

# Treatment of Severe Maxillary Crowding Using Invisalign and Fixed Appliances

ALDO GIANCOTTI, DDS  
RAFFAELLA DI GIROLAMO, DDS

**A**dult patients with severe maxillary-arch crowding often have additional dental problems that can make their treatment even more challenging. In such a case, an appropriate treatment plan that corrects the malocclusion while respecting the integrity of the dentition should be developed by a multidisciplinary team.

Despite its limitations, the Invisalign\* system has been used to treat adult orthodontic patients with increasingly complex malocclusions.<sup>1-7</sup> When severe localized crowding is treated solely with Invisalign, however, midcourse corrections or refinements are often required. The combination of clear aligners and conventional fixed appliances can offer significant advantages, including a reduced risk of root damage.

Clinicians who plan to use aligners to correct severe maxillary-arch crowding in adults face two major challenges. First, although the root positions must be carefully controlled during extraction space closure, this is one of the most significant limitations of the Invisalign technique. If mesial

tipping exceeds 10-15° during space closure, a segmental or full fixed appliance is strongly recommended to reposition the tipped teeth after the aligner therapy. Second, in a case of severe localized crowding, the thermoformed aligners may not properly grip all the teeth to be moved. This situation calls for a fixed appliance to be used before Invisalign therapy. The following patient illustrates such treatment.

## Case Report

A 30-year-old female patient presented with a Class II malocclusion and a hyperdivergent skeletal pattern (Fig. 1, Table 1). She was particularly concerned about the crowding of her maxillary front teeth, and she also wanted esthetic treatment. Intraoral examination showed “V”-shaped dental arches with severe crowding on the upper right side. The maxillary right canine had erupted ectopically, and the lateral incisor was displaced palatally in a crossbite position. The upper midline was shifted 3mm to the right, and the lower midline 1mm to the left. Mild crowding was also present in the lower arch, with the left lateral incisor in an edge-to-edge occlusion. All third molars were present; the lower third molars were partially erupted.

The upper left first premolar had a preexisting restoration, but the upper right first premolar was healthy. Because severe crowding was observed only in the upper arch and the axial position of the lower incisors was acceptable, extraction of the two upper first premolars was considered the most appropriate option. A combined treatment plan was developed involving distalization of the



Dr. Giancotti

Dr. Di Girolamo

Dr. Giancotti is an Assistant Professor and Dr. Di Girolamo is a clinical consultant, Department of Orthodontics, Associazione Fatebenefratelli per la Ricerca, Fatebenefratelli Hospital, University of Rome “Tor Vergata”, Rome, Italy. E-mail Dr. Giancotti at [giancotti@uniroma2.it](mailto:giancotti@uniroma2.it).

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**Fig. 1** 30-year-old female patient with Class II malocclusion and hyperdivergent skeletal pattern.



**Fig. 2** TMA\*\* T-loops for canine retraction.

**TABLE 1  
CEPHALOMETRIC DATA**

	Norm	Pretreatment	Post-Treatment
SNA	82° ± 3.5°	79°	79°
SNPog	80° ± 3.5°	74°	75°
ANPog	2° ± 2.5°	5°	4°
S-N/ANS-PNS	8° ± 3.0°	8°	8°
S-N/Go-Gn	33° ± 2.5°	39°	36°
ANS-PNS/Go-Gn	25° ± 6.0°	31°	28°
U1/ANS-PNS	110° ± 6.0°	110°	109°
L1/Go-Gn	94° ± 7.0°	84°	84°
L1/A-Pog	2.0mm ± 2.0mm	5mm	5mm
Overjet	3.5mm ± 2.5mm	3mm	2mm
Overbite	2.0mm ± 2.5mm	3mm	2mm
U1/L1	132° ± 6.0°	116°	119°

maxillary canines using fixed appliances, followed by Invisalign therapy.

After extraction of the maxillary first premolars, brackets were bonded bilaterally from the maxillary canines to the first molars. The canines

were retracted using T-loops in segmented .017" × .025" TMA\*\* wire (Fig. 2) over a period of four months (Fig. 3).

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**Fig. 3 Patient after four months of canine retraction.**

## Treatment of Severe Maxillary Crowding Using Invisalign

The ClinCheck\* projection anticipated satisfactory resolution of all occlusal anomalies,

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correction of the overjet and overbite, and alignment of the upper anterior teeth (Fig. 4). Standard .75mm elliptical attachments were bonded to the upper right second premolar and canine to provide reciprocal anchorage for labial movement of the

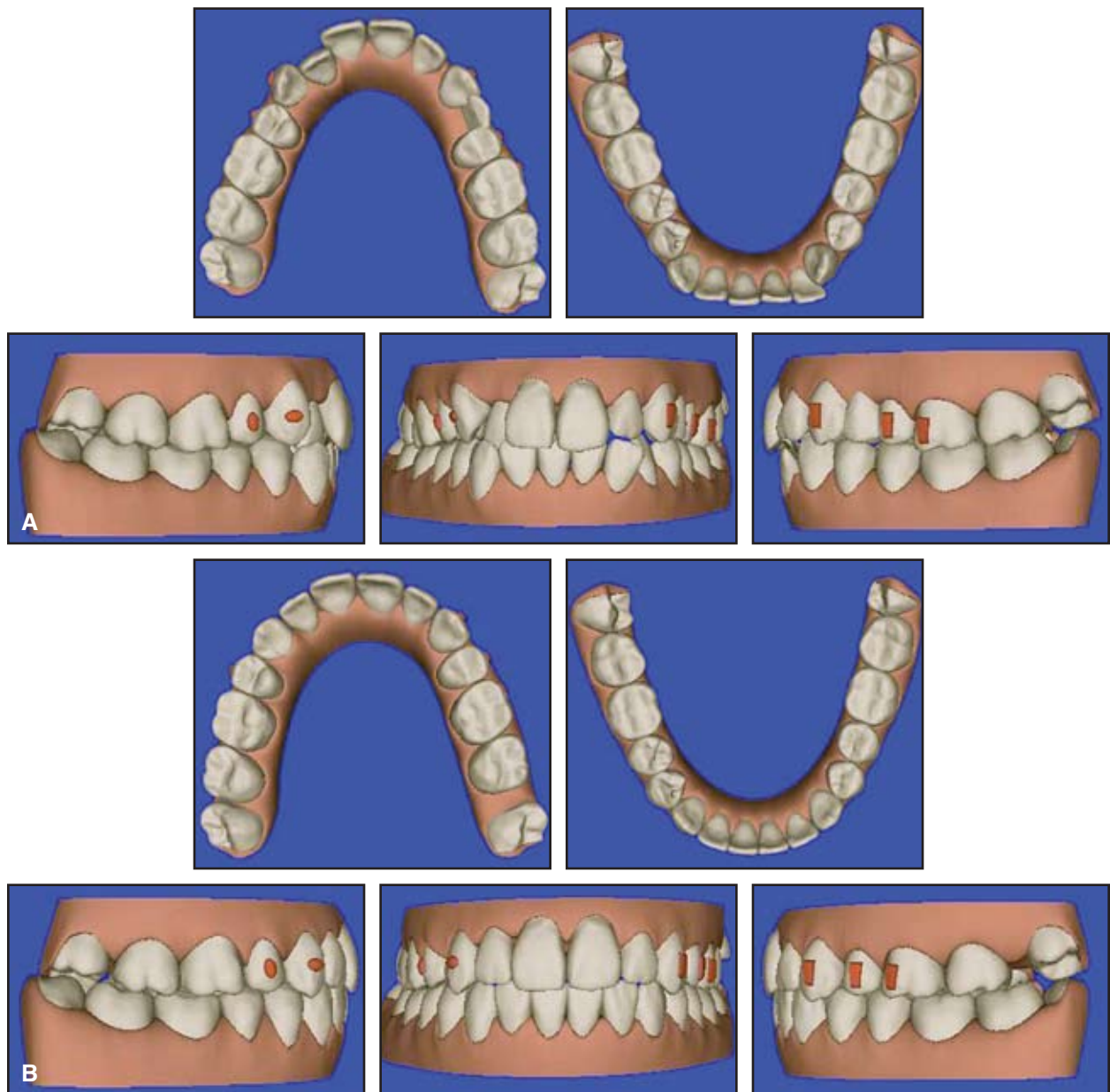


Fig. 4 Initial ClinCheck (A) and projection of treatment outcome (B).

upper right lateral incisor. On the left side, vertical rectangular attachments were placed on the canine, second premolar, and first molar to promote bodily movement during space closure. Minor reproximation was required in the lower arch.

Thirty-six aligners were planned for the upper arch and 18 for the lower arch. The patient was seen every four to six weeks (two to four aligners) to check for aligner fit, attachment stability, and cooperation. The initial Invisalign phase lasted 18 months (Fig. 5).

Because the lower left lateral incisor did not move as intended, lingual and labial grooves were added to the next aligner with detailing pliers. This adjustment produced the intended rotation. The patient needed nine refinement aligners and Class III elastics to correct the buccal intercuspation over the ensuing five months (Fig. 6).

The patient wore each aligner for two weeks as directed. After 23 months of Invisalign treatment, she was given clear overlay retainers to wear in both arches at night only.

At the end of treatment, the upper anterior teeth were aligned, and the upper right lateral incisor was properly positioned (Fig. 7). No adverse effects were observed on the adjacent teeth. The midlines were coincident and centered in the face.

The periodontium was generally healthy, with esthetic anterior gingival margins resulting in a pleasant smile.

Although the angulations of the maxillary canine roots were not ideal on the final panoramic x-ray, the outcome compared favorably with similar cases treated with fixed appliances alone. Moreover, the roots of the upper lateral incisors maintained a “neutral” tip, as was seen prior to treatment. No root resorption was evident on the final panoramic and apical x-rays.

Cephalometric analysis showed that the positions of the maxillary and mandibular incisors changed only slightly, while the interincisal angle increased by  $3^\circ$  (Table 1). The vertical dimension was controlled to a greater extent in the upper molars than in the lower molars, although the intermaxillary divergence was reduced. The convexity of the profile and the nasolabial angle did not change significantly.

## Discussion

The potentially traumatic effects of orthodontic forces should be considered when planning treatment for adult patients. For example, apical root resorption is often associated with extractions



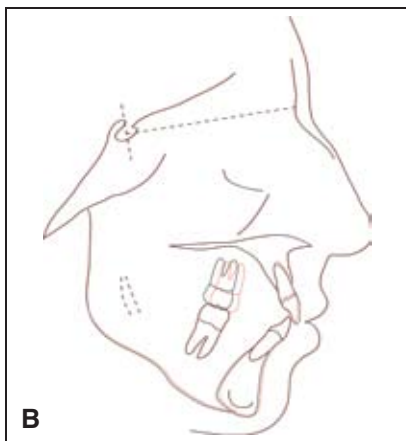
Fig. 5 After 18 months of Invisalign treatment.



Fig. 6 Case refinement using Class III elastics.



Fig. 7 A. Patient after 27 months of fixed-appliance and Invisalign treatment (continued on next page).



**Fig. 7 (cont.) B. Superimposition of pre- and post-treatment cephalometric tracings.**

because of the substantial apical displacements involved in the retraction of anterior teeth.<sup>8-12</sup> DeShields<sup>13</sup> and others<sup>8,10</sup> have reported a significant correlation between maxillary incisor retraction and root resorption. To protect the dental roots of adult patients, most clinicians attempt to minimize the amount of horizontal and vertical tooth movement and limit the duration of treatment.

Combining fixed appliances with Invisalign treatment is a reasonable option for a significant number of adult patients seeking orthodontic correction of severe localized crowding. This approach promotes and maintains the integrity and health of dental roots and periodontal tissues, increasing the likelihood of a good long-term outcome.

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