

# Combination of Clear Aligners and Beneslider for Correction of Severe Midline Deviation

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In a Class II subdivision molar relationship, the buccal intermaxillary dental relationship on one side is a Class I, while the contralateral side is a Class II. An accompanying midline shift of the maxillary anterior teeth is often observed. The asymmetry between the buccal dental segments can be caused by an underlying dental or skeletal issue or a combination of both.

Unilateral distalization of the maxillary premolars and molars is a treatment option for patients presenting with the absence of one or more premolars. Molar distalization can be performed using either intra- or extraoral appliances. Considering the compliance issues involved with the prolonged use of extraoral appliances such as headgear,<sup>1,2</sup> however, there has been an increasing clinical use of purely intraoral appliances with minimal need for patient cooperation.

Unfortunately, most toothborne appliances for upper molar distalization produce the unwanted

side effect of anchorage loss, resulting in excessive upper incisor proclination—reportedly 24–55% of the total observed tooth movement.<sup>3–5</sup> To minimize anchorage loss, mini-implants have been incorporated into the design of maxillary distalization appliances.<sup>6–16</sup> Mini-implants can be positioned intraorally with minimal surgical invasiveness, are readily integrated into orthodontic mechanics, and are relatively cost-effective.<sup>17–23</sup>

More and more patients are seeking “invisible” orthodontic treatment with clear aligner therapy. Because pure bodily movement is difficult to



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**Fig. 1** 20-year-old female patient with Class II, division 1 subdivision left malocclusion, severe midline shift to right, and proclination of upper incisors.

achieve with plastic aligners alone, only a limited amount of uni- or bilateral molar distalization can be produced. A few authors have reported as much as 2.5mm of distal upper molar movement, but a high level of patient compliance is required, since intermaxillary Class II elastics must be worn during sequential upper molar distalization.<sup>24-26</sup> Moreover, the potential side effects of Class II elastics should be considered in terms of a mesial shift of the lower anchorage teeth and resultant protrusion of the incisors. This can be a severe problem, especially in unilateral applications of Class II elastics, with the potential for development of a lower midline shift, maxillary arch rotation and yaw discrepancy, or transverse occlusal canting.

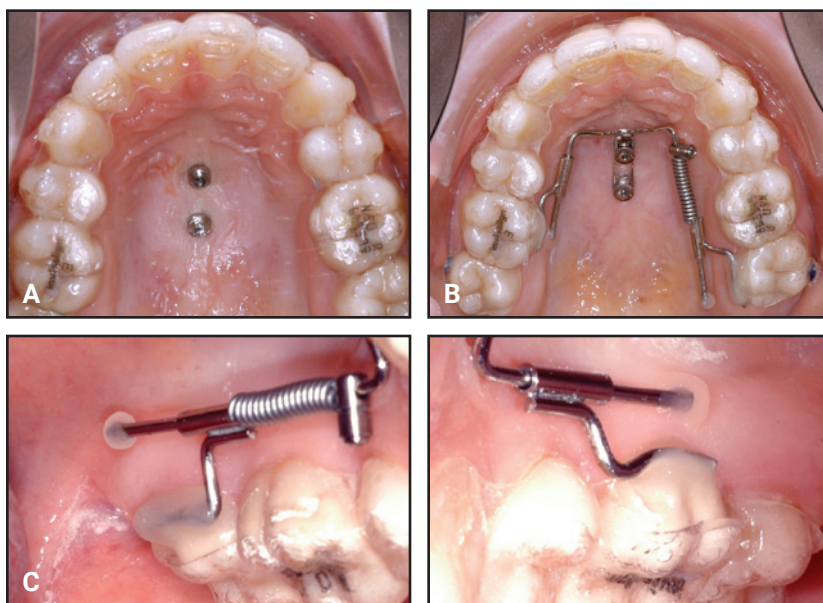
**Case Report**

A 20-year-old female presented with a Class II, division 1 subdivision left malocclusion, characterized by anterior crowding (Fig. 1, Table 1). The patient had previously undergone orthodontic treatment with full fixed appliances and the associated removal of four premolars. The maxillary posterior teeth were mesially positioned on the left side, resulting in an asymmetrical maxillary arch

**TABLE 1  
CEPHALOMETRIC ANALYSIS**

|                | Pretreatment | Post-Treatment |
|----------------|--------------|----------------|
| NSBa           | 127.8°       | 124.0°         |
| NL-NSL         | 4.7°         | 3.9°           |
| ML-NSL         | 21.9°        | 19.4°          |
| ML-NL          | 17.2°        | 15.5°          |
| SNA            | 92.5°        | 91.5°          |
| SNB            | 86.9°        | 87.6°          |
| ANB            | 5.6°         | 4.0°           |
| Wits appraisal | +4.0mm       | +0.3mm         |
| U1-NL          | 123.5°       | 110.7°         |
| L1-ML          | 100.9°       | 95.3°          |
| U1-L1          | 118.4°       | 138.5°         |
| Overjet        | 7.4mm        | 4.2mm          |
| Overbite       | 3.4mm        | 2.2mm          |

\*PSM North America Inc., Indio, CA; www.psm-na.us.



**Fig. 2 A. Two mini-implants inserted in anterior palate. B. Beneslider\* distalization appliance attached to mini-implants. C. Aligners cut out in connection areas with slider.**





**Fig. 3 After seven months of distalization.**

with a severe midline deviation to the right. The patient specifically requested “invisible” orthodontic treatment without extractions.

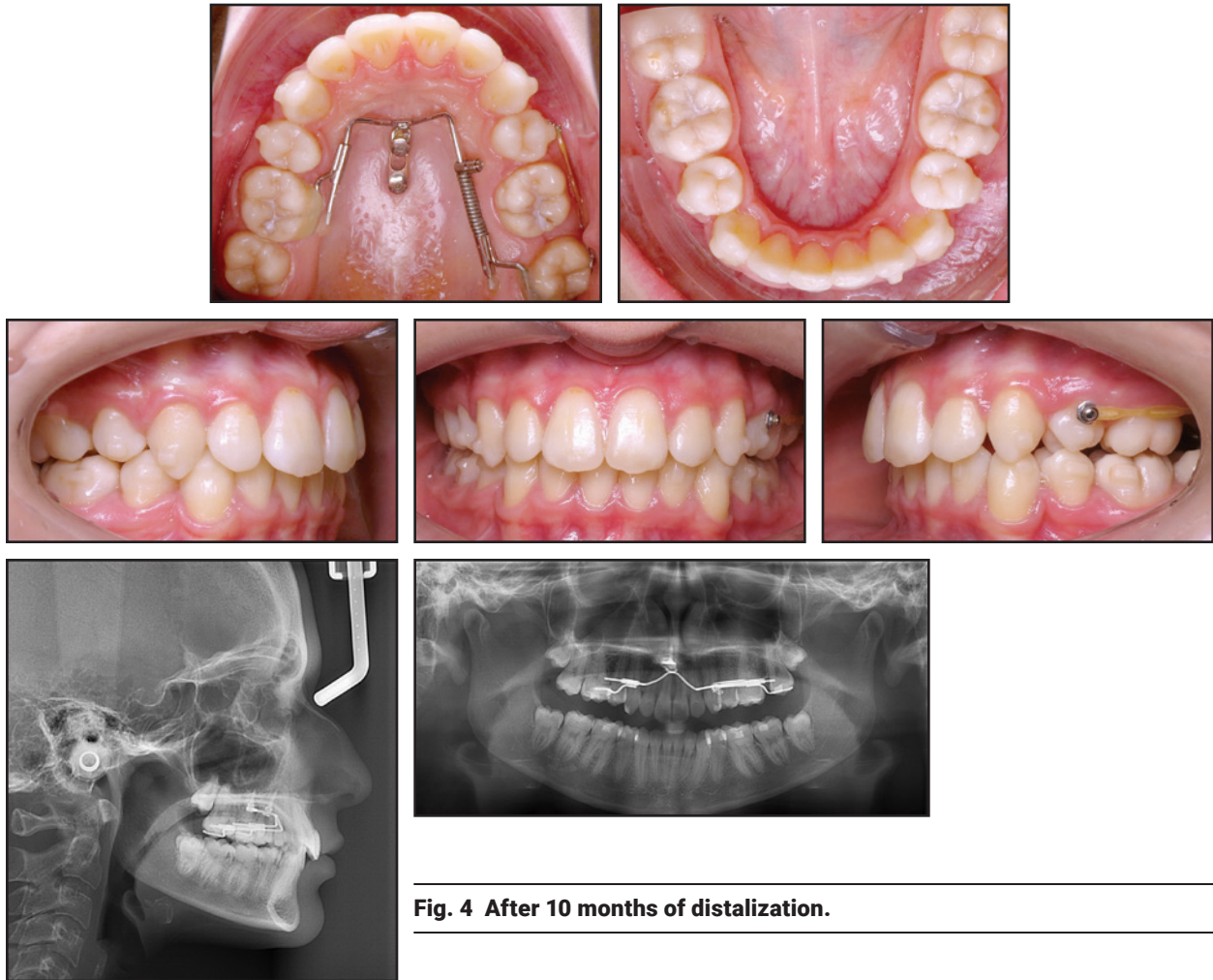
Digital scans were recorded for fabrication of clear aligners.\*\* The primary goal of the initial series was to address the overbite by leveling the curve of Spee through intrusion of the lower incisors. The manufacturer was instructed to fabricate the aligners with button cutouts on the palatal sides

of the upper right first and left second molars; these two sites would serve as connection areas for coupling with the distalization device.

Upon delivery of the aligners, two Benefit\* mini-implants were inserted in the anterior palate

\*PSM North America Inc., Indio, CA; [www.psm-na.us](http://www.psm-na.us).

\*\*Invisalign, registered trademark of Align Technology, Inc., San Jose, CA; [www.aligntech.com](http://www.aligntech.com).



**Fig. 4 After 10 months of distalization.**

(Fig. 2A), and an impression was taken. A Beneslider\* distalization appliance was later adapted on a plaster cast and inserted intraorally (Fig. 2B). The connection areas between the slider and the aligners were cut out (Fig. 2C). Treatment began with a 500g activation of the Beneslider by gentle compression of the lock onto the nickel titanium coil spring. The upper left molars were to be distalized about 5mm, while the upper right molars were securely anchored.

After seven months of active distalization, when several small interdental spaces were visible in the maxillary left buccal segment, an elastic

chain was added for retraction of the upper left second premolar (Fig. 3). After 10 months of active treatment, the upper left second molar had been distalized into a Class I occlusion, and the panoramic radiograph confirmed bodily distalization of the upper buccal segments (Fig. 4).

During the subsequent retraction period, the Beneslider was deactivated with a stainless steel ligature between the bonded tube and the activation lock. Thus, the slider was transformed into a passive molar anchorage device to keep the upper left second molar in position. The primary objective was to stabilize the maxillary molars during





**Fig. 5** After 14 months of treatment, Beneslider maintained in passive state using stainless steel ligature.



**Fig. 6** After 17 months of treatment.

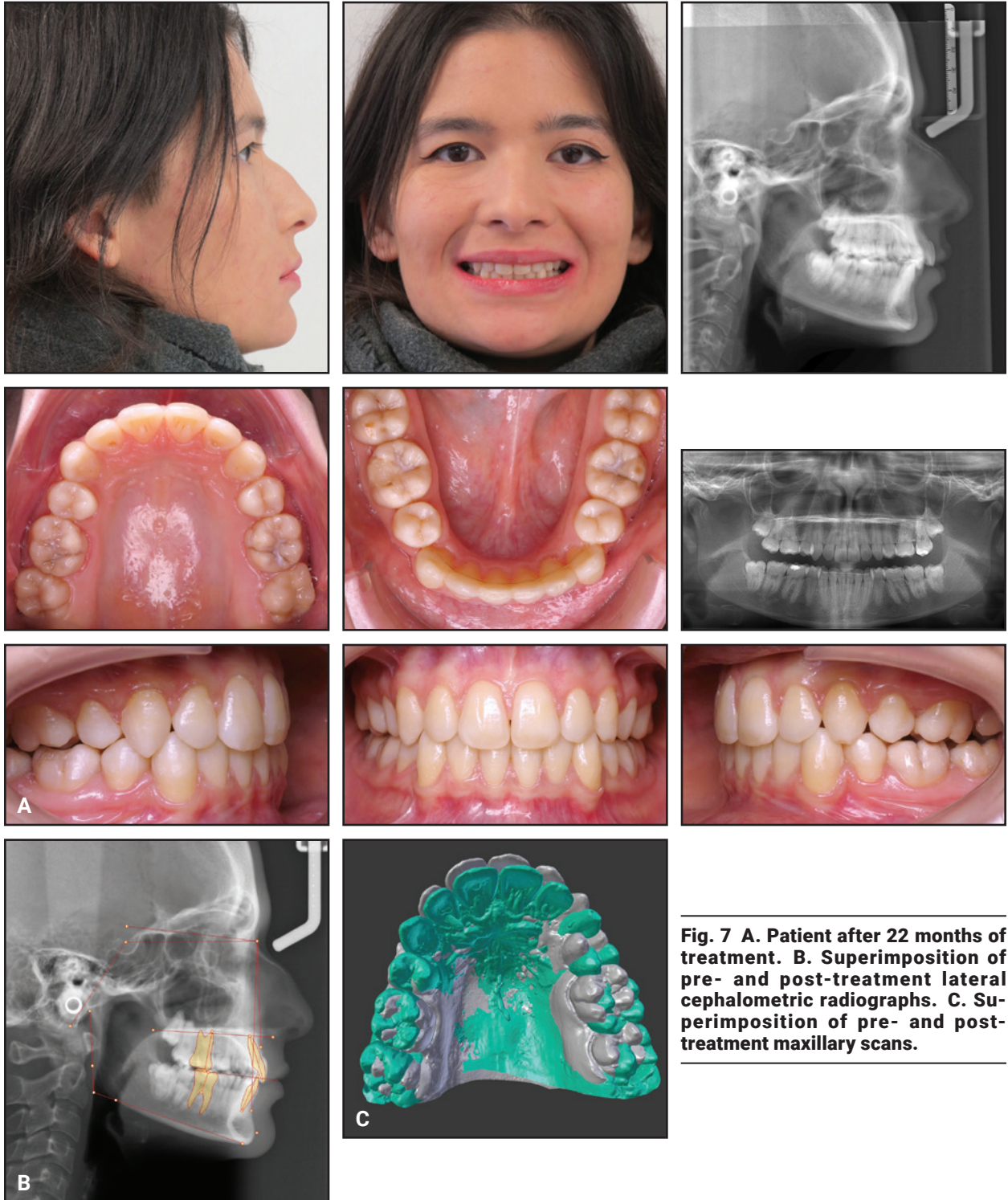
retraction of the maxillary anterior teeth (Fig. 5).

After 17 months of treatment, the interdental spaces were nearly closed to the distal, facilitating simultaneous correction of the deviated upper midline (Fig. 6). Comprehensive treatment was completed in 22 months (Fig. 7), and the palatal mini-implants were removed without anesthesia.

One year later, the treatment outcome remained stable (Fig. 8).

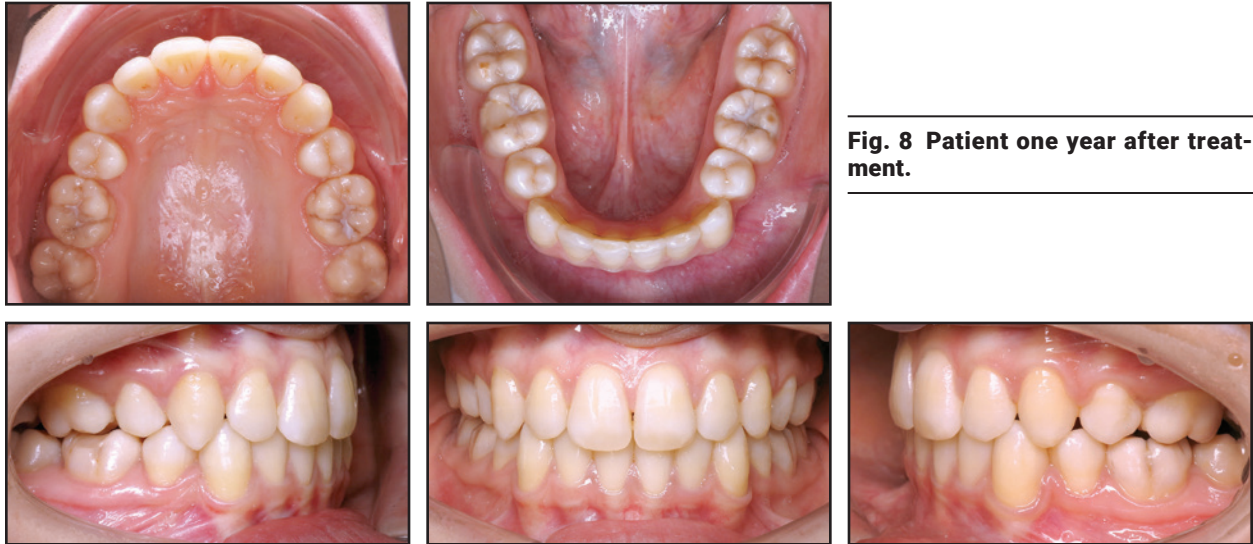
### Discussion

Various implant-supported molar distalization appliances have been introduced in recent years.



**Fig. 7 A.** Patient after 22 months of treatment. **B.** Superimposition of pre- and post-treatment lateral cephalometric radiographs. **C.** Superimposition of pre- and post-treatment maxillary scans.





**Fig. 8 Patient one year after treatment.**



**Fig. 9 Alternative method showing aligner material covering bonded connection.**

The retromolar region is unsuitable for mini-implant insertion due to poor bone quality and thick soft tissue.<sup>27</sup> Additionally, the alveolar process has been shown to be inappropriate for molar distalization because the mini-implants are in the direct path of the moving teeth, resulting in a much higher failure rate than when the anterior palate is used.<sup>28,29</sup>

The palatal area posterior to the third rugae, known as the T-Zone,<sup>30</sup> is the preferred mini-implant insertion site when the treatment objective is distal movement of the upper first permanent molars without associated anchorage loss and upper incisor displacement. Good bone quality with thin attached mucosa ensures a minimal risk of dental root injuries and a high success rate.<sup>27</sup> In contrast

to treatment strategies involving interradicular mini-implants, when the molars are distalized, the premolars are free to move distally due to the stretch of interdental fibers. Because the palatal mini-implants are not in the path of moving teeth, they do not interfere with distalization. Within the T-Zone, mini-implants can be inserted in a median or paramedian orientation,<sup>30</sup> with both insertion patterns demonstrating similar stability.<sup>31</sup>

CAD/CAM-manufactured insertion guides that facilitate safe and precise insertion of mini-implants in the anterior hard palate have recently been developed, offering less-experienced clinicians the opportunity to use palatal implants. These insertion guides allow both the mini-implants and the attached appliance to be placed in a single office visit.<sup>32,33</sup>

If clear aligners are to be employed for tooth movement, we recommend the use of bonded tubes instead of the traditional bands.<sup>34</sup> Bonded tubes offer the advantage of better esthetics and do not interfere with the adaptability and fit of the aligners. The aligner can be cut out in the connection area, as shown in the present case, or the aligner material can cover the bonded connection, as with a large attachment (Fig. 9). If the aligner material is to cover the molar connection area, impressions should be taken after fitting and insertion of the



mini-implant-borne appliance, but the distalization appliance should not be activated before delivery of the aligners. If the aligners are to be fabricated with cutout areas, the impressions can be taken either before or after insertion of the distalization appliance.

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