEDGEMENTS

We are indebted to Prof Dr Enacar, whose treatment principles were guidelines in the treatment of this patient and we mourn his premature death in May 14, 2004.

REFERENCES


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