

Treatment of Collapsed Arches Using the Invisalign System

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Dental arch collapse can be a natural consequence when teeth are missing due to early extractions or agenesis. Patients with collapsed arches tend to show altered tooth positions (Fig. 1), with typical signs that can be easily identified:

- Presence of bounded edentulous spaces
- Migration of adjacent teeth into the spaces
- Midline deviation (in asymmetrical cases)
- Loss of vertical dimension
- Flaring of maxillary anterior teeth
- Inadequate interarch space for restorations

These factors can be complicated by the esthetic demands of the patient and the general dentist. Managing edentulous spaces requires careful treatment planning and, in many cases, a multidisciplinary approach. Treatment essentially aims to replace missing teeth and simultaneously solve any other orthodontic problems, thus establishing a stable, functional occlusion.

This article describes the use of the Invisalign*

align* method for the correction of collapsed arches in two adult patients with differing etiologies.

Case 1

A 28-year-old female presented with a Class II malocclusion and a hypodivergent skeletal pattern (Fig. 2). Although she had pleasant, well-balanced facial esthetics, she was particularly concerned about the protrusion and crowding of her maxillary front teeth. Intraoral examination showed V-shaped dental arches with moderate maxillary crowding. The upper midline was shifted 1.5mm to the right, and the lower midline 3mm to the left. Mild crowding was also present in the mandibular arch, which was entirely collapsed because of a missing left second premolar. All third molars were present, and the mandibular third molars were partially erupted. The patient

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Fig. 1 28-year-old female patient with collapsed arches due to improper extraction in lower arch.

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Fig. 2 Case 1. 28-year-old female patient with Class II malocclusion, missing lower left second premolar, and hypodivergent skeletal pattern before treatment.

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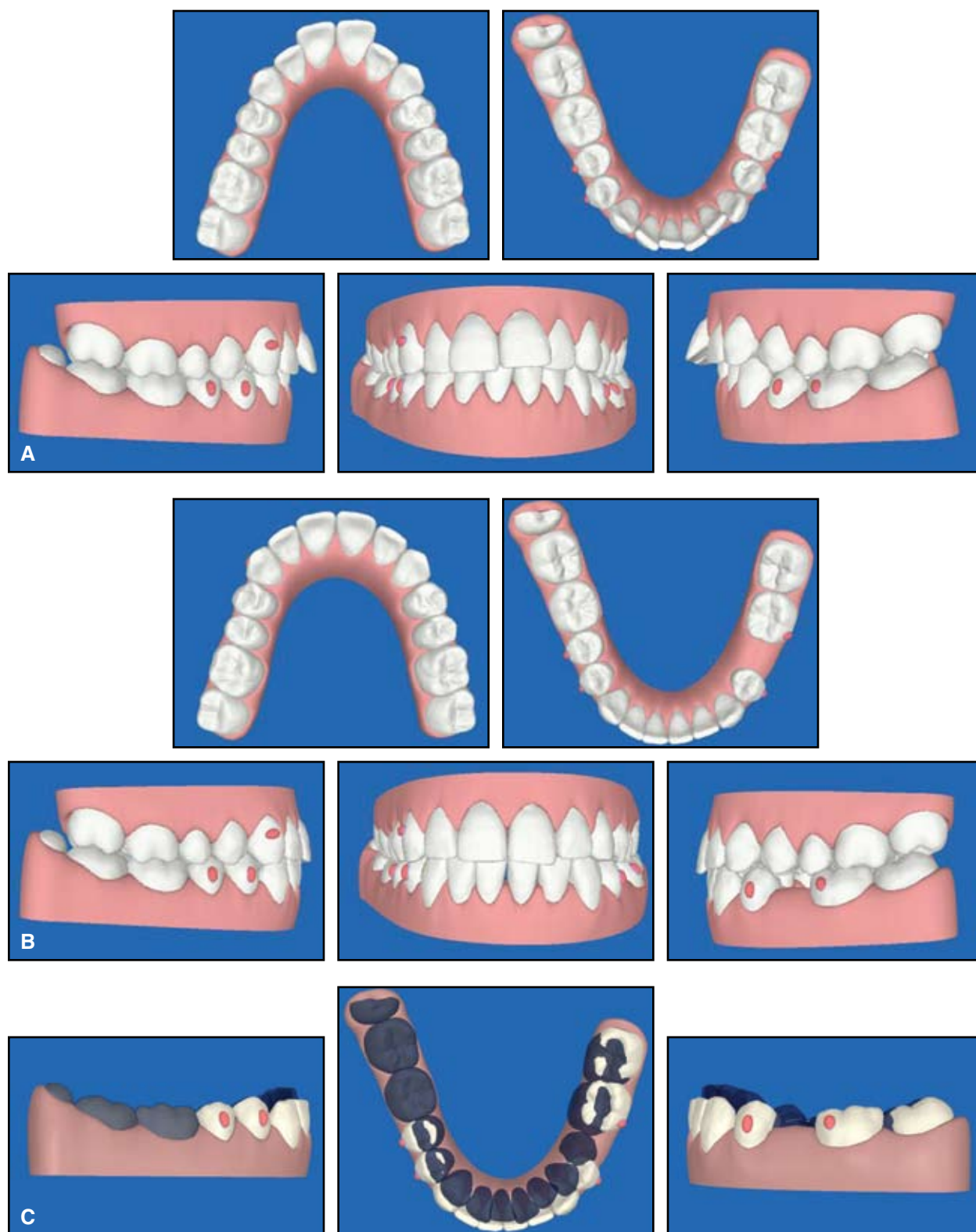


Fig. 3 Case 1. A. Pretreatment ClinCheck* analysis. B. Post-treatment ClinCheck projections. C. Superimposition of pretreatment analysis and post-treatment projections.



Fig. 4 Case 1. Progress after 10 months of treatment.

had Class I molar relationships on both sides, but a full Class II canine relationship on the left due to the migration of the lower left buccal segment. For the same reason, the overjet was excessive, causing poor lower lip posture.

The severe collapse of the mandibular arch suggested that reopening space to replace the missing left second premolar would be the most appropriate treatment. This approach would permit leveling and alignment, with consequent correction of the overjet and overbite. Therefore, the treatment objectives were to maintain a Class I molar relationship while alleviating the crowding through a combination of proclination and interproximal reduction, using the Invisalign system. The ClinCheck* projection showed a satisfactory correction (Fig. 3). The space required to replace the missing second premolar could be created by uprighting the mandibular left first molar and moving the mandibular left first premolar and canine mesially.

A standard .75mm elliptical attachment was bonded to the maxillary right canine, and vertical elliptical attachments were placed on the mandibular first premolar and first molar to promote uprighting and space opening. Minor reproximation was necessary on the right side of both arches.

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Thirty-three aligners were planned for the upper arch, and 35 for the lower. The patient was seen every four to six weeks (two to four aligners) to check the aligner fit, attachment stability, and cooperation (Fig. 4). Initial aligner treatment took 18 months; six sets of refinement aligners were then needed over an additional three months of treatment. Because the maxillary left lateral incisor did not follow the expected path, we used detailing pliers to make appropriate lingual and labial grooves in the aligners, thus creating rotational forces.

After 21 months of Invisalign treatment, the occlusion was well aligned, and the deep bite, overjet, and lower lip protrusion had been reduced (Fig. 5A). The midlines were coincident and centered in the face. Periodontal tissues were healthy, and the ideal alignment of the anterior gingival margins resulted in a pleasant smile. A remarkable aspect of treatment was the absence of root resorption, as shown in the final panoramic radiograph.

Dentascanner three-dimensional imaging (Fig. 5B) indicated that the bone thickness and height in the reopened lower left second premolar space were sufficient for immediate insertion of a titanium dental implant (4.5mm × 8mm). A ceramic crown was placed three months later (Fig. 6). The patient was given clear overlay retainers to wear at night in both arches.

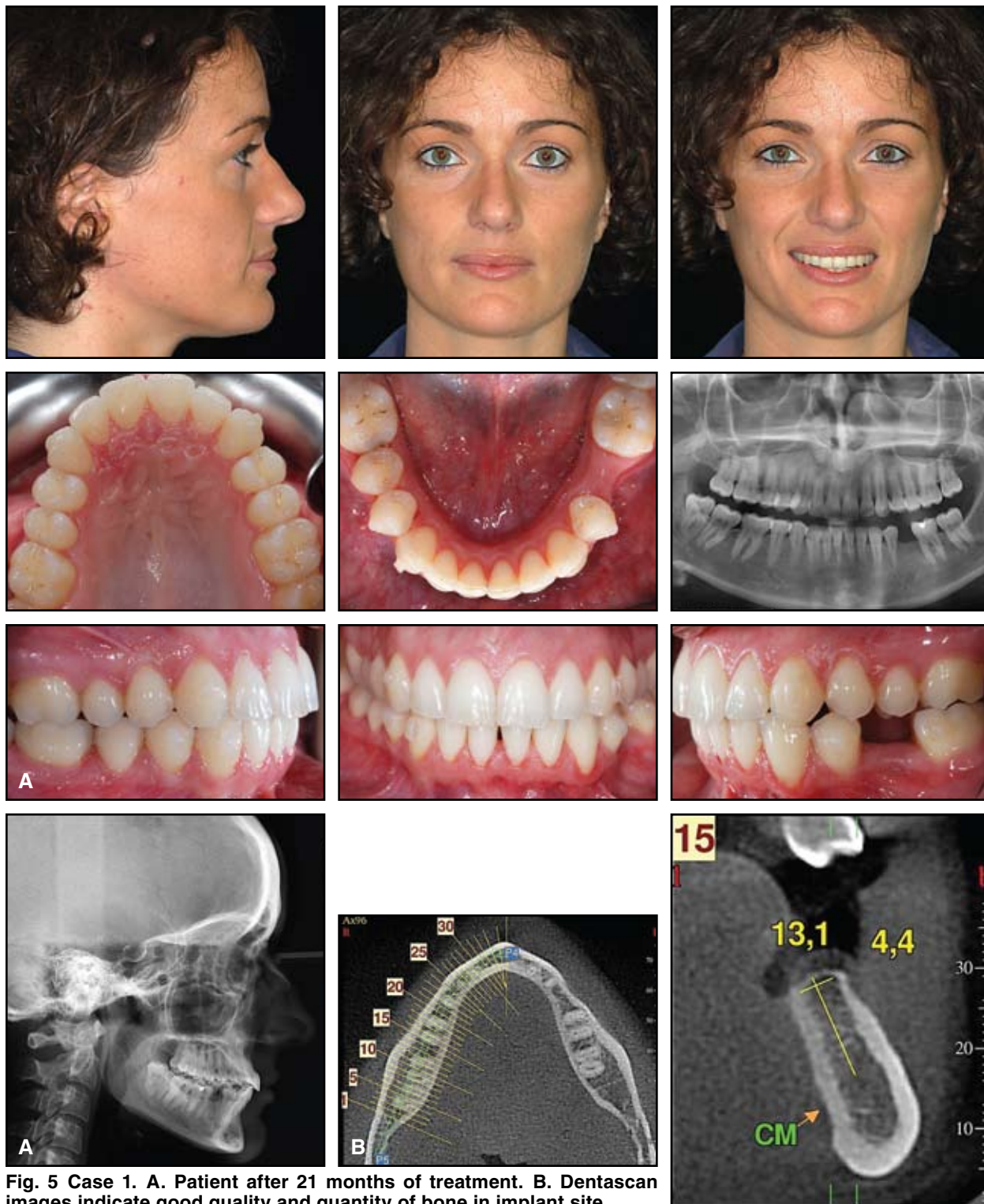


Fig. 5 Case 1. A. Patient after 21 months of treatment. B. Dentascan images indicate good quality and quantity of bone in implant site.



Fig. 6 Case 1. Three months after end of aligner treatment, ceramic crown placed on titanium implant in space opened for lower left second premolar.

Case 2

A 30-year-old female presented with the chief complaint that she “didn’t like all that space between her lower teeth” (Fig. 7). She evidenced good oral hygiene and periodontal health and had no TMJ dysfunction or caries. The patient reported that her mandibular left first molar had been extracted at age 12. Examination revealed a Class I occlusion on the right side, an asymmetrical lateral relationship, and a full Class II malocclusion on the left side, due to distal migration of the mandibular buccal segment. The upper and lower incisors were tipped lingually, with spacing between the lower incisors. She had 2mm of crowding in the upper arch, but 4mm of spacing in the lower arch because of the missing lower left first molar. The profile was balanced, and the lips were competent; the lower midline was deviated to the left. The panoramic radiograph showed normal crown-to-root ratios, with no periodontal bone loss.

The treatment plan was to close all anterior spaces, correct the overbite and overjet, and open space for prosthetic replacement of the missing lower left first molar, using the Invisalign system.

The ClinCheck projection showed acceptable alignment and space closure (Fig. 8). In the mandibular arch, space to replace the missing first molar would be created by reciprocal movement of the second molar and both premolars.

To provide better control during rotation, standard .75mm elliptical attachments were bonded to the mandibular right premolars and on the lingual side of the mandibular left lateral incisor. We also placed a vertical rectangular attachment on the mandibular left canine to facilitate mesial tipping.

Thirty-one aligners were prescribed for the upper arch, and 39 for the lower. The patient was seen every four to six weeks (two to four aligners) to check the aligner fit, attachment stability, and cooperation (Fig. 9). Following 16 months of initial aligner therapy, five sets of refinement aligners were placed during another three months of treatment.

All treatment goals were achieved over 19 months of Invisalign treatment. Both arches were leveled and aligned. Space for the lower left first molar was reopened with 8mm of reciprocal movement of the buccal teeth: the left second molar was moved 4mm distally, and the canine and premolars

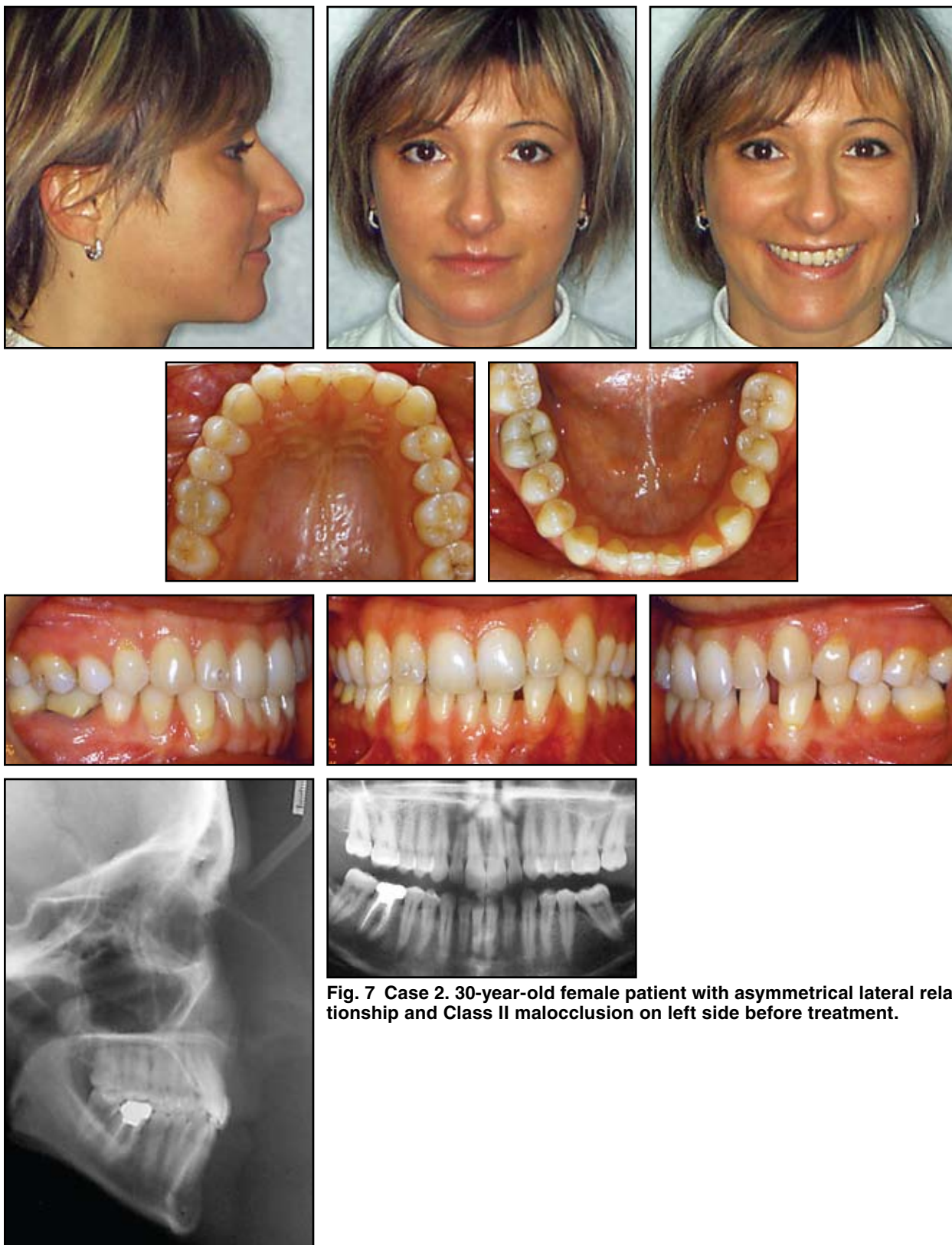


Fig. 7 Case 2. 30-year-old female patient with asymmetrical lateral relationship and Class II malocclusion on left side before treatment.

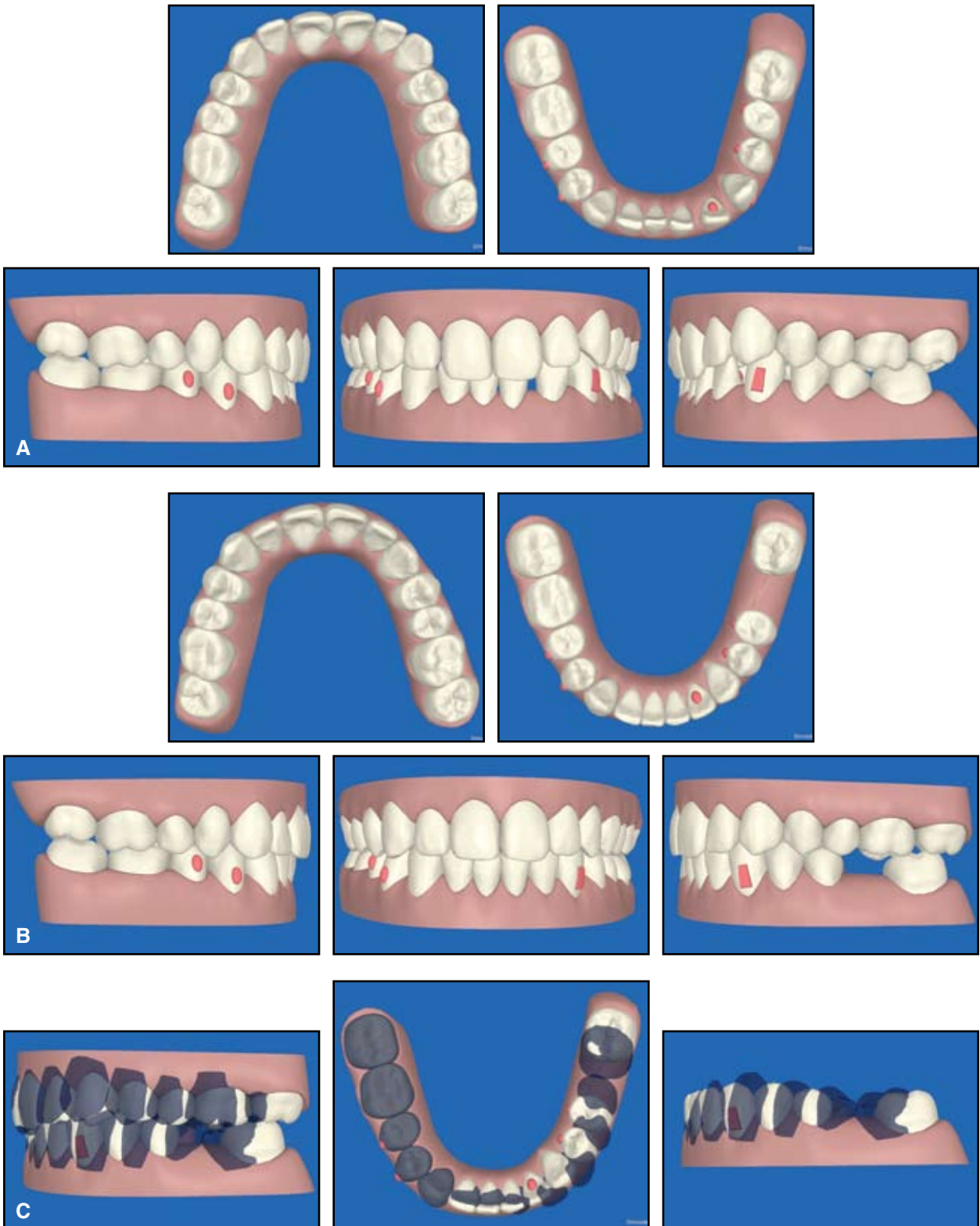


Fig. 8 Case 2. A. Pretreatment ClinCheck analysis. B. Post-treatment ClinCheck projections. C. Superimposition of pretreatment analysis and post-treatment projections.

4mm mesially. The lower midline was centered and coincident with the upper midline after treatment. Bleaching was performed to further improve the overall esthetic result.

Periodontal health was well maintained. A dental implant (4.5mm × 10mm) was placed as an abutment in the lower left first molar space at the conclusion of Invisalign treatment, and a ceramic crown was added three months later (Fig. 10).

Discussion

The Invisalign system has previously been shown to be a successful treatment modality for opening and closing of dental spaces.¹⁻⁶ Both of the patients presented here elected to have as much of their treatment as possible done with Invisalign, and in each case we were able to avoid fixed appliances altogether.

These satisfactory treatment outcomes were certainly facilitated by the apical positions of the teeth to be moved. In fact, because no apical movement was required, crown tipping was able to achieve the necessary dental corrections. Another critical point is the optimal response of the periodontal tissues, which seemed to be improved at the

end of treatment in both cases, even though complex, “traumatic” treatment had been performed. Both patients were seen for periodontal maintenance at three-month intervals throughout orthodontic treatment, and their periodontists reported reasonable control of tissue inflammation and excellent plaque removal. Little to no mobility was seen in the upper and lower incisors of either patient throughout treatment. They also showed excellent compliance with aligner wear.

We highly recommend the Invisalign method as an alternative for adult patients with collapsed arches who need preprosthetic treatment.

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Fig. 9 Case 2. Progress after 12 months of treatment.



Fig. 10 Case 2. Three months after end of aligner treatment and placement of dental implant, crown placed in reopened lower left first molar space.