ORTHODONTIC CORRECTION OF OCCLUSAL CANT USING MINI IMPLANTS: A CASE REPORT

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Abstract:
The inability of orthodontists to change the cant of the maxillary occlusal plane without surgical intervention is a limitation of orthodontic treatment. LeFort I osteotomy with asymmetric maxillary impaction is often used to correct this problem. However, canting caused by extruded teeth can be corrected easily with normal orthodontic appliances and temporary anchorage devices. The correction occurs through intrusion of the extruded teeth on one side of the maxilla. A 16-year-old female with canted maxillary occlusal plane was treated in this manner showing the possibility of correcting occlusal plane canting with mini implants thus avoiding surgical intervention.

Key Words: Canting, Mini implants, intrusion

Introduction
Many patients have canted occlusal planes caused by unilaterally extruded maxillary molars or asymmetric mandibular vertical development. Until recently, there was no reliable nonsurgical method to correct this condition. Various methods of molar intrusion have been introduced, including posterior bite blocks, highpull headgear, posterior bite blocks with high-pull headgear, and active vertical correctors with magnets. Unfortunately, there are limitations to these methods in adult patients, and the appliances are highly dependent on patient cooperation\textsuperscript{1-3}. Recently, miniscrews and miniplates have been introduced to aid orthodontic mechanics, and they have been reported to provide skeletal anchorage to permit molar intrusion\textsuperscript{4-15}. Sherwood et al\textsuperscript{7} described a method of maxillary molar intrusion for open-bite patients, and Umemori et al\textsuperscript{8} reported mandibular molar intrusion. Both studies showed good control of vertical excess through molar intrusion.

In this case report, we describe a new approach for correcting a canted occlusal plane using miniscrews thus avoiding the possibility of surgical intervention making this an attractive treatment alternative.
DIAGNOSIS:
A 16-year-old female reported with chief complaint of forwardly placed upper front teeth (Fig 1).

Extra oral examination reveals convex profile, high clinical Frankfurt mandibular angle, incompetent lips, increased nasolabial angle. Intraoral examination reveals class I molar relation on right side and class II on left side. Class I canine relation on right side and class II on left side. Mild crowding is present with upper and lower anteriors. There is highly placed canine on left side. The lower midline was shifted towards left side by 2mm. The maxillary occlusal plane is canted on right side due to extrusion of anteriors, premolars and molars on same side (Fig 2,3).

Figure 1: Extraoral front

Cephalometrically patient presents with skeletal class II pattern, vertical growth pattern, proclined upper and lower anteriors and protruded upper and lower lips.

TREATMENT OBJECTIVES:
The treatment objectives for this patient were to:
1. Correct the upper and lower crowding.
2. Correct the increased overjet.
3. Correct the molar and canine relation on left side.
4. Correct the canted maxillary occlusal plane.
5. Correct the lower midline shift.

TREATMENT PLAN:
The treatment plan included extraction of upper I premolars, lower I premolar on right side and II premolar on left side. Cant correction using miniscrews by intruding upper right quadrant.

Figure 2: Extraoral profile

Figure 3: Extraoral front smiling
TREATMENT PROGRESS:
After extraction of upper I premolars, lower I premolar on right side and II premolar on left side, treatment began by bonding both arches with MBT 0.022 X 0.028 prescription. Initial leveling and aligning was accomplished in 4 months with 0.014-in and 0.018-in round nickel titanium wires followed by 0.017 X 0.025-in rectangular nickel titanium wires and then followed by 0.019 X 0.025 stainless steel working wire. Anchorage control was done by transpalatal arch. Initially, two 8 mm miniscrews with a diameter of 1.2mm were implanted on the upper right quadrant between upper right lateral incisor and canine and upper right second premolar and first molar(Fig 4).

The miniscrews were implanted at chair side under local anaesthesia. Elastics were used to intrude the teeth and changed every 2 to 3 weeks.

The intrusion of the upper right quadrant took approximately 6 months. After the required amount of intrusion achieved the elastics were removed and ligature wire was tied from miniscrews to arch wire to maintain the intrusion achieved(fig 5).

A 3.5-mm posterior open bite was achieved on the right side by intrusion. The remaining space was closed by active tiebacks and overjet was corrected. The miniscrews were removed before the finishing stage(Fig 6).

DISCUSSION:
Changing a canted occlusal plane requires either intrusion of extruded molars or extrusion of intruded molars. Extrusion of teeth can cause clockwise
rotation of the mandible, producing a longer face. Intrusion of molars is more stable and reduces facial height\textsuperscript{11}. Because this patient would benefit from a reduction in facial height intrusion of molars was preferred. Previous studies showed excellent intrusion of molars by using skeletal anchorage with miniplates\textsuperscript{5,7,8}. For our patient, miniscrews were chosen for skeletal anchorage. The placement and removal of miniscrews require less surgery and are easier than placement of miniplates\textsuperscript{4,6,11}.

Prior to the placement of miniscrews periapical x ray films are taken to evaluate the space between the roots. In the maxilla there are relatively narrow spaces followed by large convex root curvature and distally tipped molar angulation. Kyung et al\textsuperscript{15} recommended 30 to 40 degree angulations in the maxillary teeth.

Traditional oral implants require a waiting period of at least 4 months before occlusal loading. Miniscrews, however are different because they have been used for temporary anchorage and force applied are much lower. Complete osseous integration therefore is not necessary. Orthodontic forces of 250 grams or less have been successfully applied to miniscrews after soft tissue healing\textsuperscript{12,15,16}. In our patient force was applied immediately after loading the miniscrews. One theory that supports early loading is that mechanical retention between the screw and the bone is sufficient to withstand normal orthodontic force levels\textsuperscript{17}.

**Intrusive mechanics:**

Conventional mechanics essentially consist of characteristics of extrusive mechanics. Conversely the TAD is generally located apically compared with the brackets and in this location the mechanics are advantageous in achieving intrusion.

When considering the effects of molar intrusion to decide whether a molar should be intruded the intermaxillary occlusal relationship should be considered along with condition of bone and attached

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Figure 6: Extraoral front showing pre(A) and post(B) correction
gingival should be evaluated. Stability of molar intrusion can be achieved by overcorrection$^{18}$.

To avoid root resorption, intrusive force levels should be kept near optimal$^{19}$. Burstone$^{19}$ suggested applying 20 grams of intrusion force for an incisor. Melsen and Fiorelli$^{20}$ used about 50 grams buccolingually in an adult. About 200 grams force was used to intrude molars in this study.

There are no long-term studies about the stability of intrusion with miniscrews in the orthodontic literature. It has been suggested, however, that normal occlusal forces might help prevent relapse of the intruded teeth. Proffit$^{21}$ stated the equilibrium theory: occlusal forces can assist in maintaining the correction. Intrusive forces applied apically to the buccal tooth surface result in rotational movement, leading to molar flaring. Therefore, intrusive forces should be applied to both the buccal and lingual surfaces$^{4,6}$. This allowed the use of a transpalatal arch to control the buccal flaring of the maxillary molars instead of adding intrusive forces on the lingual surface along with buccal root torque. This mechanical system worked well and eliminated the need for a miniscrew in the midpalatal suture area.

Before treatment, there were concerns about mild gingival inflammation around the miniscrews, but no adverse gingival reactions occurred. Gingival infection of the implanted site should not be a concern in patients with good oral hygiene. All miniscrews used in this patient showed no clinically discernible mobility and provided good skeletal anchorage during treatment.

CONCLUSION:
The inability of orthodontists to change the cant of the maxillary occlusal plane without surgical intervention has been accepted as a limitation of orthodontic treatment but mechanics using TADS following general biomechanical principles has provided a new alternative for cant correction without surgical intervention.

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