EFFICIENCY OF THE DISTAL SCREW IN THE DISTAL MOVEMENT OF MAXILLARY MOLARS

Aim: Conventionally, noncompliance distal movement of molars relies exclusively on intraoral anchorage. The distal screw, a distal jet appliance supplemented by two paramedian mini-implants, is an innovative alternative. The aim of this study was to evaluate the suitability of this device to move molars bodily and distally. Methods: The effects of the distal screw were evaluated in a sample of 18 consecutively treated preadolescent and adolescent individuals (nine females and nine males; mean age at the start of treatment, 11.2 years). Two conical mini-implants (length 11.0 mm, diameter 1.5 to 2.2 mm) were placed in the anterior paramedian area of the palate of each patient. The coil springs of the device were activated to deliver a force of 240 cN per side. The dental and skeletal effects were investigated on pre- and posttreatment cephalometric radiographs. Results: The distal screw produced a Class I occlusion of the first molars by moving them distally 4.7 mm, which is more than conventional appliances can accomplish. Although this took longer than conventional devices (9.1 months), it had the advantage of a roughly 2.1-mm premolar distal movement (ie, no anchorage loss as with traditional techniques). Conclusions: The distal screw anchored by two palatal mini-implants allows not only translatory molar distal movement, but also distal movement of the maxillary first premolars, thereby avoiding characteristic anchorage loss. World J Orthod 2010;11:341–345.

Key words: maxillary molar distalization, mini-implant, skeletal anchorage

Distal molar movement is useful in resolving a Class II occlusion in patients with dentoalveolar protrusion and only slight skeletal discrepancy. While the conventional approach involves extraoral traction, comparable results have been achieved using fixed, esthetically acceptable appliances that rely on intraoral anchorage, thereby eliminating the need for patient compliance. In general, these devices exploit a combination of dental (maxillary premolars) and palatal (Nance button) anchorage. This approach leads to an anchorage loss (a mesial displacement of the premolars, canines, and incisors), a situation that cannot be improved by bracketing additional teeth.

One intraorally anchored device is the distal jet, an intramaxillary appliance that is effective due to two Ni-Ti coil springs attached to the bands on the maxillary first molars. If the distal jet is constructed according to Bolla et al, the force vector passes through the center of resistance of these teeth, which results in almost complete bodily movement. Several authors, including those...
of the present study, have developed skeletally anchored alternatives to the conventional distal jet. The distal screw uses two palatally inserted mini-implants for skeletal anchorage. Numerous studies have demonstrated that the optimal sites for mini-implant are not only the lingual interradicular spaces, but also the paramedian region of the palatal vault. The aim of this study was to clinically evaluate the efficiency of the distal screw.

METHOD AND MATERIALS

Eighteen consecutive patients (nine males, nine females; mean age at beginning of treatment 11.2 years) with a bilateral dentoalveolar distal occlusion were treated solely with a distal screw. In six of these patients, the maxillary second molars had fully erupted, while they had erupted partially in four. They had not erupted in the remaining eight patients. No patients dropped out during the trial.

For all patients, intra- and extraoral photographs, impressions, panoramic radiographs, and lateral cephalographs were obtained at the beginning and end of the first molars’ distal movement.

The appliance was a modified distal jet in which the metallic arms normally used for dental anchorage were eliminated and the Nance button altered to enclose a moldable metal plaque fixed by two mini-implants (Figs 1 and 2). The two mini-implants were placed in the paramedian region of the anterior palatal vault along a line connecting the two synergetic premolars. They were inserted by predrilling and using a manual screwdriver after the patients had rinsed with a 0.1% chlorhexidine gluconate solution. Local anesthesia with an adrenalin-free analgetic was performed.

The insertion site was selected on the basis of various studies demonstrating its safety, thereby eliminating the need for any further radiographic evaluation. Also, according to Ardekian et al, nasal floor perforations of less than 2 mm tend to heal spontaneously.

The mini-implants employed were made of titanium, measured 11.0 mm long, and were shaped like a truncated cone with a diameter of 1.5 mm at the tip and 2.2 mm at the neck. The shank was 1.0 mm in diameter, the threaded part had a length of 8.0 mm, and the head featured a hexagonal slot to house the head of the screwdriver or contra-angle handpiece (Fig 3).
The superelastic springs were compressed by adjusting the attachment screws until a force of 240 cN could be measured; reactivation was carried out at 4-week intervals.

To quantify the distal movement achieved, any premolar or canine displacement was evaluated according to the methodology suggested by Ghosh and Nanda16 (Fig 4). This method was chosen to compare the results of this study with those of other studies.1,17

Statistical analysis

Mean, standard deviation, and range of each continuous variable were calculated before (T1) and after (T2) distal movement. Also, the absolute and relative frequencies of the categoric variables were determined.

RESULTS

The data from the cephalometric analyses are listed in Table 1. It also shows that the average time required to achieve a Class I molar relationship was 9.1 ± 2.7 months. The mean distal movement of the maxillary molars (PTV–U6) was −4.7 ± 1.6 mm. Simultaneously, the first premolar (PTV–U4) moved distally on average −2.1 ± 1.8 mm. Distal tipping of the first molars (SN–U6/U4/U1) amounted to −2.6 ± 2.3 degrees and −2.0 ± 3.1 degrees for the first premolars. The incisors tipped labially 0.3 ± 2.9 degrees. Extrusion with respect to the bispinal plane of the first molars (PP–U6/U4/U1) was 0.7 ± 1.9 mm, 1.3 ± 1.5 mm for the first premolars, and 0.4 ± 0.8 mm for the incisors. The distance PTV–A increased by 0.4 ± 0.8 mm.
DISCUSSION

The introduction of skeletal anchorage to orthodontics has permitted not only the simplification of many procedures conventionally employed to control anchorage, but also reduced the undesirable effects of many appliances. Initial attempts were based on osseointegrated implants, but the related costs, invasiveness, and delay of loading prompted clinicians to seek alternatives. Thus, mini-implants were used based on their low cost, reduced invasiveness, and versatility. Clinical and laboratory studies have demonstrated the usefulness of mini-implants for orthodontic purposes.

Compared to Bolla et al, who treated a similar number and type of patients using a distal jet, the amount of molar distal movement was greater with the distal screw (3.2 vs 4.7 mm). Moreover, the patients treated with the distal screw did not experience any anchorage loss of the first premolar in contrast to those treated with the distal jet (mean loss 1.3 mm). Actually, the first premolars moved distally, too (2.1 mm). The fact that a Class I occlusion was achieved in 5 to 6 months in the study by Bolla et al as compared to 9.1 months in this study could be explained by the fact that the distal occlusion might have been more severe in the patients treated with the distal screw. In any case, the distal movement of the first molars was nearly the same in both studies (0.5 vs 0.6 mm).

From the cephalometric perspective, the distal screw conserves the positive characteristics of the distal jet but overcomes its negative aspect: the medioanterior anchorage loss.

Finally, the distal screw seems to behave clinically differently than conventional and other skeletally anchored distal movement devices. Authors who used a pendulum with skeletal anchorage achieved a greater distal movement in a shorter time (5.4 mm in 6.5 months), which was, however, accompanied by severe first molar (5.6 to 12.2 degrees) and first premolar tipping (3.8 to 7.9 degrees). In contrast, this appliance produced a tipping of only 2.6 (molars) and 1.9 degrees (premolars).

Similar results for molar distal movement were documented in a study of 10 adolescent patients treated with a distal jet anchored to the first premolars by two palatal mini-implants. It was also reported that the second premolar moved 1.9 mm distally with about 3.0 degrees of tipping. In contrast to the results of this study, Kinzinger et al described a mesial displacement of 0.7 mm for the first premolar, which can be explained by the different anchorage setup.

Overall, the distal screw has numerous advantages with respect to both conventional appliances and other skeletally anchored molar distal movement devices. In fact, the distal screw not only overcomes anchorage loss, but also simplifies the treatment because premolar banding is rendered unnecessary and the same appliance, once inactive, can further be employed for final premolar and canine retraction. As these screws are positioned in the palate, they do not interfere with the distal movement of the posterior teeth. All advantages of the distal screw are obtained without taking additional radiographs.

CONCLUSIONS

The distal screw allows an almost completely bodily distal movement of the maxillary first molars and a spontaneous distal drift of the premolars. In comparison to the distal jet, the distal screw simplifies the clinical procedure without any special radiographic evaluation.

The longer time needed to achieve a Class I relationship is compensated by the simpler subsequent distal movement of the remaining teeth because the premolars need less distal movement.
REFERENCES


