Case Report

Orthodontic treatment for preserving periodontally hopeless teeth in a middle-aged patient: a case report

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ABSTRACT

In this case report, we show a strategic approach to prolonging the lifespan of pathologically migrated maxillary canines with a hopeless prognosis in a 57-year-old female patient, highlighting the potential of orthodontic management for middle-aged patients to enhance both occlusion and facial esthetics while minimizing the need for extensive prosthetic treatment. According to the visual treatment objective, the nonextraction treatment plan showed advantages in the type of orthodontic tooth movement and final occlusal relationship. Therefore, considering the favorable periodontal treatment results and single-root teeth, the hopelessly migrated maxillary canines were relocated, eliminating the existing trauma from occlusion. Segmental tooth movement was performed, and orthodontic temporary skeletal anchorage devices were used to support strategic orthodontic tooth movement. After 27 months of treatment, proper occlusion was established with a significant improvement in facial esthetics. The periodontally compromised teeth were preserved with adequate periodontal support. The patient expressed satisfaction with the results, and the 30-month follow-up records confirmed the stability of treatment outcomes. (*Angle Orthod*. 0000;00:000–000.)

KEY WORDS: Pathologic tooth migration; Hopeless prognosis; Orthodontic treatment; Middle-aged patients

INTRODUCTION

Pathologic tooth migration (PTM) is characterized by the displacement of teeth from their normal positions due to periodontitis and traumatic occlusion (TFO).[1] Beyond its esthetic effects, untreated PTM can culminate in tooth loss due to progressive surrounding periodontal tissue deterioration and hinder maintenance of the entire dentition.[2] These consequences significantly impact patient quality of life, both physical and psychosocial well-being, and motivate them to seek treatment.[3–5]

While periodontal treatment mitigates PTM to some extent, combined orthodontic intervention becomes necessary for repositioning displaced teeth and addressing existing TFO.[6] Despite the demonstrated safety and efficacy of meticulous orthodontic intervention in improving periodontal health and preserving compromised teeth,[2,7] limited information is available regarding the feasibility of orthodontic care for severe PTM with poor prognosis, particularly in middle-aged individuals. This lack of scientific evidence and expert recommendations challenges practitioners when determining the appropriate therapeutic approaches.

In this case report, we present a strategic approach to prolonging the lifespan of pathologically migrated maxillary canines with a hopeless prognosis, highlighting the potential for orthodontic management in middle-aged patients to refine both occlusion and facial esthetics.

Diagnosis and Etiology

A 57-year-old female patient was referred for space management before placement of maxillary canine

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Accepted: November 26, 2024. Submitted: April 20, 2024.
Published Online: January 13, 2025

Figure 1. Pretreatment photographs.

implants. No specific medical history was noted, and extraction of the maxillary and mandibular right first molars and periodontal flap surgery were done 4 months previously in the Department of Periodontics.

Initial examination revealed dental crowding of 6 mm in the maxilla and 5 mm in the mandible. The maxillary canines were extruded, and mobility grade 1 on the right side and grade 2 on the left side was noted, with severe gingival recession (Figures 1 and 2; Table 1). The mandibular left central incisor was blocked out and showed grade 2 mobility with severe gingival recession (Figures 1 and 2). Premature contact was observed on the maxillary canines during lateral excursion, and the maxillary left canine showed fremitus due to TFO at maximum intercuspation.

Extraoral examination revealed a convex profile with unnatural lip closure due to the extruded maxillary canines. Chin deviation to the left side was noted with facial and dental midline discrepancy. The patient exhibited a Class II dental relationship with 7 mm overjet and 5 mm overbite (Figures 1 and 2). Excessive 6-mm-deep probing depths were noted on the maxillary canines, the right maxillary and mandibular premolars, and the molars; however, no bleeding was recorded. The patient showed good oral hygiene (Figure 1).

Lateral cephalometric analysis revealed a hyperdivergent skeletal Class II pattern with proclined mandibular incisors (ANB = 6.1°; Wits appraisal = 1.2 mm; Sella-Nasion to mandibular plane angle, SN-MP = 41.3°; and incisor-mandibular plane angle, IMPA = 105.2°). The panoramic radiograph showed mesioangular maxillary right premolars, and generalized alveolar bone loss was observed (Figure 3; Table 2). Notably, the maxillary canines presented

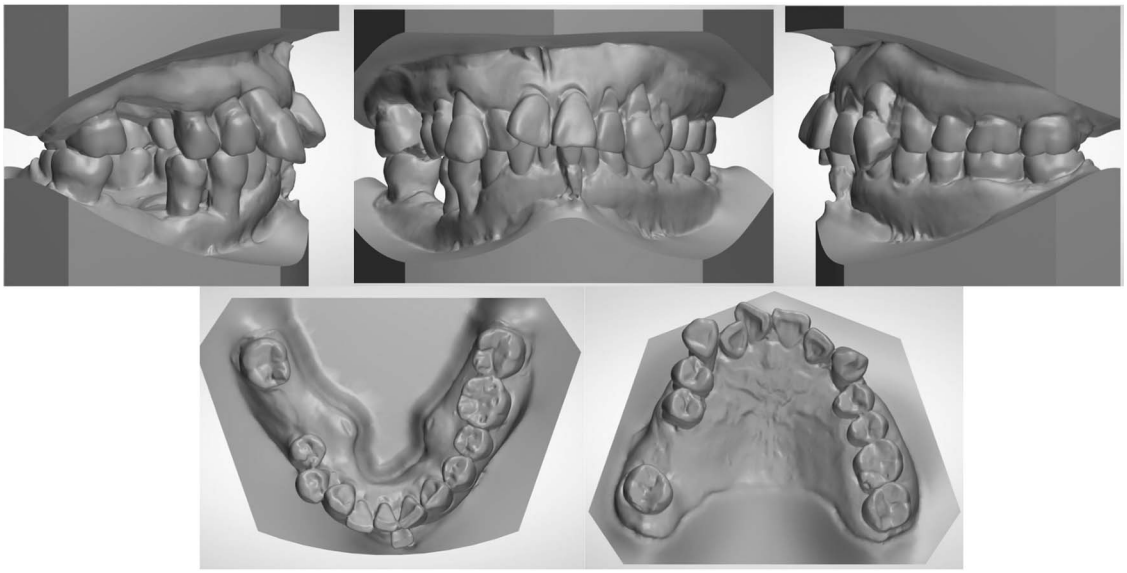

Figure 2. Pretreatment dental models.

severe alveolar bone loss extending close to the root apex in the cone beam computed tomography (CBCT) images (Figure 3).

The patient was diagnosed with a hyperdivergent skeletal Class II malocclusion, severe PTM with a hopeless prognosis, and chronic periodontitis.

Treatment Objectives

The treatment objectives were (1) eliminating TFO, (2) correcting dental crowding and establishing proper occlusion, and (3) improving lip protrusion and facial esthetic.

Treatment Alternatives

Two treatment plans were considered, and model setups were performed to visualize the treatment objectives (VTO; Figure 4).

Table 1. Periodontal Tissue Examination[a]

	Initial consultation	30 months of retention
Maxillary right canine		
Probing depth (mm)		
Buccal	537	435
Palatal	FF5	637
Mobility	+	−
Bleeding	−	−
Maxillary left canine		
Probing depth (mm)		
Buccal	347	437
Palatal	FFF	389
Mobility	++	−
Bleeding	−	−

[a] Probing depth: >10 mm (F indicates full length of the periodontal probe). Mobility: No mobility (−); Grade 1 (+); Grade 2 (++). Bleeding: No bleeding (−).

(1) Extraction of the maxillary canines and mandibular left central incisor was planned to address dental crowding due to their poor prognosis (Figure 4A). However, an excessive Class II molar relationship would be expected with a dental midline discrepancy. Additionally, mesial movement of the maxillary premolars and molars was needed to close the extraction space of maxillary canines, posing a challenge due to the mesioangular maxillary right premolars (Figure 3). This treatment plan showed disadvantages when considering the patient's age, periodontal condition, types of orthodontic tooth movement, and final occlusion.

(2) A nonextraction approach was proposed (Figure 4B). According to the VTO, 5 mm of distalization of the maxillary right premolars was required. Although this type of orthodontic tooth movement was considered feasible due to the angulation of the maxillary right premolars (Figure 3), the possibility of preserving the hopeless maxillary canines remained questionable. Since TFO existed without active inflammation, TFO should be eliminated by relocating the PTM while monitoring their reaction. Then the final treatment plan was determined accordingly.

Treatment Progress

At the beginning of treatment, intrusive distalization of the maxillary right premolars and the maxillary and mandibular left posterior segments was performed to regain space for the alignment of the maxillary canines and mandibular left central incisor. To prevent iatrogenic TFO during sequential intrusion, the vertical dimension was preserved at the posterior

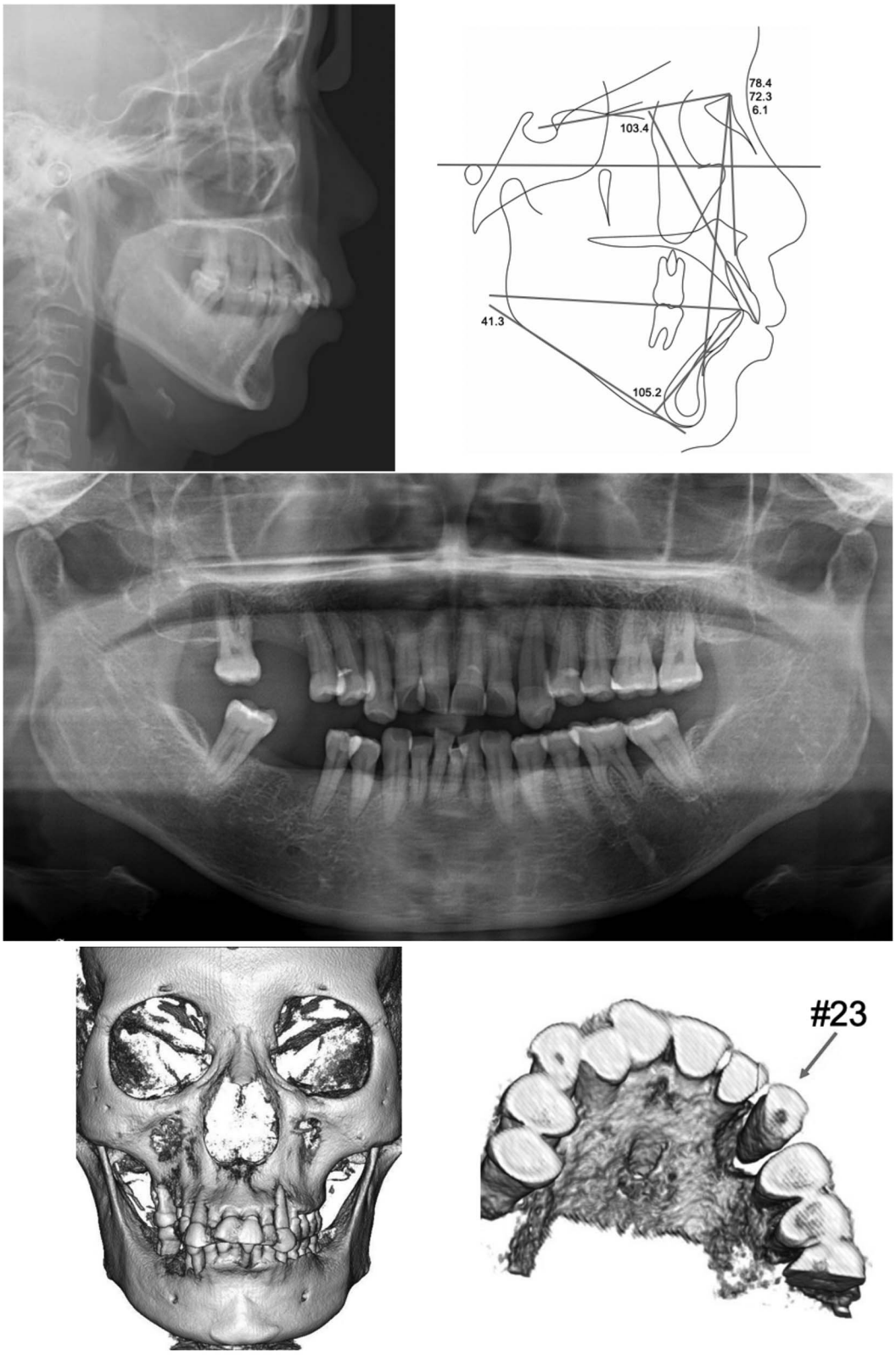

Figure 3. Pretreatment radiographs, cephalometric tracing, and three-dimensional reconstruction images.

Table 2. Cephalometric Analysis Measurements

Measurement	Pretreatment	Posttreatment	30 mo of Retention
SNA angle (°)	78.4	78.0	78.0
SNB angle (°)	72.3	72.3	72.3
ANB angle (°)	6.1	5.7	5.7
Wits appraisal (mm)	2.6	3.7	3.7
SN to mandibular plane (°)	41.3	40.9	40.9
U1 to SN (°)	103.4	102.5	102.5
IMPA (°)	105.2	104.2	104.2

segment, especially on the right side, while maintaining the incisal relationship (Figure 5A). For this purpose, 0.016 × 0.022 inch stainless steel ribbon arches were bonded directly to the target segments, and temporary skeletal anchorage devices (TSADs; 1.8 mm in diameter and 7.0 mm in length; Orlus, Ortholution, Seoul, Republic of Korea) were placed on the distobuccal side of the second premolars. Then oblique upward lines of force were applied accordingly (Figure 5A). In the mandibular left segment, the TSAD was later relocated to the buccal interradicular space between the first molar and second molar, then to the distobuccal side of the second molar, preventing root contact during distalization.

After regaining sufficient space, the maxillary canines were aligned with a self-ligating bracket system using a 0.018 inch Roth prescription (Tomy Inc., Tokyo, Japan) and a 0.012 inch nickel-titanium archwire (Figure 5B). After 5 months of treatment, the maxillary dentition was aligned, and TFO was addressed, followed by initial alignment of the mandibular teeth with the same bracket system (Figure 5C). The treatment showed favorable progress without signs of periodontal destruction. The nonextraction approach was selected to achieve the treatment objectives (Figure 4B).

To improve the Class II molar relationship and avoid TFO on the flared maxillary anterior teeth, intrusive distalization of the maxillary dentition was performed. A constant force system with controlled vertical dimension was applied to secure the absence of iatrogenic TFO during retraction (Figure 5C). For efficient total arch movement, bilaterally dual TSADs were used along with a stiff 0.016 × 0.022 inch stainless steel archwire (Figure 5C). After, an open coil spring was used to gain adequate space for the right maxillary first molar implant. Throughout treatment, iatrogenic TFO, alveolar bone, and root status were strictly checked. Additionally, regular periodontal examination and cleaning were performed, ensuring that periodontal tissues were inflammation-free during orthodontic tooth movement.

Active treatment was completed after 27 months. The appliance and TSADs were removed, followed by the placement of fixed retainers (Figure 6). The patient's periodontal tissue was monitored, and scaling was

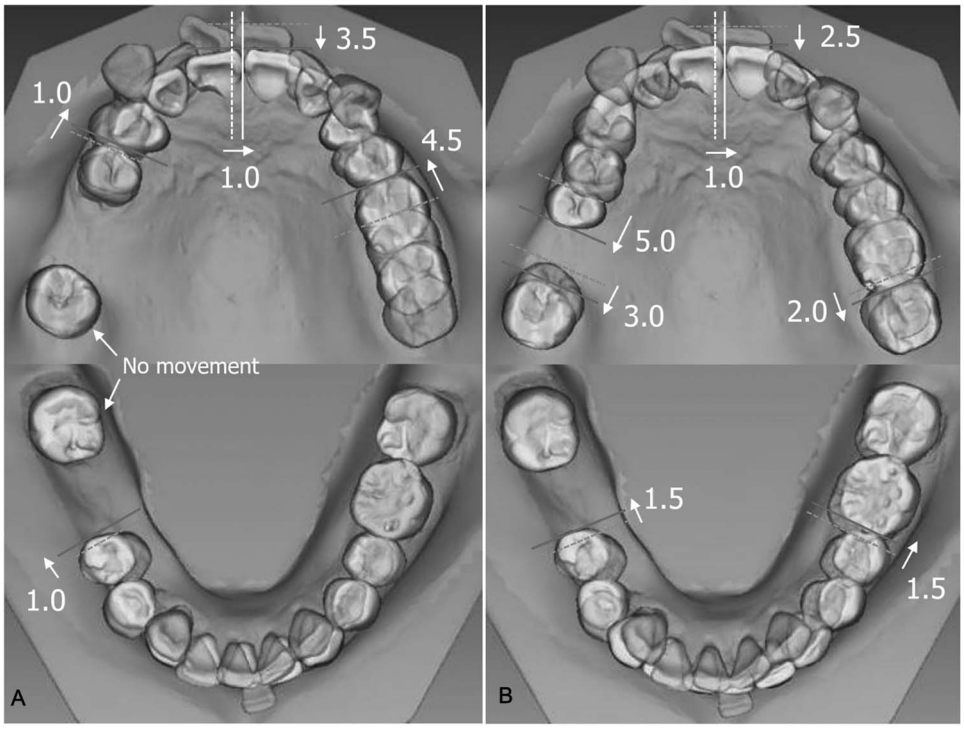

Figure 4. Visual treatment objective for (A) extraction and (B) nonextraction approaches.

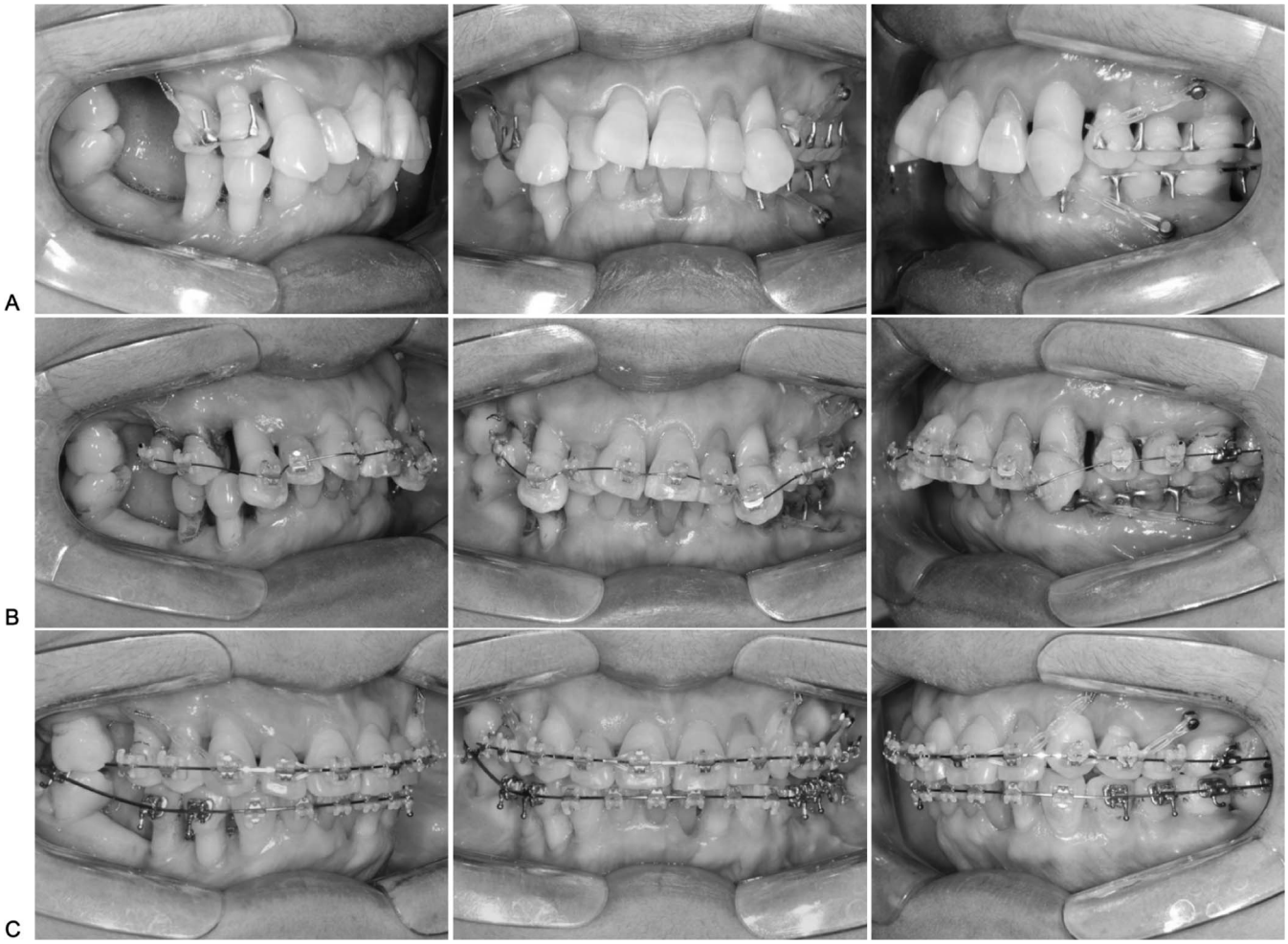

Figure 5. Intraoral photographs taken during treatment. (A) Segmental orthodontic tooth movement to regain space for alignment; (B) leveling and alignment of maxillary teeth; and (C) strategic intrusive distalization of maxillary dentition and alignment of mandibular teeth.

done regularly by a periodontist. After 10 months of retention, the intraoral condition remained stable; the maxillary and mandibular first molar implants were placed in regions of missing teeth.

Treatment Results

After treatment, dental crowding was successfully addressed without extraction of teeth (Figures 6 through 8). TFO was removed, and a proper cusp-fossa occlusal relationship was established with a significant improvement in facial esthetics. Severity of the gingival recession was obviously reduced, and no tooth mobility was observed (Figure 6; Table 1). However, minor root resorption of the left maxillary posterior teeth and the mandibular incisors were observed and monitored (Figure 9).

Cephalometric analysis and superimposition revealed a slight improvement in the skeletal relationship (Figure 10; Table 2). Posttreatment CBCT revealed a significant improvement in periodontal support, especially at the root apex of the maxillary canines (Figure 11).

The 30-month follow-up records confirmed the stability of treatment outcomes. The periodontally compromised teeth were preserved successfully (Figures 10 and 12; Tables 1 and 2).

DISCUSSION

Managing severe, periodontally consequential secondary malocclusions poses significant challenges and often necessitates the extraction of compromised teeth with poor prognosis, particularly in elderly patients.[4,8] Although prosthodontic interventions such as dental implants, fixed bridges, or removable partial dentures offer solutions for tooth replacement, they may not fully address malocclusion and esthetic concerns, and patients may face the burden of installation of multiple implants and

Figure 6. Posttreatment photographs.

denture prostheses with high costs.[9,10] Given the rising life expectancy worldwide, this case report holds particular significance, as we demonstrate an alternative treatment approach that preserves the natural dentition and minimizes the need for extensive prosthetic solutions in a middle-aged patient with hopeless teeth. By employing an etiology-based diagnosis and strategic orthodontic tooth movement, this approach facilitated not only the establishment of a stable occlusion but also improvements in overall periodontal health and facial esthetics.

The ideal timing for commencing orthodontic treatment postperiodontal therapy to prevent exacerbating periodontal damage has been debated extensively.[2,11–14] According to the time for complete healing of periodontal tissue, 3 months to 6 months after nonsurgical treatment, 6 months to 9 months after open flap debridement, and 12 months after regenerative surgery were recommended, respectively. Authors of a recent study proposed initiating orthodontic treatment 4 months postregenerative surgery to reduce overall treatment duration in Stage IV periodontitis patients.[11,13,14] In this patient, the periodontitis was managed by periodontists and orthodontic treatment was started 4 months after periodontal flap surgery when the periodontal health and patient compliance in maintaining oral hygiene showed favorable and stable results.

Decision-making regarding extraction or preservation of periodontally compromised teeth with a poor prognosis presents a dilemma for clinicians.[15,16] Dental implants should be considered as a treatment for tooth loss rather than a direct substitute for teeth, while a high risk of peri-implantitis should be considered in cases of teeth with poor periodontal prognosis.[17,18] Authors of numerous studies have highlighted the positive impacts of orthodontic tooth movement on

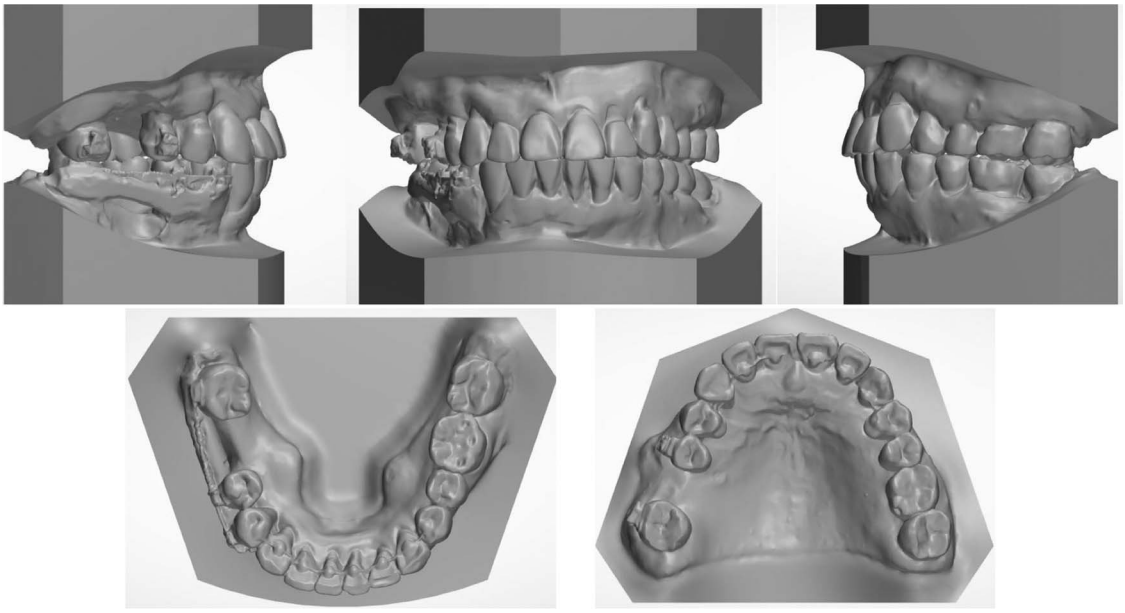

Figure 7. Posttreatment dental models.

compromised periodontal tissues, suggesting the potential to minimize or even prevent tooth loss to some extent.[2,3,6,7,11,14] Since TFO and periodontitis are exacerbated by nonaxial occlusal forces, addressing the existing TFO is paramount for creating a favorable environment to improve periodontal health and explore the possibility of tooth preservation (Figures 1 and 2).[12,19] Thus, considering the advantages of a nonextraction approach, favorable periodontal treatment resulted in controlling active inflammation and maintaining good oral hygiene, and single-rooted teeth, efforts were made to preserve the hopelessly migrated maxillary canines in this middle-aged patient. This was achieved despite challenges such as probing depths exceeding 6 mm, grade 1 to 2 tooth mobility, severe gingival recession, and bone defects (Table 1).[12]

Administering orthodontic treatment in patients with compromised periodontal health necessitates careful consideration. Since the characteristics of PTM are extrusion and flaring of the maxillary anterior teeth, intrusion and retraction to reverse them are the main goals of orthodontic treatment (Figures 1 and 2).[6] A careful orthodontic biomechanical design was devised while considering the periodontal tissue adaptation.[2] First, to minimize the risks of exacerbating periodontal attachment loss and accelerating tooth loss due to iatrogenic TFO,[20] segmental tooth movement was initially performed by using a 0.016 × 0.022 inch stainless steel direct-bonded ribbon arch with minimum wire play and vertical bowing in this patient (Figure 5A). Conventional continuous archwire should be avoided during initial alignment to prevent inducing extrusion of teeth that leads to iatrogenic TFO. Second, orthodontic TSADs were used strategically to provide points of force application to achieve the target tooth movements (Figure 5). The amount and direction of movement was closely monitored and controlled based on the relationship between the line of force and the estimated center of

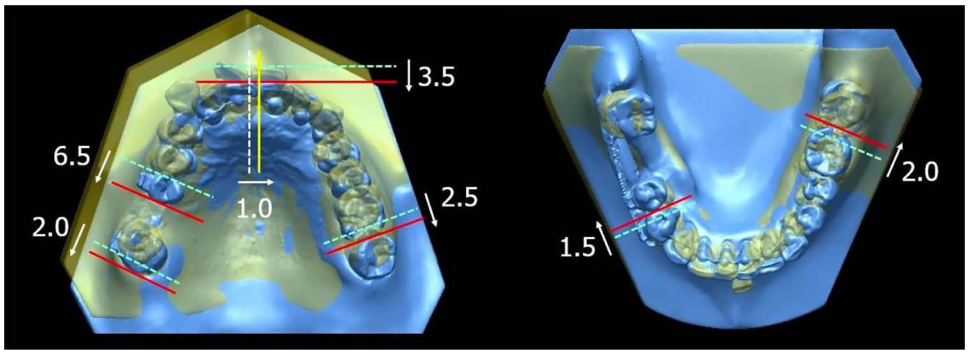

Figure 8. Superimposition of pretreatment and posttreatment dental models.

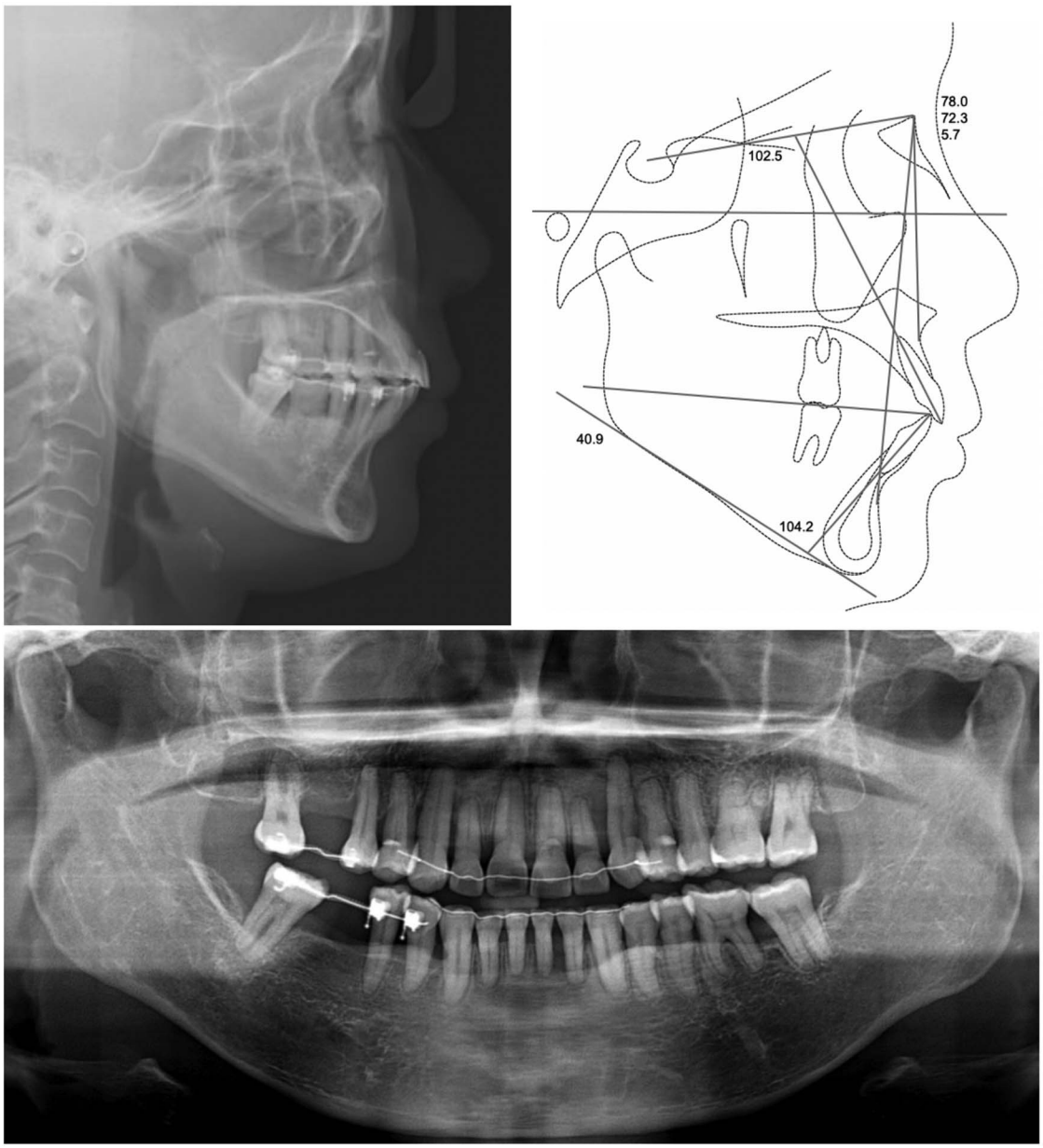

Figure 9. Posttreatment radiographs and cephalometric tracing.

resistance (CoR) of the target segments throughout active treatment.[21] However, it could be challenging in teeth with severe alveolar bone loss due to the displaced CoR and the risk of uncontrolled tipping.[2,22] Therefore, the magnitude of force must be minimal, and the CoR of the target segment must be estimated according to the amount of alveolar bone loss.[11,22,23]

In this patient, to regain space for alignment, intrusive distalization of the maxillary right premolars and maxillary and mandibular left posterior segments were performed. For the maxillary right premolar segment, TSADs were placed so that the line of action of the force passed below the CoR of the segment to induce a clockwise rotation, and for the left segments, the line of action of the force passed close to the CoR to induce translation (Figure 5A). After alignment of the canines, to improve the Class II molar relationship and avoid TFO on the flared anterior teeth, TSADs were placed additionally in the buccal interradicular space between the maxillary canines and first premolars to optimize total arch intrusive distalization and minimize occlusal plane rotation (Figure 5C).[24] Eventually, active treatment took 27 months, resulting in a proper occlusion while preserving natural teeth with adequate periodontal support (Figures 6 and 7; Table 1). The patient expressed satisfaction with the results, and the

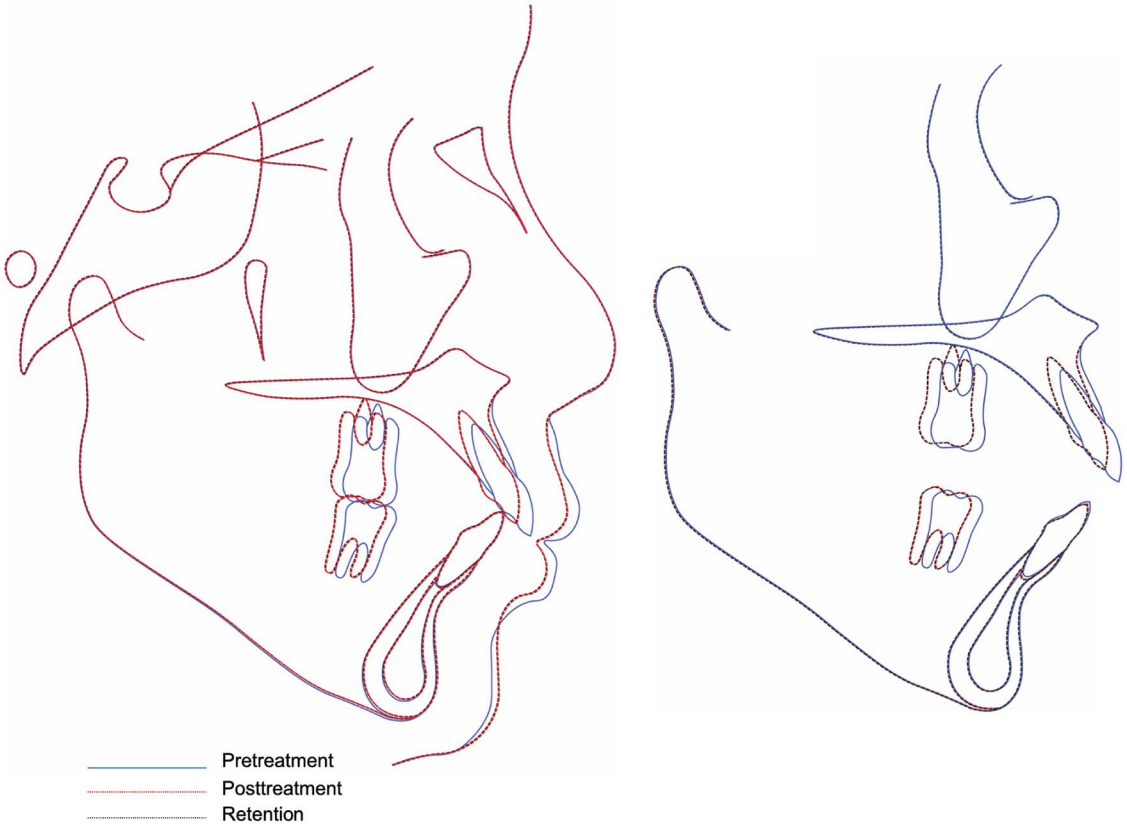

Figure 10. Superimposition of pretreatment and posttreatment, and 30-month retention tracing.

30-month follow-up records confirmed the stability of treatment outcomes (Figure 12).

The success of this case underscores the potential of orthodontic intervention in managing complex periodontally compromised malocclusions, especially in middle-aged patients with poor prognosis for their dentition. Although the possibility of preservation of hopeless teeth was questionable at the beginning and it was difficult to expect new attachment of periodontal tissue in this patient when considering the severity of attachment loss, the patient's age, and the potential for tissue regeneration, proper periodontal support was confirmed surrounding the pathologically migrated maxillary canines in the posttreatment CBCT images and during periodontal tissue examination at 30 months of retention (Figure 11; Table 1). Such a treatment approach should be encouraged, and an adequate etiology-based diagnosis along with a strategic orthodontic force system design could be crucial factors for success.

CONCLUSIONS

- In this case report, we illustrate the potential of orthodontic intervention to preserve periodontally compromised teeth by eliminating TFO.

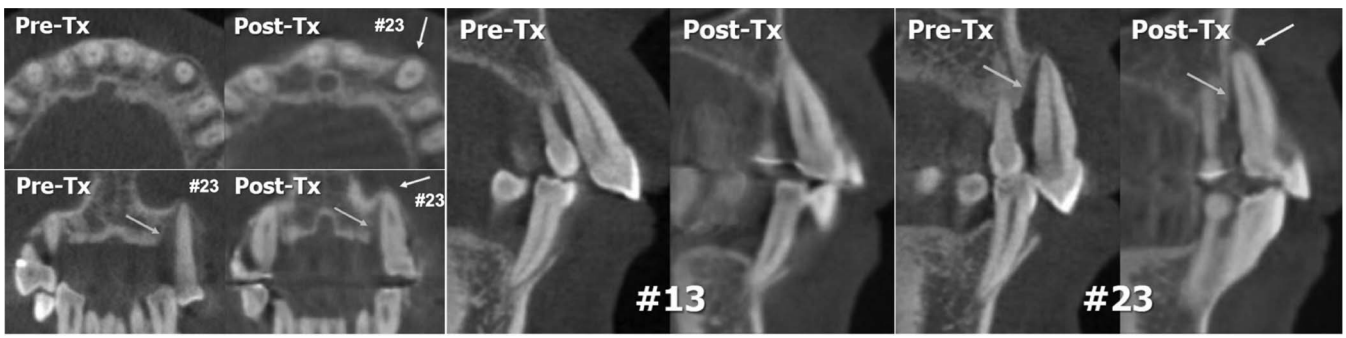

Figure 11. Serial cone beam computed tomography images taken pre- and post-treatment of the maxillary canines.

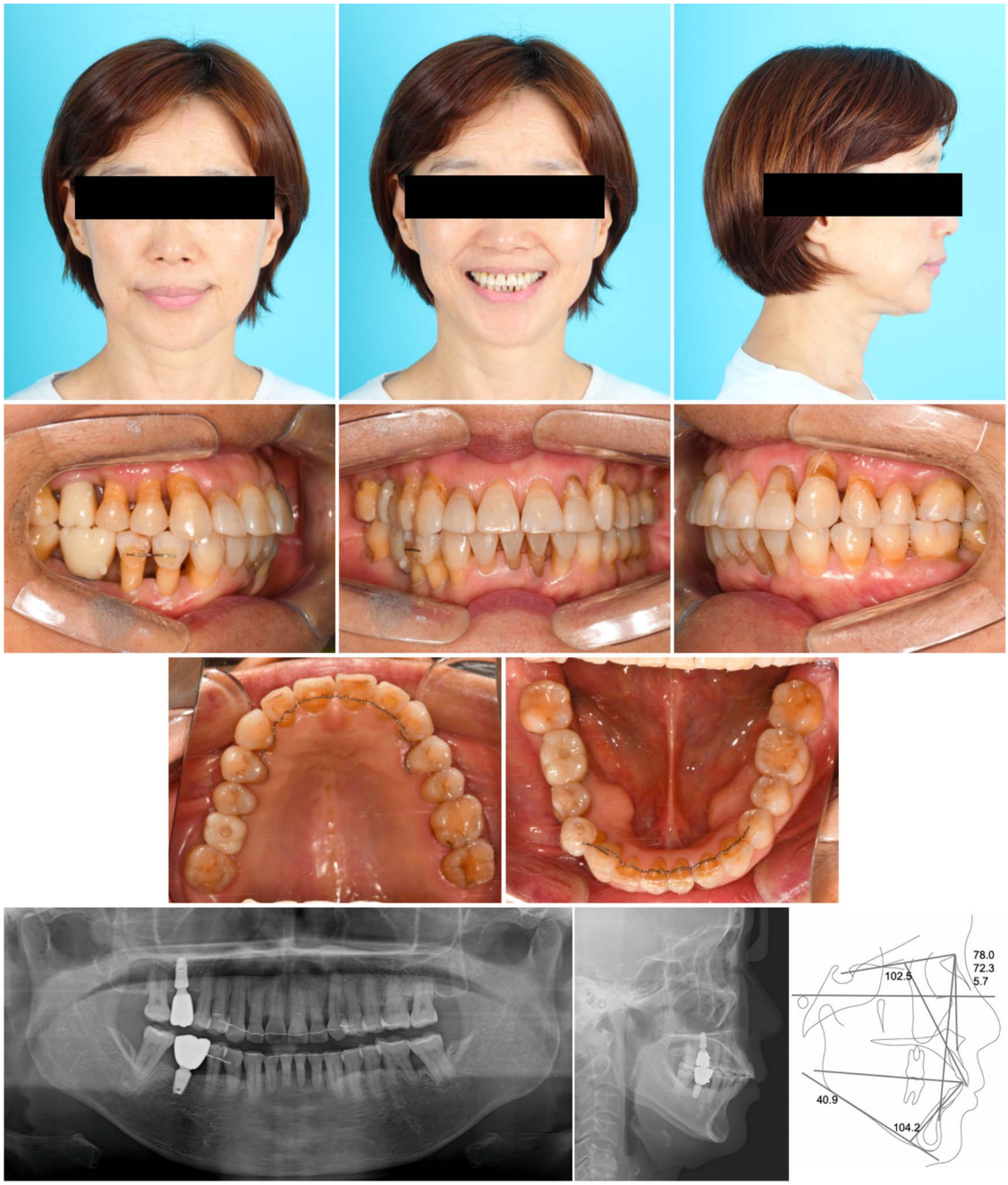

Figure 12. Thirty-month retention photographs, radiographs, and cephalometric tracing.

- Pathologically migrated teeth under TFO necessitate immediate orthodontic relocation.
- Sequential segmental intrusion was used to align the compromised teeth, resulting in proper bone support.

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