

Biocreative Torque-Maintaining Archwire for Adult Patients with Pathologically Migrated Incisors

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Treatment of pathologically migrated upper anterior teeth in patients with advanced periodontitis is always difficult. Extraction and implant placement combined with bone augmentation may be the treatment of choice. The migrated teeth can be intruded with the same mechanics as when utility arches and miniscrews are used to reduce a deep overbite; when forces are applied on the labial side, however, the intrusion is inevitably accompanied by flaring.¹

In some patients, severe horizontal bone loss in the upper anterior area can compromise the success of bone augmentation and make it critical to avoid labial flaring (Fig. 1). Because the center of resistance of a tooth moves apically with alveolar bone loss, teeth with reduced bony support are more likely to tip facially than to translate. Adverse side effects such as fenestration and increased mobility can easily occur. Additional concerns include the unpredictable esthetic outcome and, in elderly patients, possible contraindications to surgery because of systemic diseases.

Periodontal flap surgery for the treatment of intrabony defects has been strongly associated with improved periodontal clinical parameters and a high rate of tooth retention.² Melsen and colleagues



Fig. 1 Intrusion of upper teeth with buccal flaring requires torque control, especially in periodontally compromised patients.



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reported that a combination of periodontal flap surgery and orthodontic intrusion could improve the periodontal condition, provided that both the biomechanical force system and oral hygiene were properly controlled.^{3,4}

The aim of the present study was to assess the effect of periodontal plus orthodontic treatment in two adult patients with pathologically migrated upper anterior teeth and severe alveolar bone resorption. The pathologically migrated anterior teeth were intruded by means of a C-tube orthodontic microplate* in the interradicular region of the central incisors.⁵ Anterior torque was maintained with a Biocreative torque-maintaining archwire (C-TMA), which can help avoid buccal flar-

ing when the intrusion force is applied to the buccal segmental archwire.

Biocreative Torque-Maintaining Archwire

Polat-Ozsoy and colleagues reported less labial flaring of the anterior teeth during intrusion with a temporary anchorage device (TAD) than with a utility archwire,¹ because the line of action for the intrusion force was closer to the center of resistance. Although flared teeth can be corrected after intrusion, this approach will prolong

*Shinhung Co., Seoul, Korea; www.shinhung.co.kr.

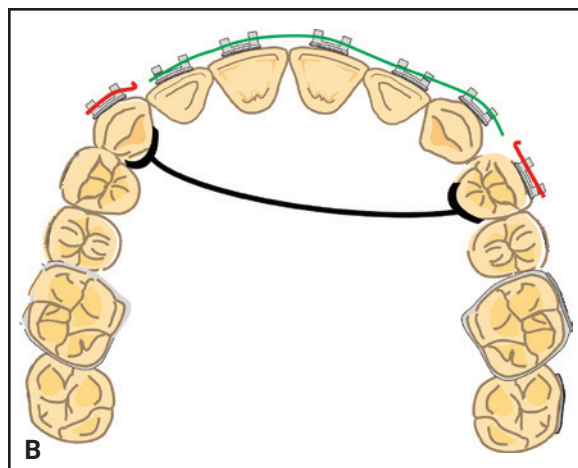
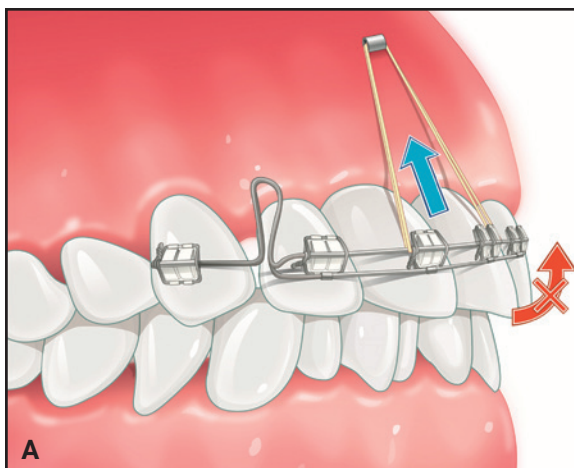


Fig. 2 A. Biocreative torque-maintaining archwire (C-TMA) restricts labial flaring of incisors. B. Bonded transpalatal archwire (TPA) from canine to premolar minimizes side effects of C-TMA force.

treatment, and the jiggling movements can induce external root resorption.

The C-TMA prevents the anterior teeth from flaring during intrusion by means of a biomechanical system using two wires (Fig. 2A). A segmental stabilizing wire anchors the intrusion forces from the microplate, and a stainless steel C-TMA (.016" × .022" to .018" × .025") provides torque control.

The C-TMA is tied to the premolars, but it is formed to contact the incisors incisally to the brackets, rather than cervically, to control their torque. Because the distance from the tooth's center of resistance to the contact point is longer, the torque-control moment becomes larger. Loops between the lateral incisors and canines are activated .5-1mm to provide some retraction force if needed.

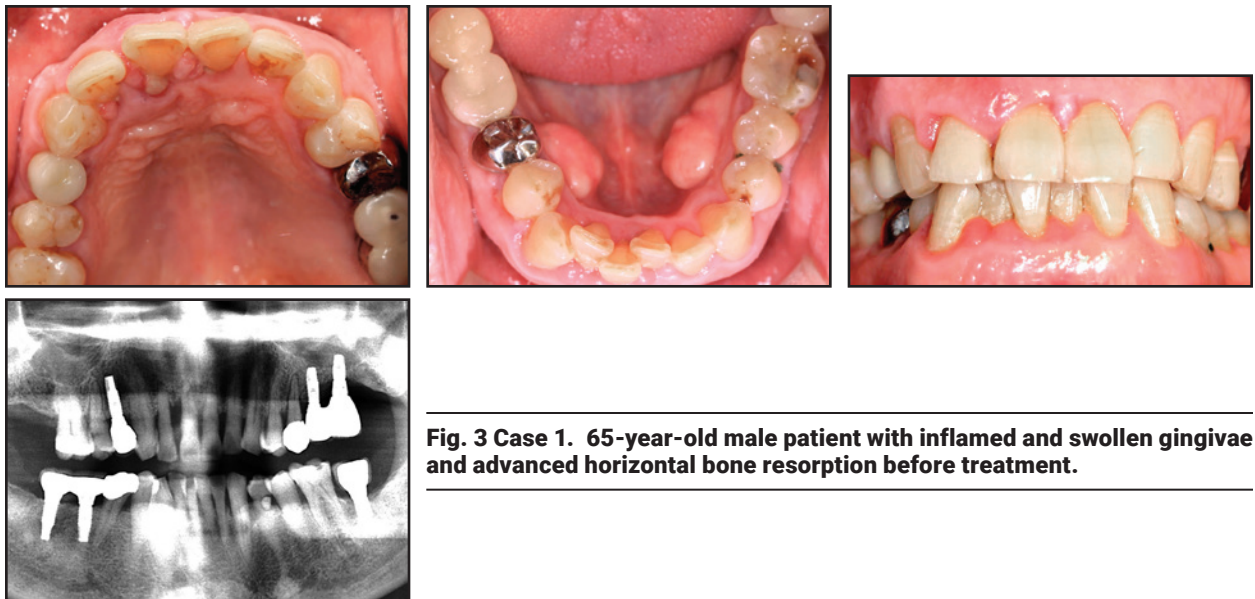


Fig. 3 Case 1. 65-year-old male patient with inflamed and swollen gingivae and advanced horizontal bone resorption before treatment.

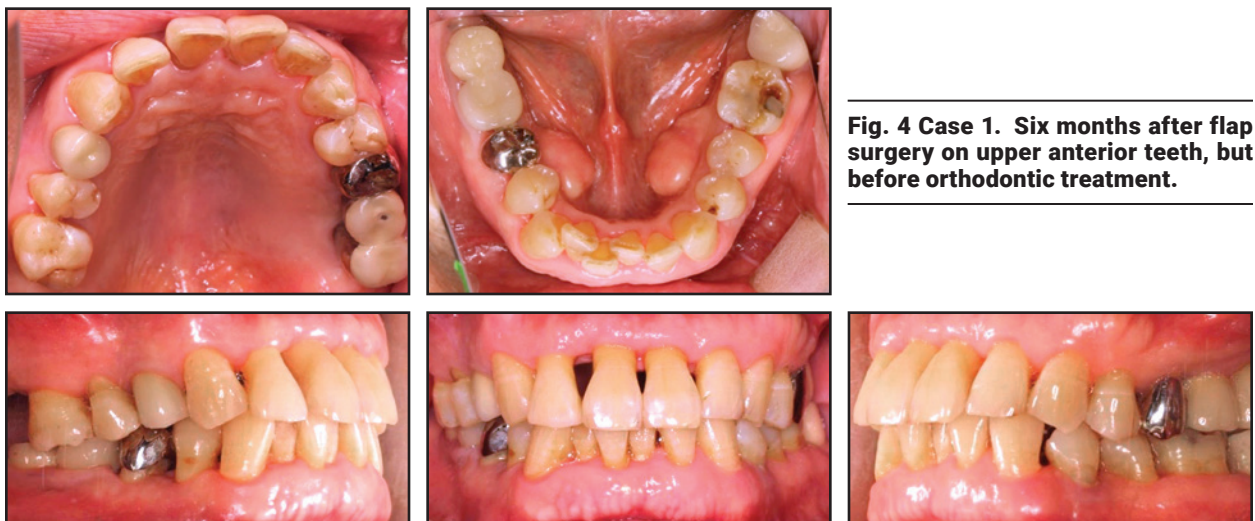


Fig. 4 Case 1. Six months after flap surgery on upper anterior teeth, but before orthodontic treatment.

A bonded transpalatal arch (TPA) connected to the premolars will minimize the reaction force from the C-TMA and thus prevent arch deformation (Fig. 2B). The light intrusive force from a TAD (about 20-30g/tooth), combined with the C-TMA and TPA, reduces (but does not completely eliminate) incisor flaring compared with a utility arch.

Case 1

A 65-year-old male presented with inflamed and swollen gingivae of the upper anterior teeth (Fig. 3). He was taking aspirin for high blood pressure. Poor oral hygiene was apparent in generalized subgingival calculus deposition, gingival inflammation, and heavy supragingival calculus on the lower anterior teeth. There was a pus discharge through the gingiva at the upper central incisors and right lateral incisor. Periodontal examination revealed pocket probing depths of 7-10mm, along with pathologic migration and Miller Class 2 mobility. Loss of lamina dura continuity was observed at the crest of alveolar bone on the upper central incisors and right lateral incisor.

Radiographic analysis showed advanced horizontal bone resorption in a buccal and vertical bony defect on the mesial side of the upper right central and lateral incisors. Cephalometric analysis indicated a skeletal Class I relationship (SNA

= 83°, SNB = 79.4°), and the molars and canines were also in a Class I relationship. The upper and lower incisors showed normal inclination; anterior overbite was 2.5mm.

Initial therapy consisted of scaling and root planing, as well as oral-hygiene instruction. After six weeks of initial therapy, periodontal surgery was performed. A facial full-thickness flap was raised, but the palatal tissues were undisturbed. Clinical examination six months after flap surgery indicated tooth mobility and gingival inflammation (Fig. 4).

At this point, orthodontic treatment was initiated on the upper anterior teeth with .022" edge-wise appliances,** assisted by a C-tube microplate as skeletal anchorage for anterior intrusion (Fig. 5). This C-tube was placed in the interradicular space of the maxillary central incisors through an incision adjacent to the upper labial frenum. After elevation of the periosteum, the microplate was bent to fit along the outer rim of alveolar bone to prevent loosening or failure. Two 5mm mini-screws* were installed to fix the plate, and the flap was sutured.^{5,6}

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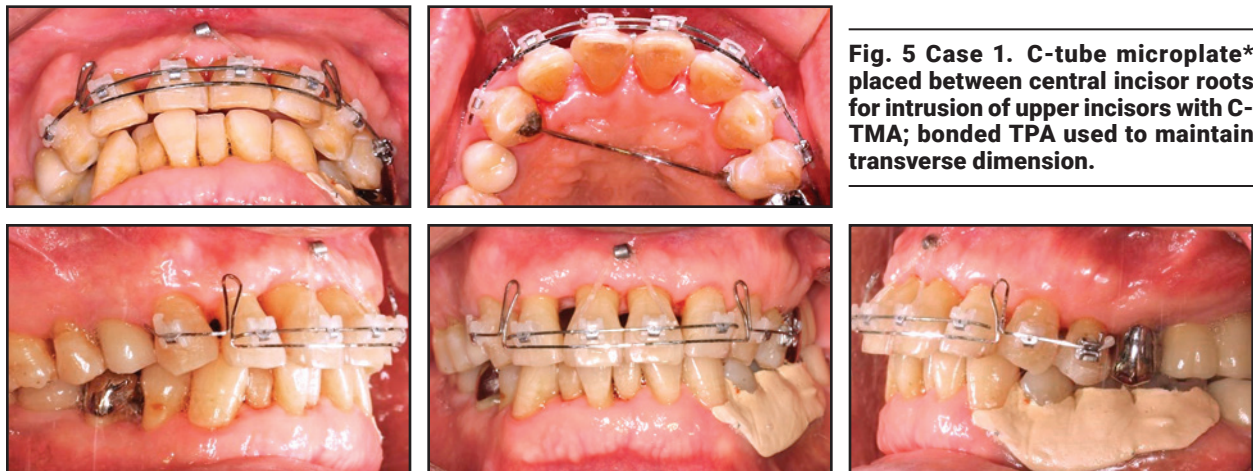


Fig. 5 Case 1. C-tube microplate* placed between central incisor roots for intrusion of upper incisors with C-TMA; bonded TPA used to maintain transverse dimension.

After one month of leveling, intrusion forces were delivered with elastic thread*** from the C-tube to an .016" × .022" nickel titanium wire segment on the upper four incisors. The .016" × .022" stainless steel C-TMA was placed incisal to the brackets to offset flaring, and the closing loops were activated .5mm each. A bonded TPA from the upper right canine to the left first premolar provided occlusal stabilization against the lingual forces. Periodontal treatment was continued in the posterior regions during orthodontic treatment.

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Interproximal reduction of the upper anterior teeth was carried out during intrusion to compensate for the 1mm of arch-length discrepancy. After seven months of orthodontic treatment, the C-tube was removed under local anesthesia. A 3-3 lingual retainer was bonded, and a modified wraparound retainer with an anterior bite plane was delivered to provide a stop for the lower incisors.

After a total 15 months of treatment, the patient was satisfied with his upper anterior teeth (Fig. 6). Follow-up records taken 45 months after treatment demonstrated good stability and oral health (Fig. 7). The anterior axis showed no flar-

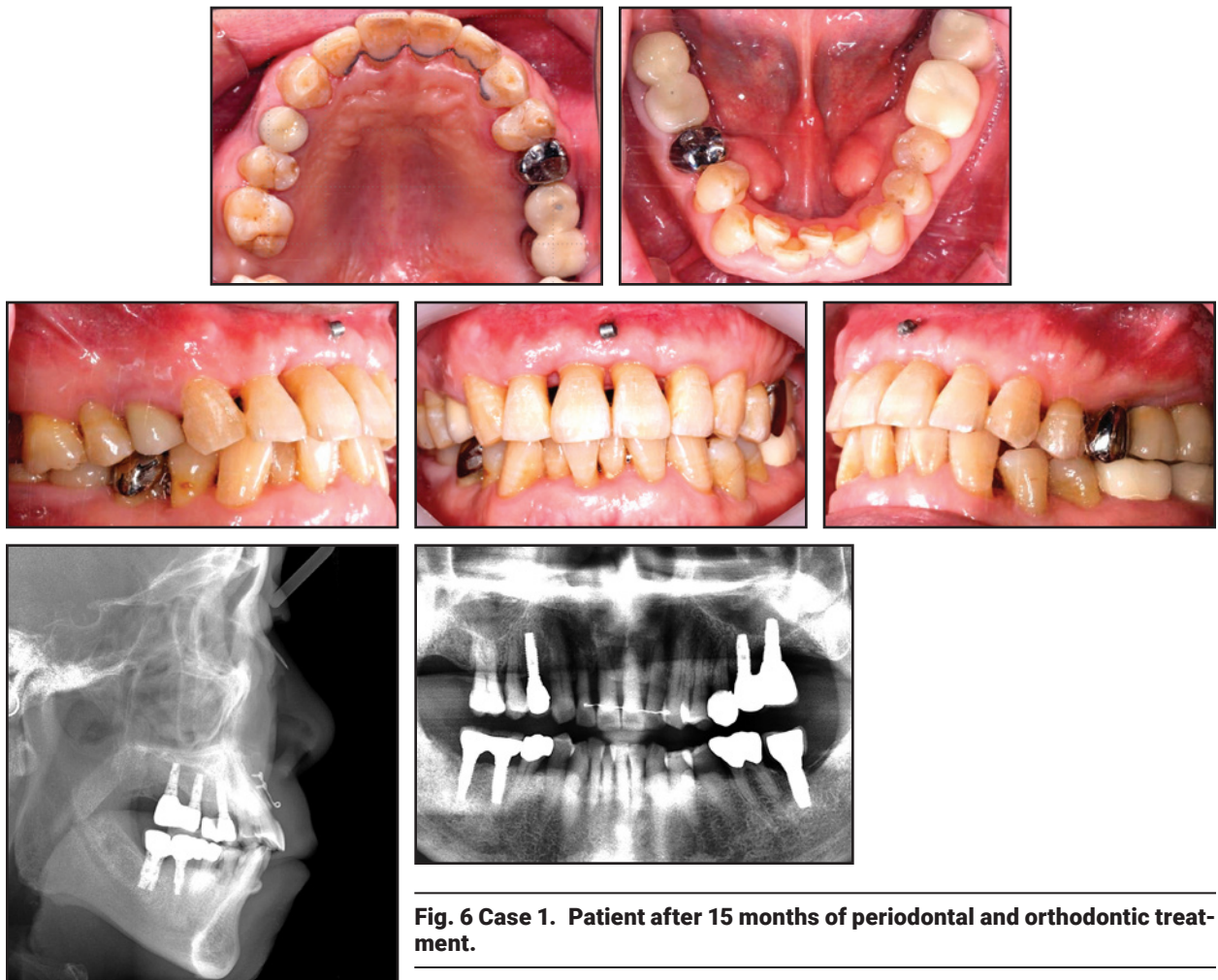


Fig. 6 Case 1. Patient after 15 months of periodontal and orthodontic treatment.



Fig. 7 Case 1. Patient 45 months after treatment.

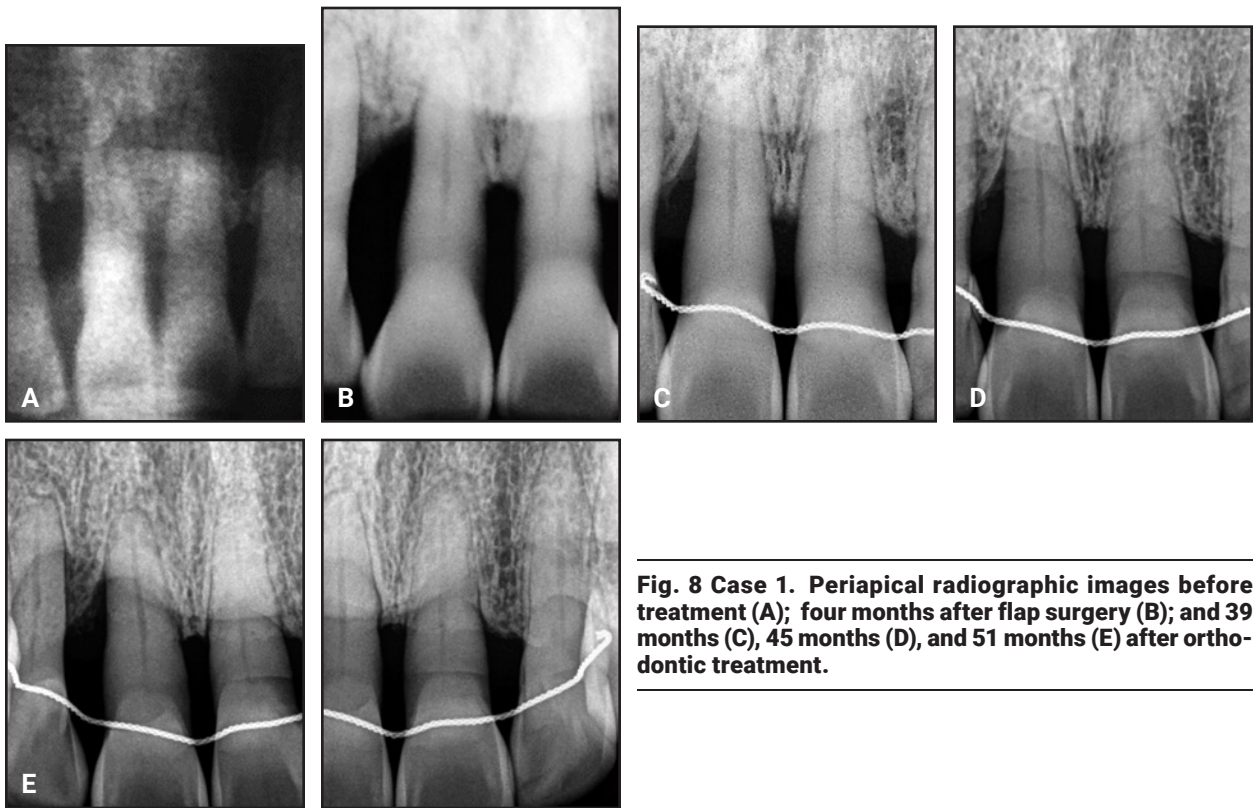


Fig. 8 Case 1. Periapical radiographic images before treatment (A); four months after flap surgery (B); and 39 months (C), 45 months (D), and 51 months (E) after orthodontic treatment.

ing from the intrusion. Four months after flap surgery, the probing pocket depth was 3-4mm at the upper central incisors and right lateral incisor; the lamina dura of the upper incisors was evident radiographically, and crestal alveolar bone levels had increased (Fig. 8A,B). Although a wedge-shaped radiolucency was apparent on the mesial aspect of the upper right lateral incisor, there was no fuzziness or break of continuity of the lamina

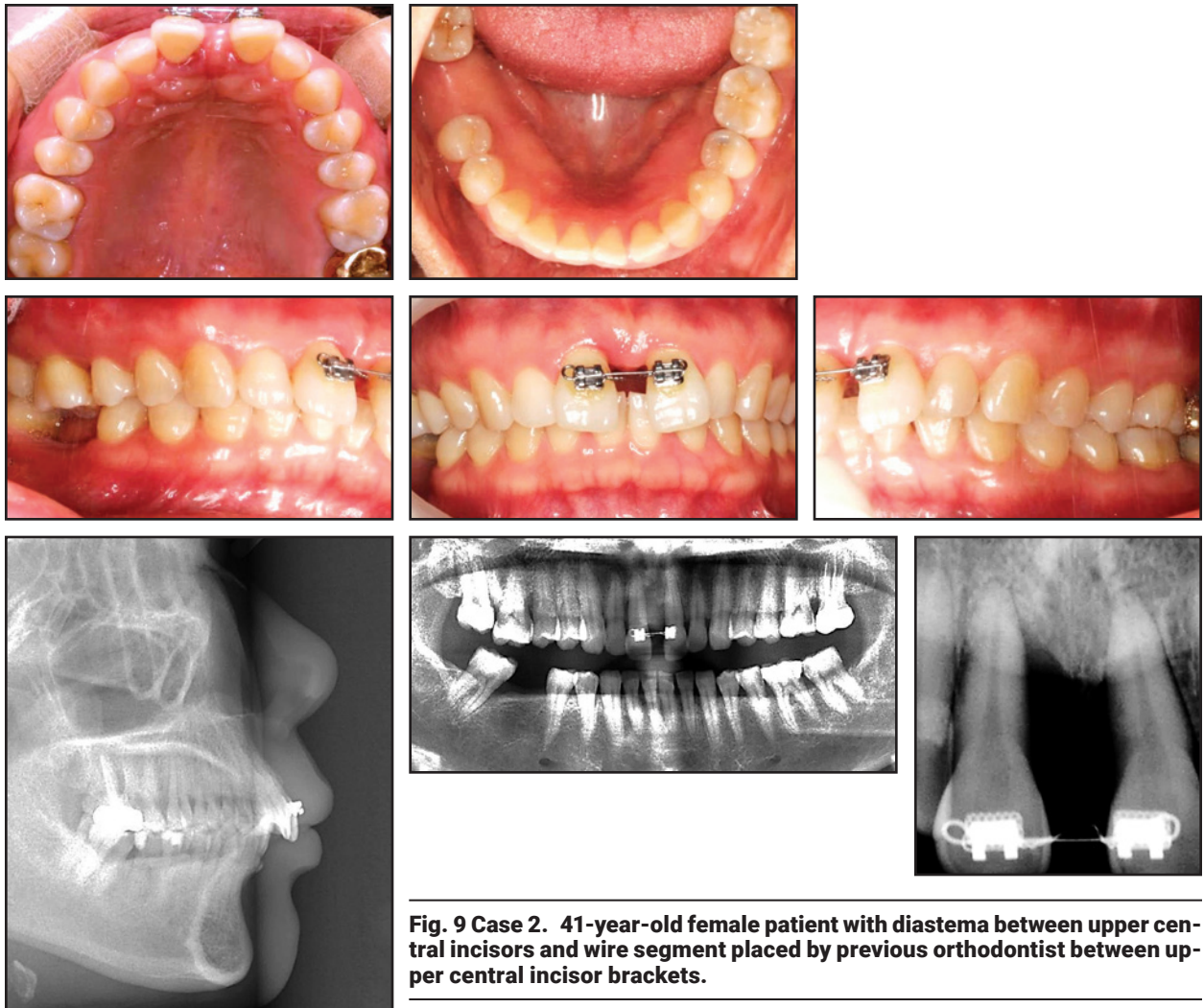
dura at the crest of alveolar bone between the upper right central incisor and lateral incisor (Fig. 8C). The mobility of the teeth had diminished remarkably. These conditions have been maintained remarkably. These conditions have been maintained for more than four years (Fig. 8D,E). The patient was happier and reported a higher level of self-confidence because of the retention of his natural teeth and the improvement in periodontal health at his age.⁷

Case 2

A 41-year-old female presented with the chief complaint of a diastema between the upper central incisors (Fig. 9). Clinical examination showed extruded and flared upper central incisors and a mesially tipped lower right second molar. The previous orthodontist had used a segmental archwire for closure of the diastema, but we discontinued this because it might have resulted in extrusion. After six weeks of initial periodontal therapy, the patient's condition had improved, and orthodontic

treatment was begun.

First, an I-type C-tube plate with two 1.5mm × 4mm miniscrews was placed under local anesthesia in the upper anterior alveolus (Fig. 10A). A Weingart plier was used to adapt the tube position. An .016" × .022" stainless steel C-TMA was placed on the labial side of the upper lateral incisors and canines to restrict flaring of the upper incisors, and triangular elastic chain was applied to close space and begin intrusion (Fig. 10B). A bonded TPA made of .036" round stainless steel wire and mesh pads was attached between the lingual surfaces of



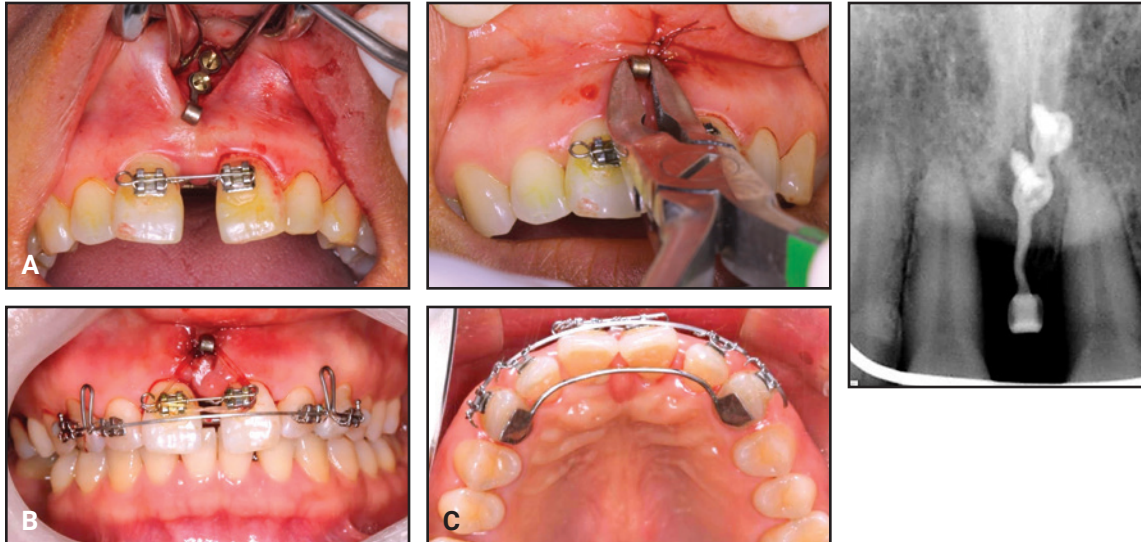


Fig. 10 Case 2. A. I-type C-tube placed between central incisor roots. B. C-TMA contacting upper incisors to restrict flaring; triangular elastic chain applied for space closure and intrusion through C-TMA. C. Bonded TPA placed to minimize side effects of C-TMA.

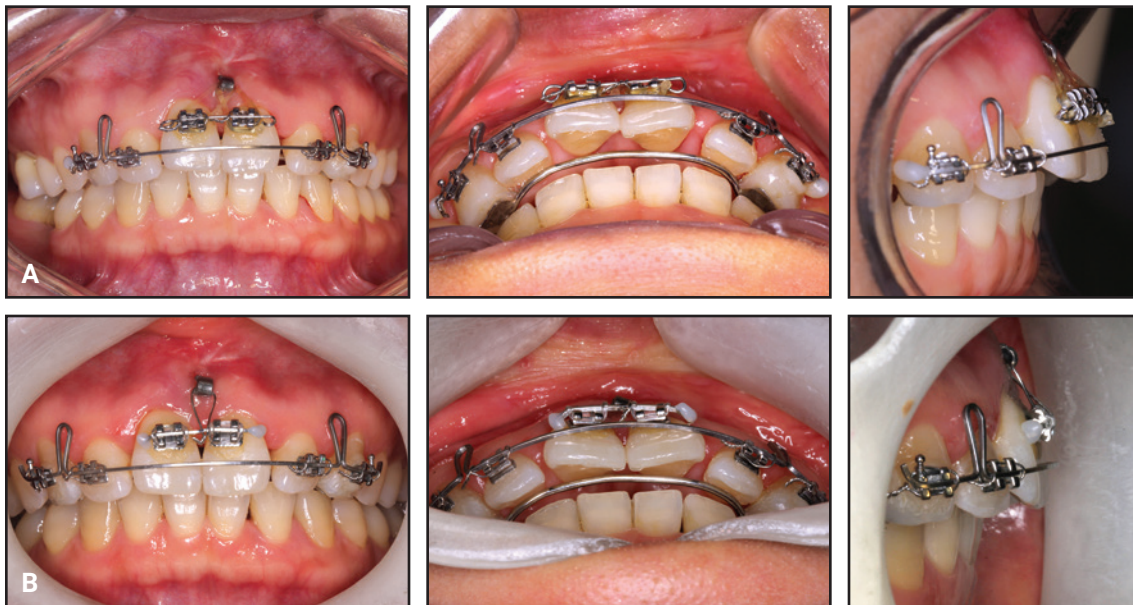


Fig. 11 Case 2. A. After two months of intrusion. B. After three months of intrusion, C-TMA loops activated for anterior retraction.

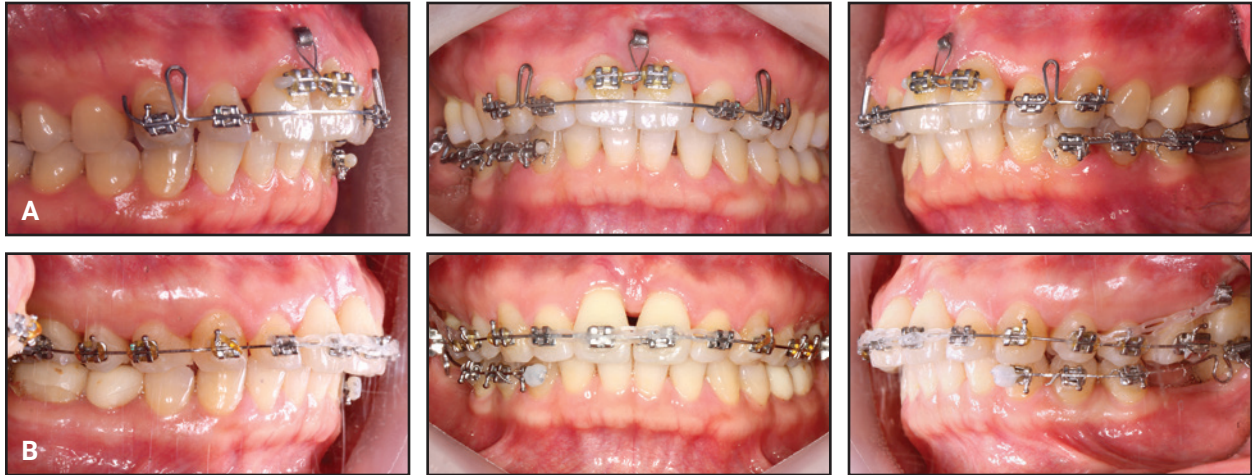


Fig. 12 Case 2. A. After nine months of treatment. B. Five months later, elastic power chain attached from right posterior miniscrew for midline correction.

the upper canines to minimize side effects from the C-TMA (Fig. 10C).

After two months of intrusion and space closure, the premature contact between the upper and lower anterior teeth had disappeared (Fig. 11A). A month later, the closing loops of the C-TMA were activated to provide some retraction of the mildly flared upper central incisors (Fig. 11B).

After three months of intrusion, the patient hit her upper right central incisor with the telephone; therefore, we continued holding the vertical dimension of the upper anterior teeth with a ligature wire tied to the C-tube head for another six months (Fig. 12A). Five months later, midline correction was initiated with elastic power chain from a right posterior miniscrew through an .017" × .025" stainless steel archwire (Fig. 12B).

Total treatment time for the upper anterior correction was 22 months (Fig. 13A). The panoramic radiograph confirmed an improved vertical relationship of the upper anterior teeth, and the lateral cephalogram showed successful anterior intrusion without significant labial flaring (Fig. 13B).

Discussion

Re and colleagues reported that 30-50% of

patients with moderate to severe periodontitis will experience pathologic migration such as crowding, rotation, and extrusion of the involved teeth.^{8,9} Such dental malpositions may cause secondary occlusal trauma and can affect periodontal and emotional health. Since pathologically migrated teeth cannot return to their original positions under periodontal treatment alone, a multidisciplinary approach is often necessary to resolve the occlusal trauma.¹⁰⁻¹²

Ghezzi and colleagues reported treating infrabony defects adjacent to migrated incisors with either enamel matrix protein or bone grafting plus a collagen membrane, followed a year later by orthodontic therapy.¹³ In Case 1, we used only conventional periodontal flap surgery, without bone grafting or guided tissue regeneration (GTR), to produce a satisfactory outcome with orthodontic treatment. Although GTR therapy might have provided better bone levels, it was not considered because the patient was elderly and taking antiplatelet medication. Pathologically migrated posterior teeth diagnosed as hopeless by a periodontist, as in this case, can be successfully treated with implants and guided bone regeneration.¹⁴ Nonetheless, one study showed a significant increase in peri-implant marginal bone loss over five years in patients with periodontally associated

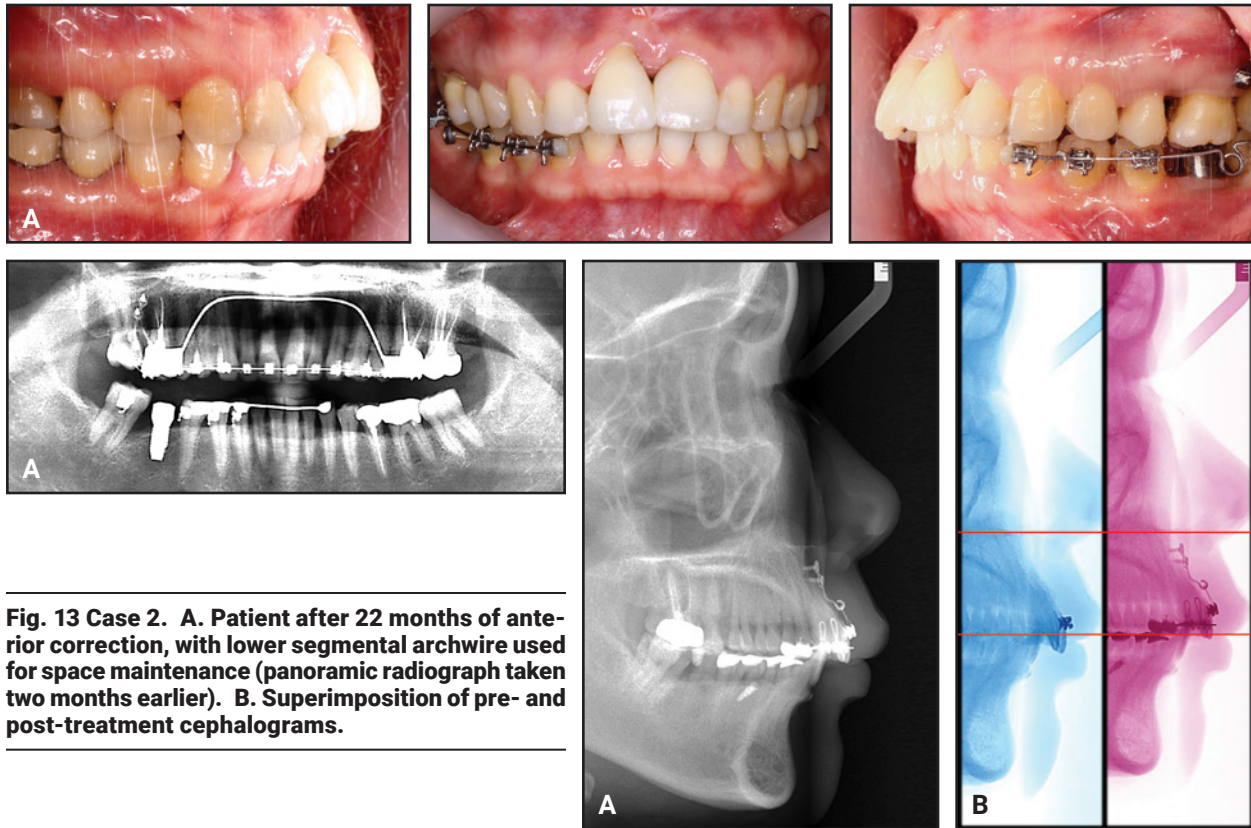


Fig. 13 Case 2. A. Patient after 22 months of anterior correction, with lower segmental archwire used for space maintenance (panoramic radiograph taken two months earlier). B. Superimposition of pre- and post-treatment cephalograms.

tooth loss, compared with non-periodontally associated tooth loss.¹⁵ It is also important to emphasize that periodontally affected teeth can be preserved for a long period of time when properly treated.¹⁶⁻¹⁸

Bonded brackets on posterior teeth are prone to accumulate plaque, which may worsen periodontitis in periodontally compromised patients. Selective bonding of brackets using the Bio-creative technique avoids that risk.¹⁹ The placement of a TPA instead of posterior brackets eliminates the possibility of arch deformation or adverse occlusal changes of the posterior teeth from selective bonding of the anterior teeth for intrusive mechanics. Minimal bracket placement also promotes good oral hygiene, enabling successful treatment of periodontal disease even in advanced stages.²⁰ When periodontal treatment is

performed and hygiene is well controlled, orthodontic intrusion can lead to a notable attachment gain in connective tissue.³

We observed mild external root resorption after treatment of both patients. Although increased force levels and treatment time are positively related to external inflammatory root resorption,²¹ the intrusion force was applied for only three months in Case 1, with an overall orthodontic treatment period of 15 months. In Case 2, the intrusion time was also three months, but total treatment time was 22 months because of the trauma to the central incisor. The root resorption in both cases may be attributable to diminished bone density related to aging, as observed by Pietschmann and colleagues in a rat study.²² For this reason, orthodontic movement in older patients must always be carefully planned.²³

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