Esthetic Class II Treatment with the Beneslider and Aligners

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Maxillary molar distalization is a common treatment method for dental Class II patients with excessive overjet, anterior crowding, or both. Given the unpopularity of headgear among patients,[1,2] clinicians increasingly prefer intraoral appliances with minimal need for patient cooperation. Unfortunately, most of the conventional non-compliance devices produce unwanted side effects. Anchorage loss of 24-55% can result in mesial migration and protrusion of the anterior dentition.[3-5]

An acrylic palatal button reduces the effects of reciprocal forces, but this soft-tissue-borne appliance is not always completely stable, and it impairs oral hygiene in the palatal area. In recent years, temporary anchorage devices (TADs) have been integrated into distalization appliances to prevent anchorage loss.[6-15] Mini-implants are particularly attractive because of their minimal invasiveness and low cost.[16-20]

Various insertion sites for distalization mechanics using TADs have been recommended. The retromolar region proved unsuitable for mini-implant insertion due to its poor bone quality and thick soft tissue.[21] The alveolar process also seems inappropriate, since TADs may impede distal tooth movement when the premolars are pulled along with the molars by interdental fibers. Mini-implants placed in the alveolar process also fail at a much higher rate compared to the anterior palate, which offers good bone quality, a thin attached mucosa, and no risk of dental injury from tooth contact.[22]

Molar Distalization with the Beneslider

The Beneslider* is a distalization appliance anchored to one or two coupled Benefit* mini-implants in the anterior palate[20,23-26] (Fig. 1). Interchangeable abutments affixed with an inner microscrew are used to achieve a safe and stable connection between the mini-implants and the distalization mechanism (Fig. 2). To further

*PSM Medical Solutions, Tuttlingen, Germany; www.psm.ms. Distributed in the U.S. by Mondeal North America, Inc., Indio, CA; www.mondeal-ortho.com.

Fig. 1 Beneslider* distalization appliance. A. Open-coil springs are activated by pushing activation locks distally; Benetubes* slide into lingual first-molar sheaths. B. Appliance anchored with one mini-implant and abutment. C. Appliance with two mini-implants and Beneplate.*

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enhance stability, two Benefit mini-implants placed about 5-10mm apart along the line of force can be coupled with a Beneplate*[24] (Figs. 1C, 2H). The distalizing force is delivered by two open-coil springs* (240g for children and 500g for adults), activated by sliding locks, to two Benetubes* inserted into lingual sheaths on the first-molar bands (Fig. 1A).

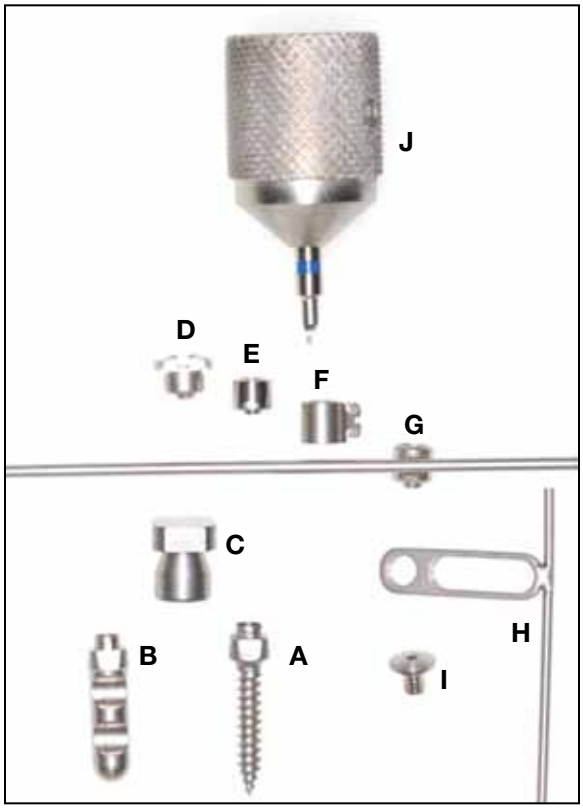

Fig. 2 Benefit* system. A. Mini-implant. B. Laboratory analog. C. Impression cap. D. Slot abutment. E. Standard abutment. F. Bracket abutment. G. Abutment with .045" stainless steel wire. H. Beneplate with .045" stainless steel wire. I. Fixation screw for Beneplate. J. Screwdriver for abutment fixation.

We usually prepare and place the Beneslider components without a plaster cast setup. Under topical or local anesthesia, a dental probe is used to identify a site with thin mucosa by measuring the soft-tissue thickness from anterior to posterior in the area near the third palatal rugae (Fig. 3). This is important to achieve sufficient primary stability and avoid long lever arms.[27,28]

The self-drilling Benefit mini-implants can be inserted without predrilling, but because of the high bone density in the anterior palate, especially in older patients, we advise predrilling in patients older than 12 to keep insertion torque within a safe range. Predrilling can be performed by adapting the PSM handpiece* to a standard contra-angle,[28,29] with no need for cooling at such low speed. The predrilling diameter is 1.4mm for a 2mm mini-implant and 1.8mm for a 2.3mm mini-implant; a depth of 3mm is adequate. These miniscrew diameters provide superior stability.[29-32] If only one mini-implant is inserted, the recommended dimensions are 2.3mm × 11mm (Fig. 4A); if two are used, the recommended dimensions are 2mm × 11mm for the anterior screw and 2mm × 9mm for the posterior (Fig. 4B).

The Benefit mini-implants are inserted using the contra-angle and PSM handpiece (Fig. 5). At the same appointment, bands with lingual sheaths are cemented to the upper molars, and the Benetubes are plugged into the sheaths from the mesial (Fig. 6). To avoid soft-tissue irritation, we usually bend the Benetube slightly (Fig. 6B). The incorporated .045" stainless steel wire of the abut-

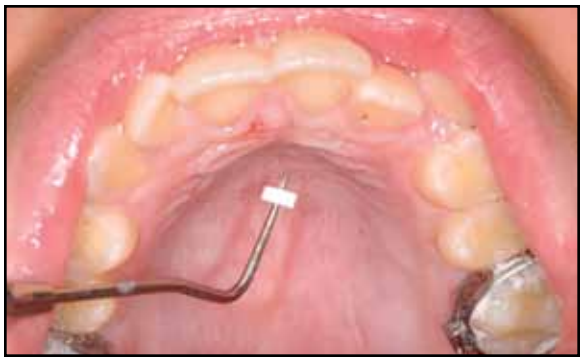

Fig. 3 Soft-tissue thickness measured with dental probe.

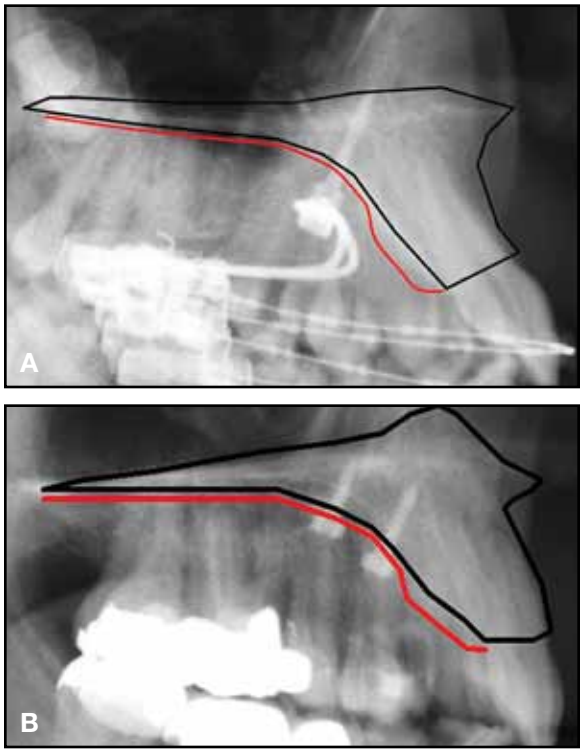

Fig. 4 A. Single mini-implant (2.3mm × 11mm) inserted in anterior palate. Note thicker soft tissue in incisive papilla region. B. Recommended dimensions for tandem implants: 2mm × 11mm (anterior) and 2mm × 9mm (posterior).

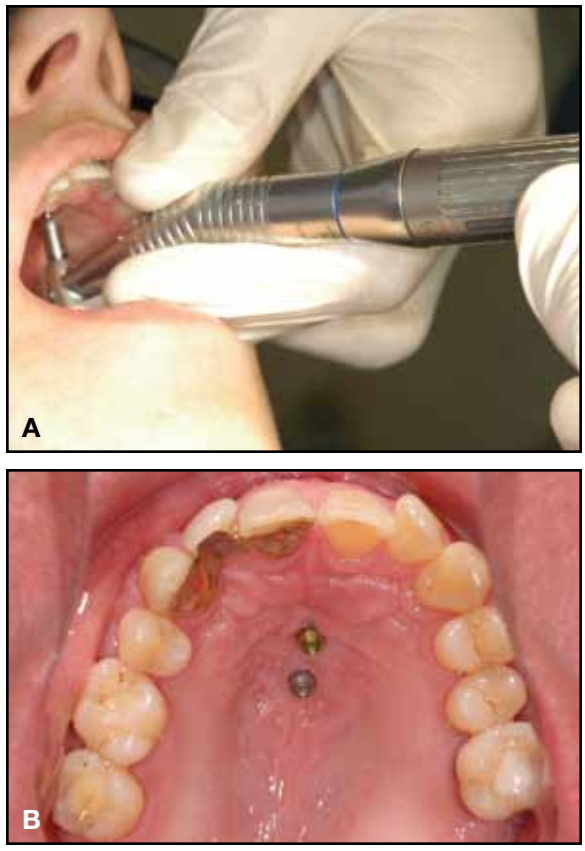

Fig. 5 A. Insertion of mini-implant using contra-angle and handpiece. B. Two mini-implants placed about 5-10mm apart in median anterior region of palate.

ment (Fig. 2G) or the wire attached to the Beneplate (Fig. 2H) is adapted to the curvature of the palate (Fig. 6D). Depending on the axis and location of the two mini-implants, the Beneplate body can also be bent (Fig. 6E). Changing the angulation of the .045" wire makes it is possible to produce intrusion or extrusion of the molars simultaneously with distalization (Fig. 7).

Direct bonding of the Benetube to the lingual molar surface, a technique developed by Dr. Thomas Banach, is a more esthetic option that eliminates the need for bands (Fig. 8). If aligners are to be used for finishing, molar bands can impede their fit.

The adapted abutment or Beneplate is

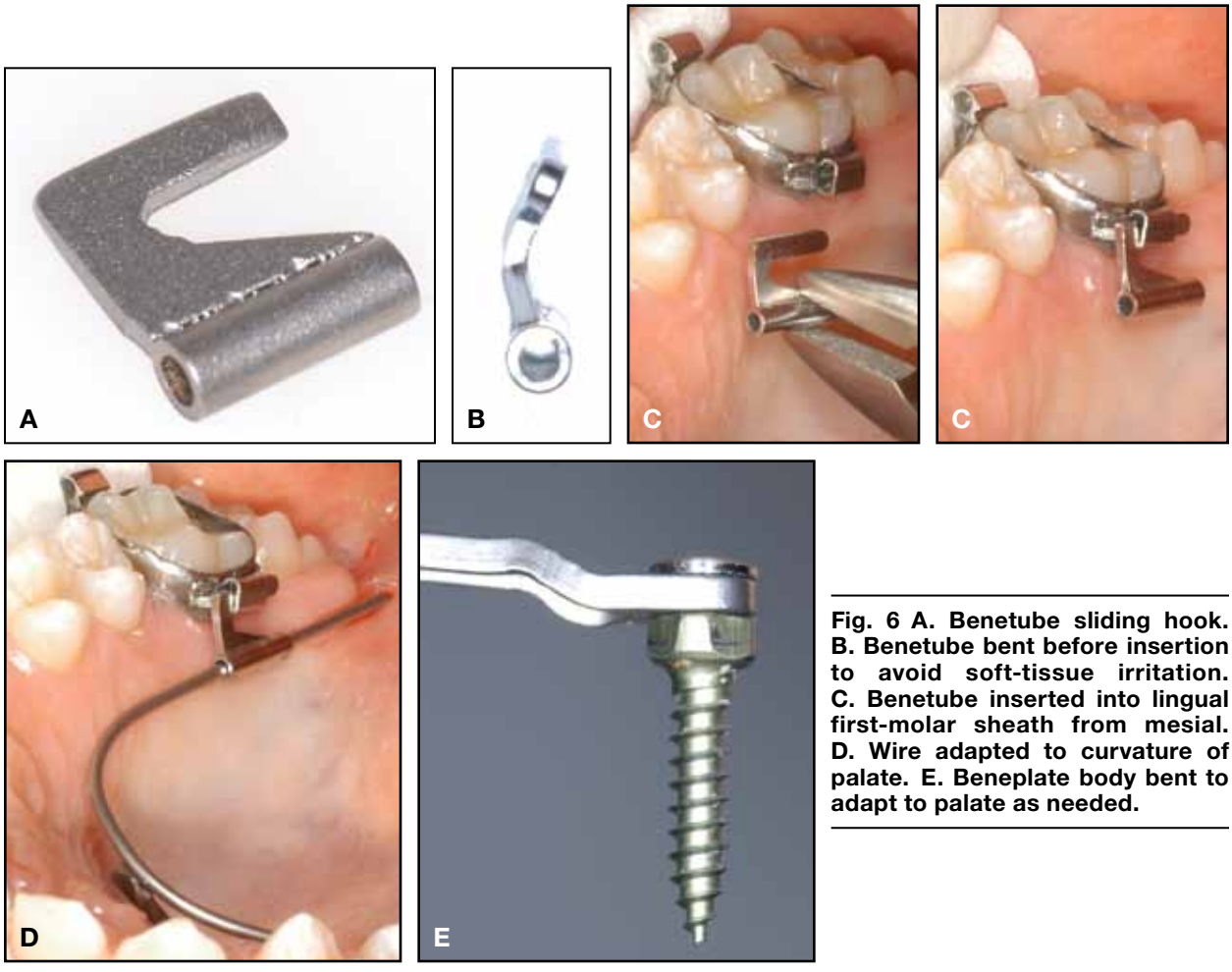

Fig. 6 A. Benetube sliding hook. B. Benetube bent before insertion to avoid soft-tissue irritation. C. Benetube inserted into lingual first-molar sheath from mesial. D. Wire adapted to curvature of palate. E. Beneplate body bent to adapt to palate as needed.

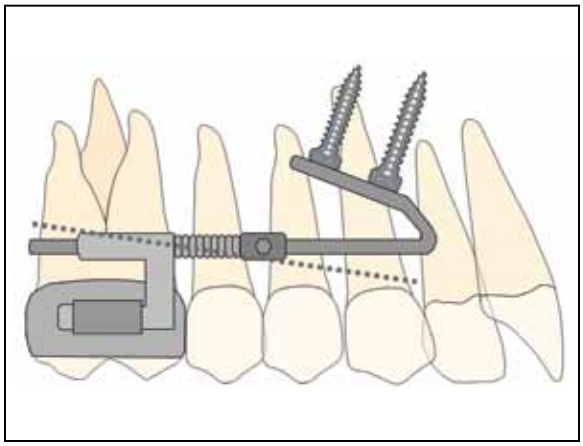

Fig. 7 Changing angulation of .045" stainless steel wire can produce simultaneous molar intrusion or extrusion during distalization.

Fig. 8 Benetube bonded to lingual molar surface to avoid banding.

Fig. 9 Adapted Beneplate fixed in place by two microscrews, using Benefit screwdriver.

Fig. 10 Distalization force applied by sliding activation locks distally and tightening.

attached to the single or tandem mini-implants with the inner fixing screw, using the kit's screwdriver (Fig. 9) or the contra-angle and handpiece, which is generally more comfortable for the clinician. The distalization force is applied by pushing the activation locks distally (Fig. 10). Follow-up appointments are scheduled every four to six weeks.

Although the Beneslider system can be placed without welding, soldering, or even taking an impression, it is possible to save some chairtime by preparing the appliances on a plaster cast. After mini-implant insertion, impression caps are placed over the screw heads (Fig. 11A). Laboratory analogs are then placed on the impression caps (Fig. 11B), and a plaster cast is fabricated with all components in place (Fig. 11C).

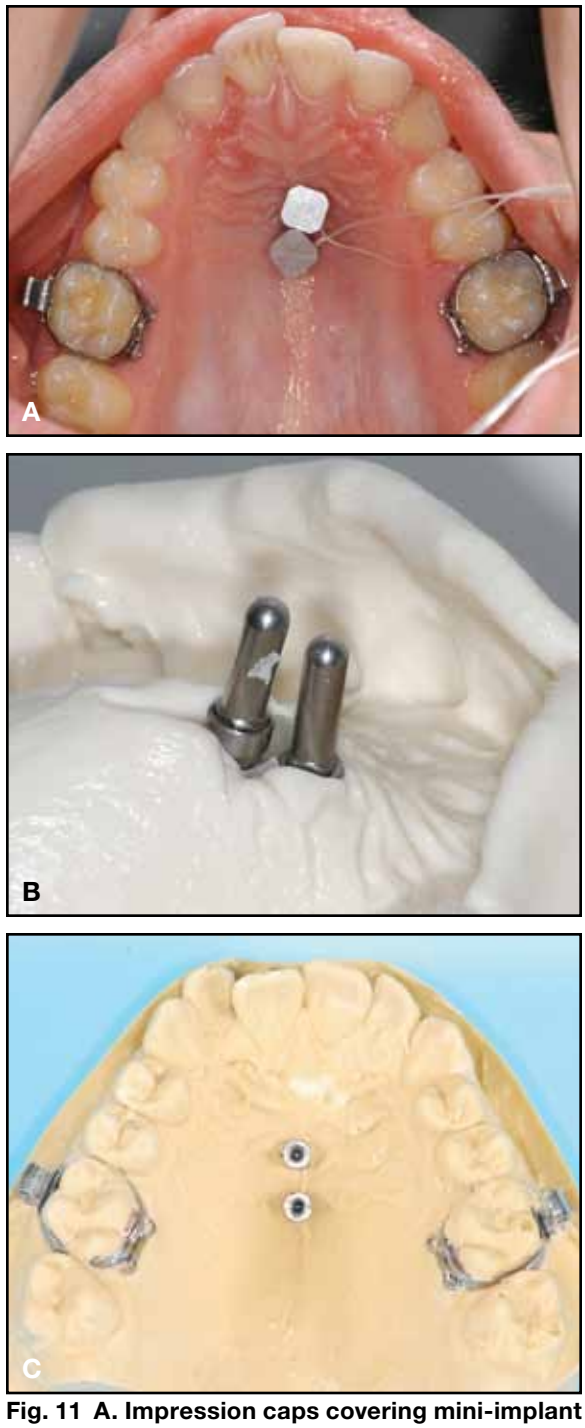

Fig. 11 A. Impression caps covering mini-implant heads. B. Laboratory analogs placed over impression caps. C. Plaster cast ready for fabrication of Beneslider appliance.

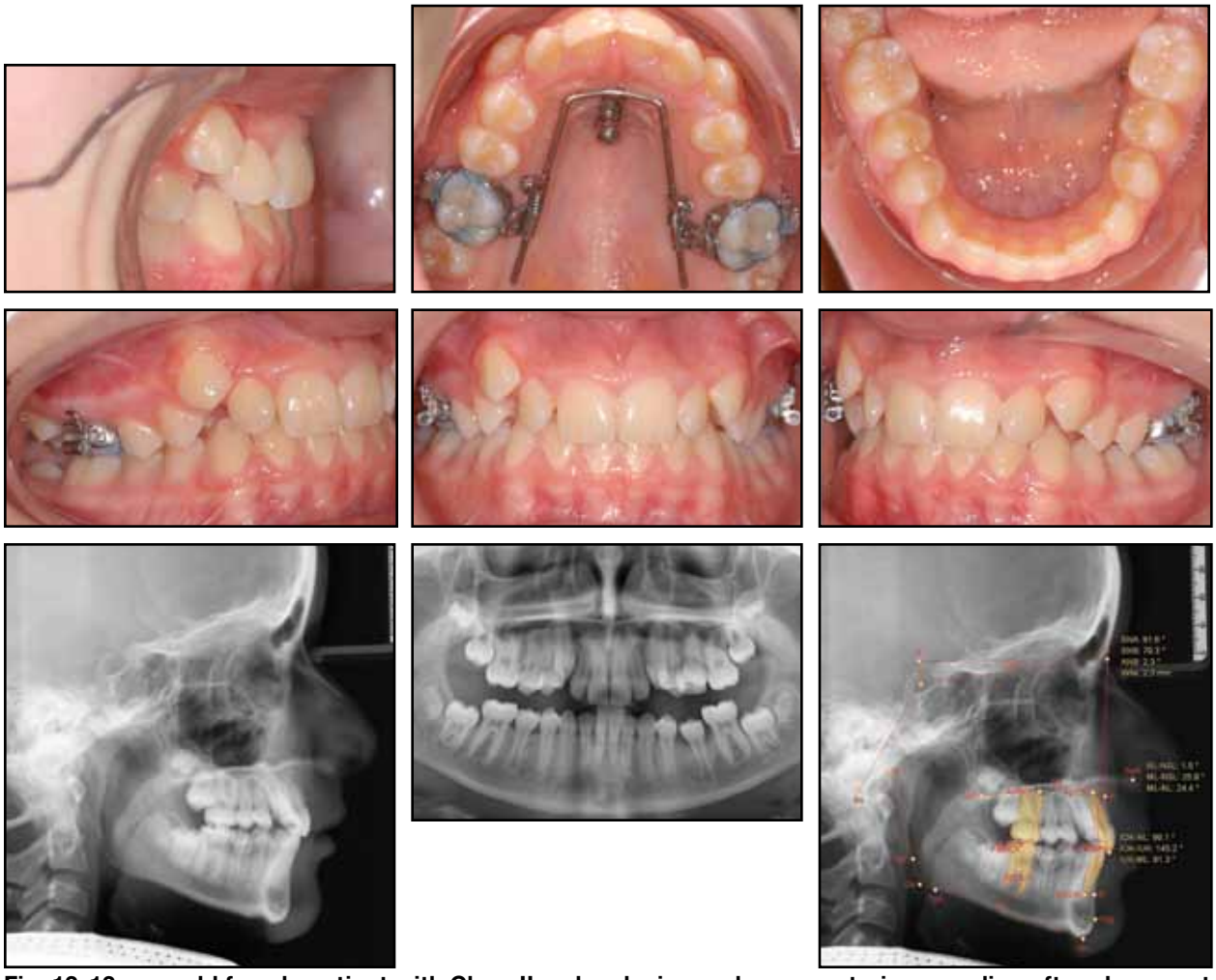

Fig. 12 12-year-old female patient with Class II malocclusion and upper anterior crowding after placement of Beneslider appliance.

Case Report

A 12-year-old female presented with a complete Class II malocclusion and anterior crowding (Fig. 12). The patient and her parents requested esthetic treatment without extractions.

Two Benefit mini-implants were placed in the anterior palate, and the Beneslider appliance was placed and activated. The patient easily adapted to the appliance and especially appreciated its esthetic appearance. After five months, spaces had opened in the premolar region (Fig. 13). Two months later, the molars were in a Class I relationship (Fig. 14A). Stainless steel ligatures were then

Fig. 13 After five months of molar distalization.

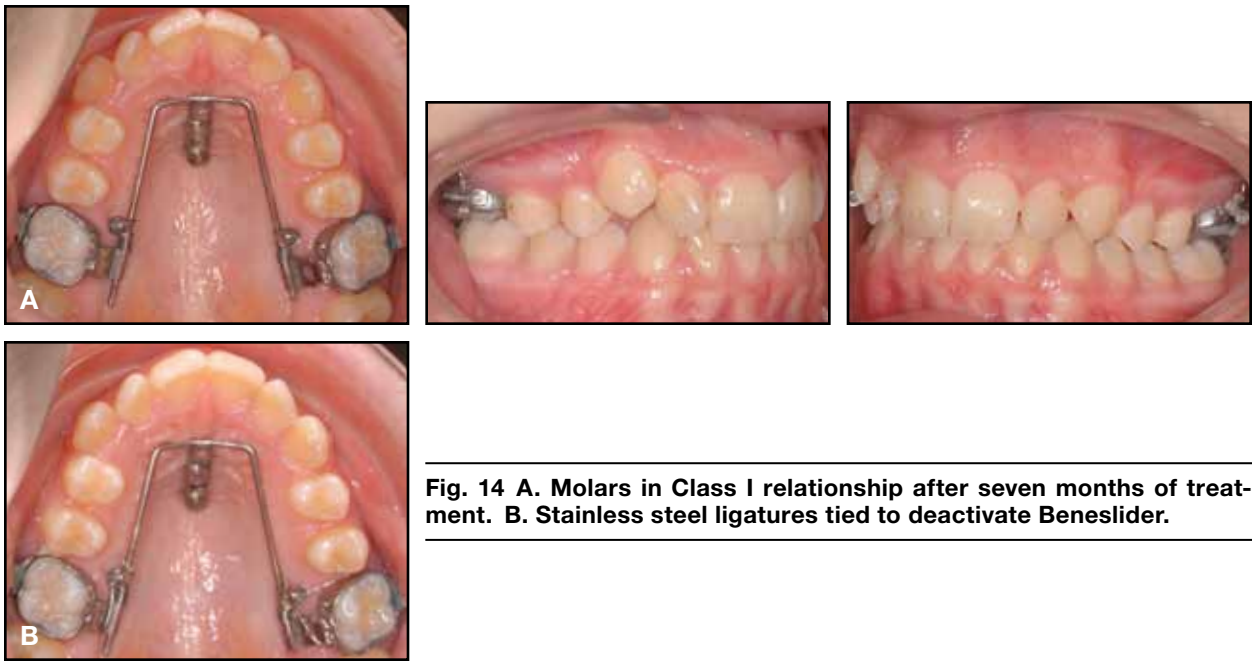

Fig. 14 A. Molars in Class I relationship after seven months of treatment. B. Stainless steel ligatures tied to deactivate Beneslider.

Fig. 15 Attachments bonded to teeth (arrows) and Ortho Caps aligners fabricated for finishing, with Beneslider kept in place.**

tied between the Benetubes and the activation locks, converting the Beneslider to a passive anchorage device (Fig. 14B). Impressions were taken for fabrication of aligners** to finish treatment (Fig. 15).

After a total 13 months of treatment (seven months of distalization, two months of retention, and four months of aligner treatment), the Beneslider was debonded. Post-treatment records showed significant bodily distalization of the molars (Fig. 16).

Discussion

We have placed 164 Beneslider appliances for molar distalization, with only 3.9% mini-implant failures. This high success rate for TADs in the anterior palate is corroborated by other authors.[22] Since there are no roots, blood vessels, or nerves in the region, the risk of complication is extremely low; even penetration of the nasal cavity does not seem to create any problems.[33] The orthodontist can easily insert mini-implants in this area without referring the procedure to an oral surgeon.

In a previous study of Beneslider mechanics, we recorded an average 4.6mm bodily movement of the molars.[25] This amount ranks in the upper third of molar distalization compared to other studies of non-skeletally anchored distalization

**Ortho Caps GmbH, Hamm, Germany; www.orthocaps.com.

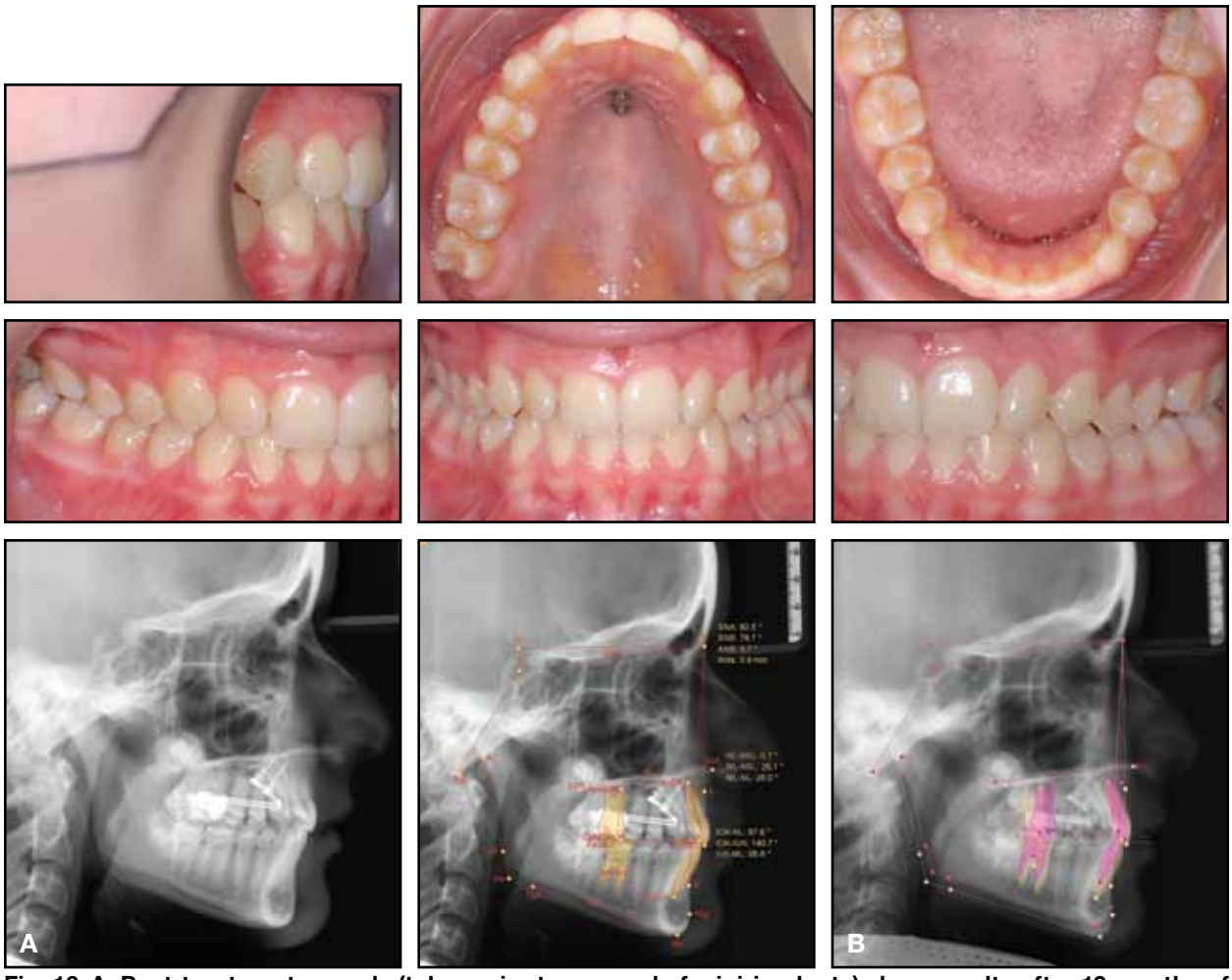

Fig. 16 A. Post-treatment records (taken prior to removal of mini-implants) show results after 13 months of total treatment time. B. Superimposition of pre- and post-treatment cephalometric tracings (final cephalogram taken prior to removal of Beneslider).

appliances (1.4-6.1mm).[34]

In all our cases, including adolescents, the mini-implants were inserted in the area of the midpalatal suture. The maximum insertion moments of mini-implants placed in the anterior and median regions of the suture range from 8Ncm to 25Ncm, which can be regarded as adequate for primary stability. Although Asscherickx and colleagues did note an inhibition of transverse maxillary growth after inserting tandem Orthosystem*** implants in the sutures of beagles,[35] only one control animal was used in this study, and only one parameter differed between the experimental and control groups.[36] Furthermore, the applicability of this research to mini-implants is questionable due to the greater diameter and rough surface of the Orthosystem implants. We have not observed any tendency toward impaired transverse maxillary growth in our cases, but future studies should investigate this issue in more detail. If desired, the mini-implants can be inserted as far as about 3mm lateral to the suture, where sufficient bone volume is still available.[37]

In some patients, we saw transverse maxillary expansion with a scissor-bite tendency during distalization. An intraoral compression of the .045" wire with a three-prong plier resolves this problem.

Conclusion

The Beneslider is an effective and reliable appliance for upper molar distalization. Abutments provide a stable and reliable connection between the mini-implants and the distalization mechanism. After distalization, finishing can be performed with labial or lingual fixed appliances or, in many cases, with aligners.

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