

# CASE REPORT

## Extraction Treatment of Class II, Division 2 Malocclusion and Deep Overbite Using Aligners and Temporary Anchorage Devices

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**C**lear aligners have become firmly established as a means of orthodontic treatment, primarily because of their comfort<sup>1</sup> and esthetics<sup>2</sup> compared with conventional fixed appliances. Although the basic Invisalign\* system has been shown to be a viable alternative for

nonextraction treatment of mild to moderate malocclusions,<sup>3,4</sup> more complex tooth movements require the use of auxiliaries such as temporary anchorage devices (TADs) or intermaxillary elastics.<sup>5</sup>

\*Registered trademark of Align Technology, Inc., San Jose, CA; www.aligntech.com.



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Clear aligner treatment involving premolar extractions is even more difficult to manage.<sup>6</sup> The advantage of digital planning with the ClinCheck\* program is that it can be used to control molar anchorage and incisor torque, both of which are extremely important during space closure.<sup>7</sup> The effectiveness of aligners in achieving tooth movements such as these, as well as central incisor retraction and premolar derotation, will depend on the patient’s age, the amount of tooth movement required, and the clinician’s skill in using attachments.<sup>8</sup>

The complex mechanics needed for incisor intrusion during space closure may require addi-

tional anchorage.<sup>9</sup> Moreover, while successful deep-bite correction using TADs and conventional fixed appliances has been described,<sup>10</sup> there is a lack of published reports about the utilization of such mechanics with clear aligner therapy, especially in premolar extraction cases.

This case report illustrates the treatment of a Class II, division 2 malocclusion and deep overbite in an adult patient using maxillary first-premolar extractions, clear aligners, TADs, and Class II elastics.

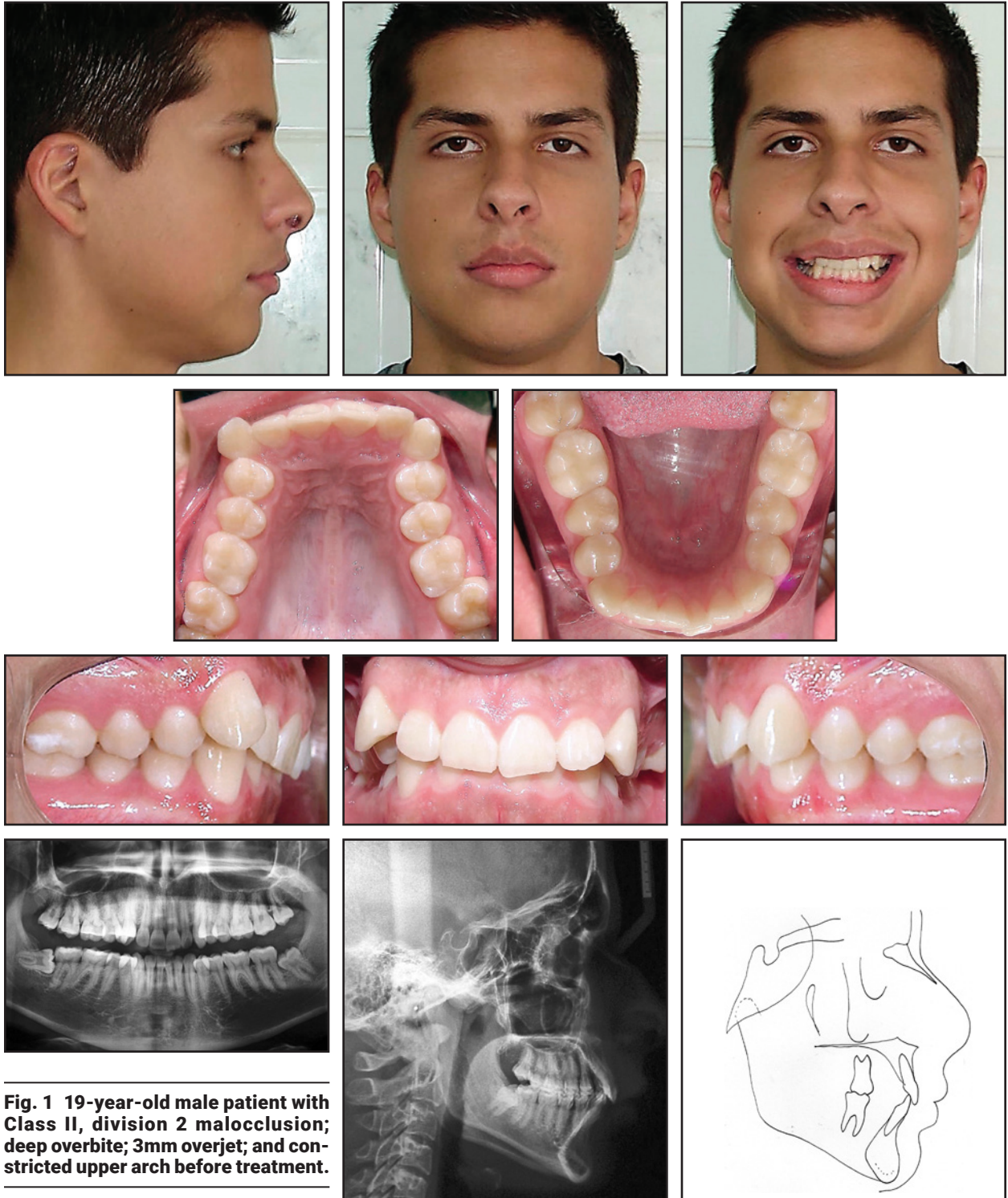
**Diagnosis and Treatment Plan**

A 19-year-old male presented with the chief complaints of misaligned teeth and a deep overbite (Fig. 1). He had a symmetrical face with a convex

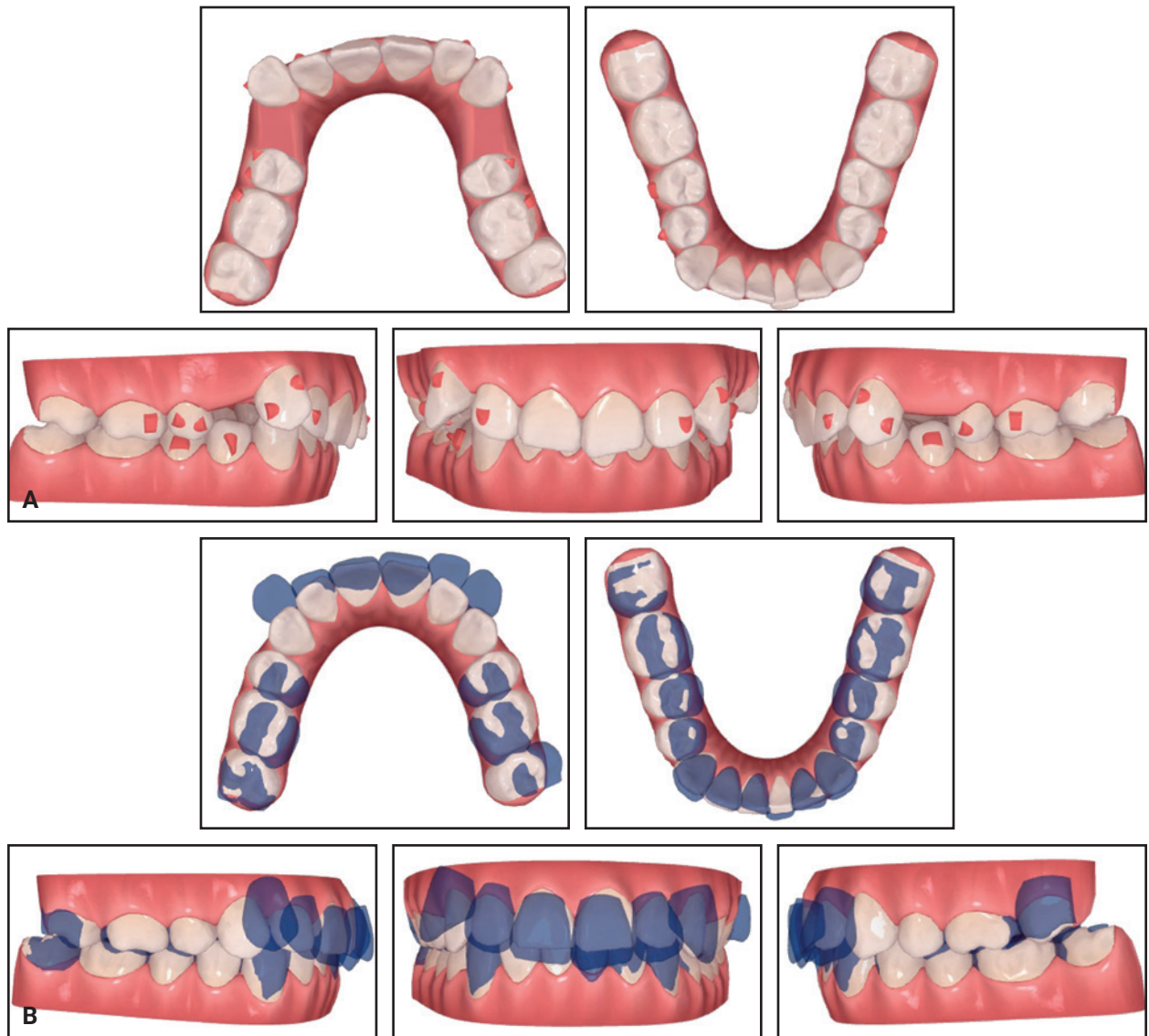
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**TABLE 1  
CEPHALOMETRIC ANALYSIS**

	Pretreatment	Post-Treatment	One Year Post-Treatment
SNA	89°	89°	89°
SNB	82°	83°	83°
ANB	7°	6°	6°
Wits appraisal	+7mm	+7mm	+7mm
Facial angle	83°	84°	86°
Convexity	15°	12°	13°
FMA	26°	24°	25°
SN-GoGn	27°	26°	27°
Y-axis	62°	61°	63°
U1-NA	-1mm	1mm	0mm
U1-NA	11°	24°	18°
L1-NB	8mm	9mm	8mm
L1-NB	35°	29°	27°
IMPA	103°	99°	96°
Interincisal angle	126°	120°	128°
Z-angle	69°	72°	71°



**Fig. 1** 19-year-old male patient with Class II, division 2 malocclusion; deep overbite; 3mm overjet; and constricted upper arch before treatment.



**Fig. 2 A. ClinCheck\* plan for upper first-premolar extractions and bonded attachments. B. Comparison of initial virtual model (blue) and predicted final tooth positions (white).**

profile. Intraoral examination found a Class II, division 2 malocclusion with a 3mm overjet and a 90% overbite. The maxillary arch was constricted at the level of the first molars and premolars, with the maxillary right canine in infraeruption. The arch-length deficiency was 8mm in the maxillary arch and 4.5mm in the mandibular arch. The

maxillary midline was coincident with the facial midline, but the mandibular midline was shifted 1mm to the right.

The panoramic radiograph showed adequate

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**Fig. 3** After 21 months of treatment (first stage of aligners).



alveolar bone and impacted mandibular third molars. Cephalometric analysis (Table 1) indicated a skeletal Class II relationship ( $ANB = 7^\circ$ , Wits appraisal = +7mm) with a mesofacial growth pattern ( $SN-GoGn = 27^\circ$ ,  $FMA = 26^\circ$ ). The maxillary incisors were retroclined ( $U1-NA = 11^\circ$ ), and the mandibular incisors were proclined ( $L1-NB = 35^\circ$ ,  $IMPA = 103^\circ$ ).

Treatment objectives included leveling and alignment, space closure, achievement of Class I canine relationships on both sides, normalization of overjet and overbite, and improvement of the facial profile.

The first treatment alternative involved extraction of the maxillary first premolars, bonding of full fixed appliances, and space closure with sliding mechanics, using Class II elastics. The second option called for the same extractions followed by Invisalign treatment and space closure with Class II elastics. The patient preferred the use of clear aligners because of their comfort, ease of cleaning, and esthetics.

### Treatment Progress

The maxillary first premolars were extracted. Posterior attachments were bonded to facilitate

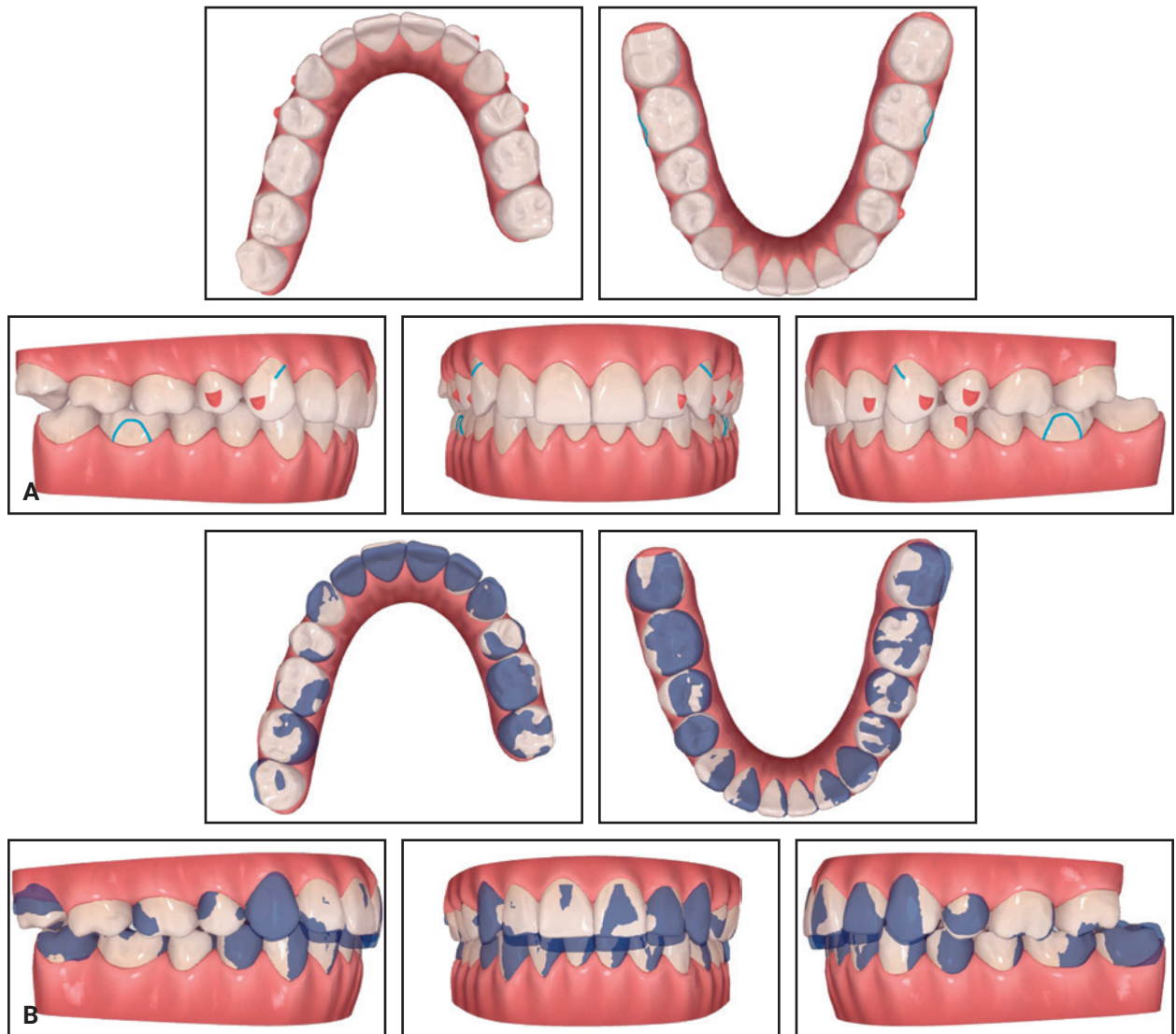
tooth movement as planned in the ClinCheck (Fig. 2). The treatment plan called for 42 maxillary aligners and 15 mandibular aligners, to be worn 20-22 hours per day and changed every 14 days. Passive lower aligners were worn after the initial 15 trays.

At the end of the first stage of treatment, which required 21 months, a slight Class II canine relationship remained on the right side and the deep overbite persisted (Fig. 3). We therefore decided to take new impressions for additional aligners (Fig. 4). Twenty aligners were prescribed for each arch.

Six months later, buccal miniscrews were inserted between the maxillary canine and lateral incisor on each side to provide anchorage for elastics to correct the deep bite (Fig. 5). Class II elastics were also worn for the last three months of treatment.

### Treatment Results

After 31 months of treatment, all objectives were achieved (Fig. 6). Class I canine relationships were obtained on both sides, with normal overjet and overbite (Table 1). Dental and facial esthetics were substantially improved. The outcome remained stable one year later (Fig. 7).



**Fig. 4 A. Second ClinCheck projection, showing bonded attachments and precision cuts for additional aligners. B. Comparison of second virtual model (blue) and predicted final tooth positions (white).**

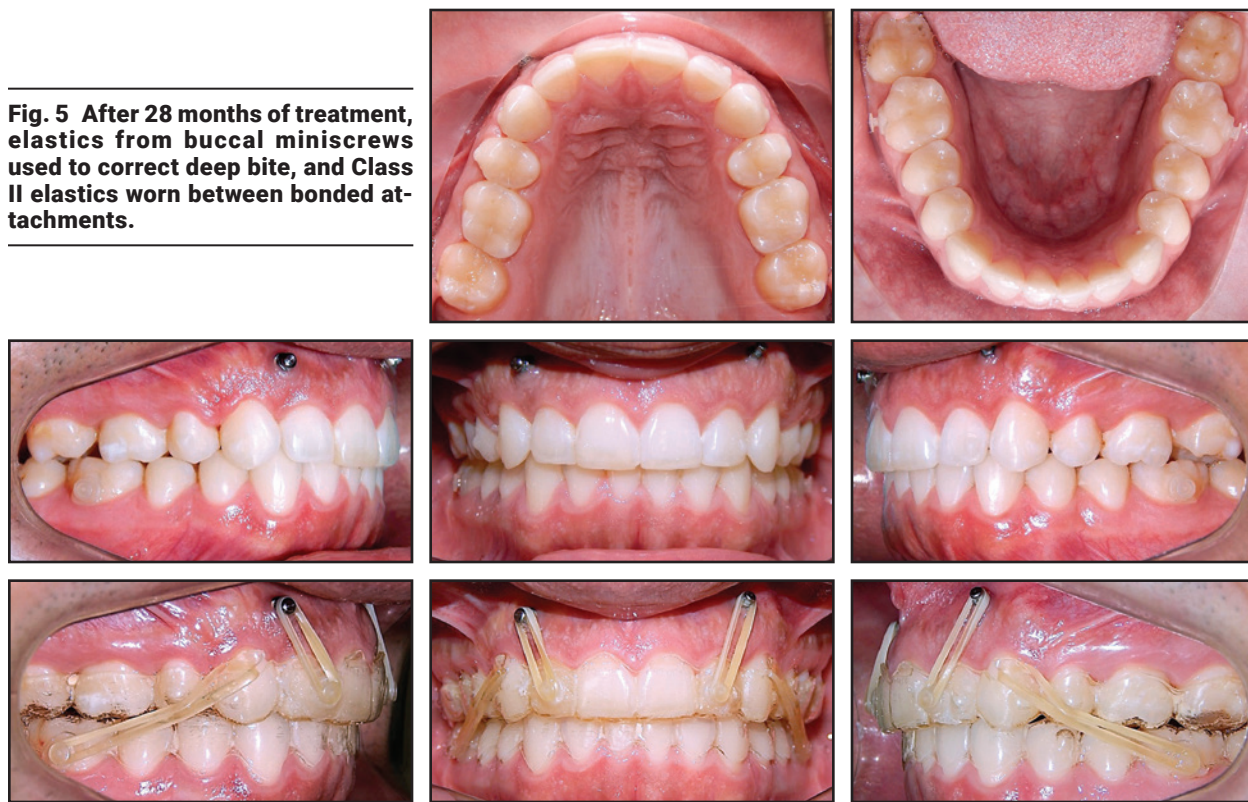
## Discussion

When clear aligners are used in extraction cases, the tilting effect makes it difficult to control torque during maxillary incisor retraction.<sup>11</sup> Several authors have found significant tipping of the adjacent crowns rather than bodily tooth movement.<sup>6</sup> It is important to point out, however, that

the Invisalign system has been improved for management of premolar extraction cases.<sup>12</sup> Li and colleagues, in a comparison of Invisalign with conventional fixed appliance treatment, reported similar scores for alignment, marginal ridge leveling, occlusal relationship, overjet, interproximal contacts, and root angulation.<sup>13</sup>

In the present case, TADs were placed between

**Fig. 5** After 28 months of treatment, elastics from buccal miniscrews used to correct deep bite, and Class II elastics worn between bonded attachments.



the lateral incisors and canines on both sides after space closure to anchor intrusion and proclination of the maxillary incisors for correction of a deep overbite. To ensure proper finishing, it is critical to program overcorrection or to prescribe additional aligners.<sup>8</sup> In this patient, additional aligners were used in conjunction with TADs and Class II elastics.

Gu and colleagues reported that Invisalign patients finished treatment 30% (5.7 months) faster than patients wearing conventional fixed appliances, but that the fixed appliances corrected the malocclusions more effectively. The need for additional aligners to achieve equivalent results may negate the savings in treatment time.<sup>14</sup> In fact, an analysis of extraction cases found 44% longer treatment times with Invisalign than with fixed appliances.<sup>13</sup> In our case, the first stage of aligner treatment lasted 21 months, but additional detailing with new aligners required another 10 months.

Studies of adult patients have shown that the Invisalign system can manage the vertical dimension relatively well in deep-bite cases, with a 1.5mm median bite opening.<sup>15</sup> This correction primarily involves proclination of the mandibular incisors and intrusion of the maxillary incisors. Auxiliary devices can be employed if a more substantial overbite correction is required, as demonstrated in our patient. The force applied from TADs to the maxillary incisors resulted in intrusion and proclination of those teeth, while Class II elastics were used to improve the sagittal relationship.

The orthodontist's expertise and clinical experience, as well as the patient's compliance and motivation, are fundamental to treatment success,<sup>6</sup> especially in complex aligner cases where the application of TADs and elastics will play an important role.

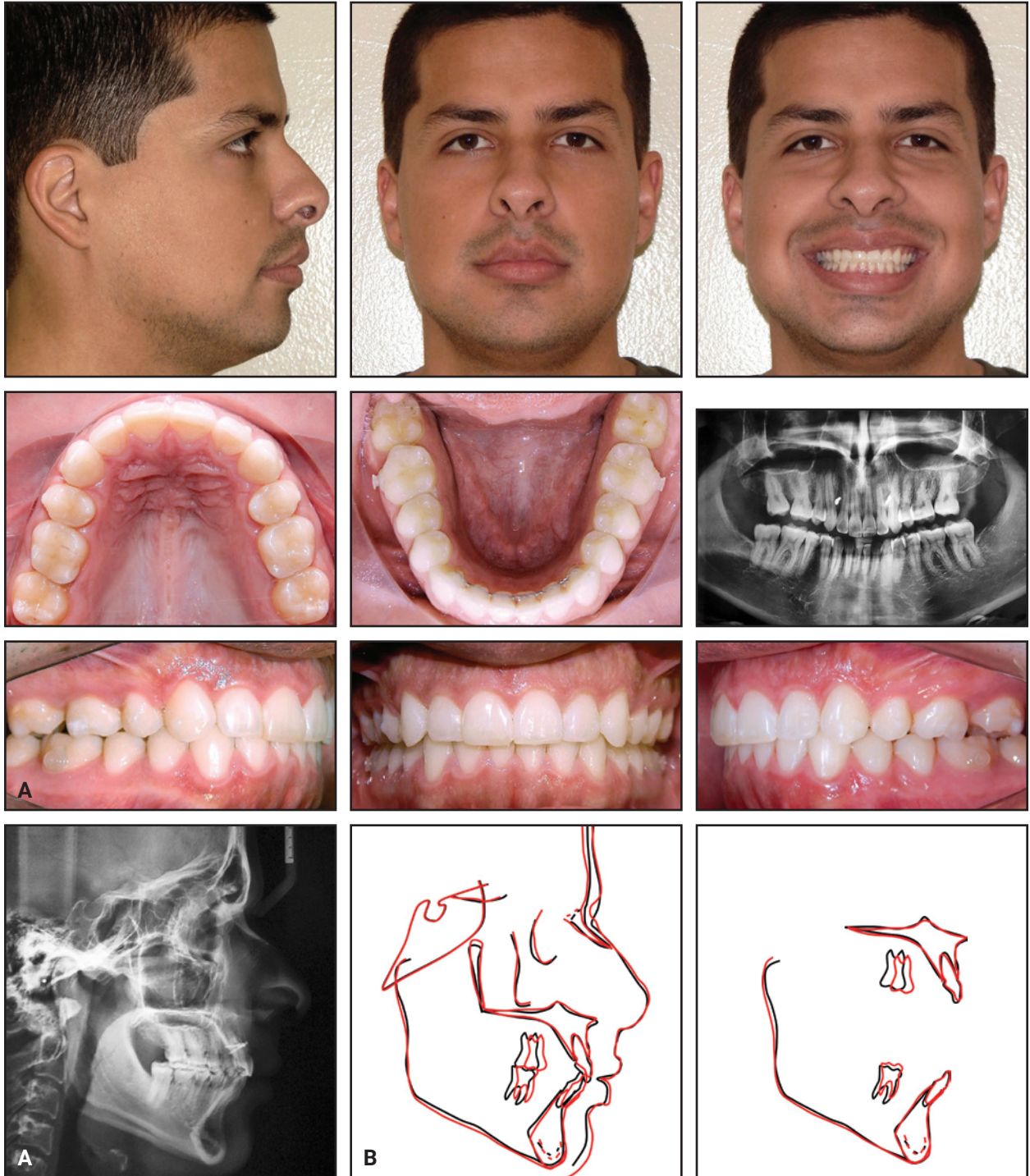
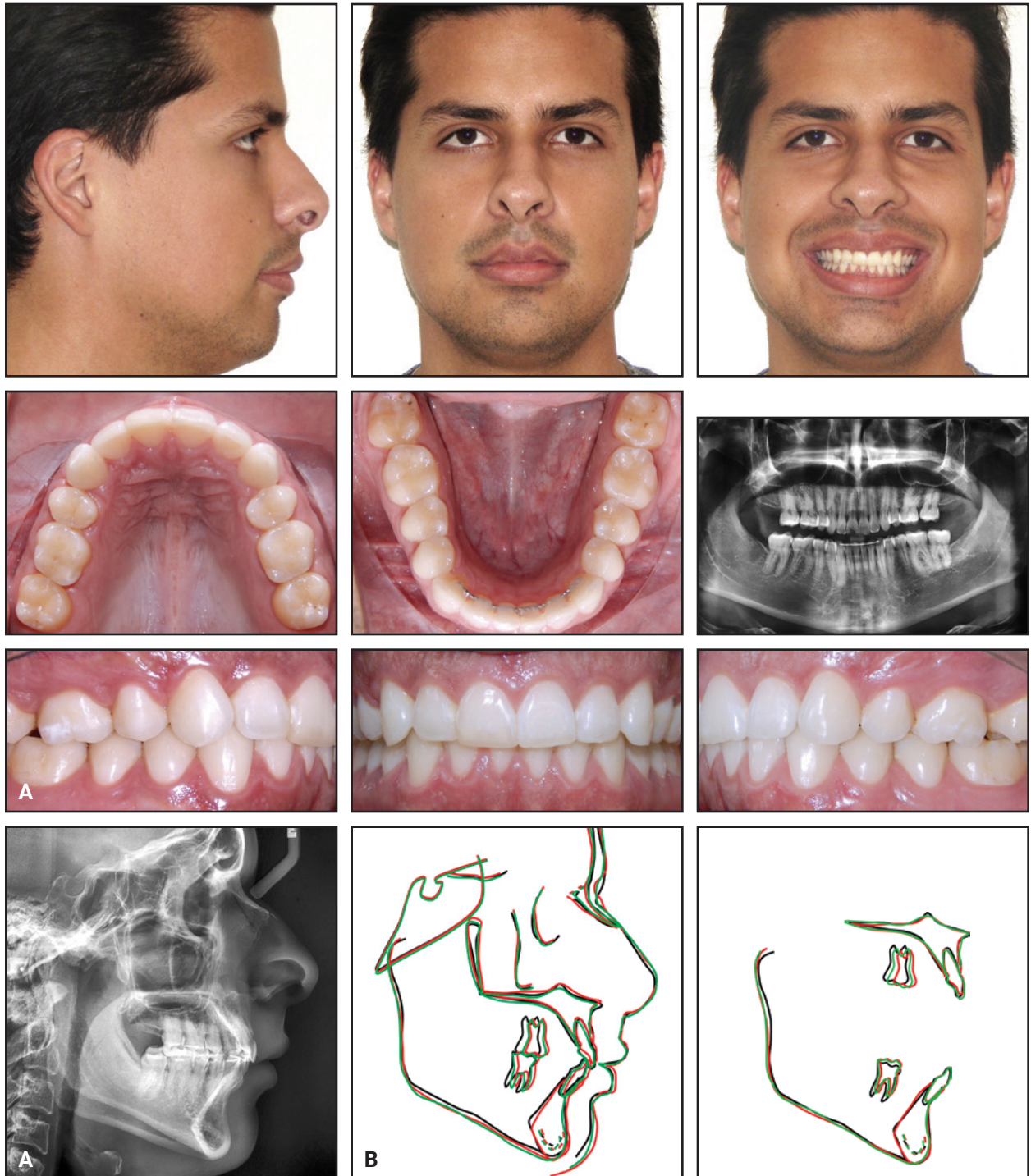


Fig. 6 A. Patient after 31 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.





**Fig. 7 A.** Patient one year after treatment. **B.** Superimposition of pretreatment, post-treatment, and one-year follow-up cephalometric tracings.

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