Case Report

Orthodontic treatment of a middle-aged patient with periodontally compromised dentition accompanied by pathologic tooth migration

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ABSTRACT

Orthodontic treatment in patients with periodontally compromised dentition often presents challenges, necessitating special considerations. This case report describes treatment of a 52-year-old female patient with advanced chronic periodontitis and pathologic tooth migration through an interdisciplinary orthodontic–periodontal approach. By integrating comprehensive periodontal treatment with strategic use of miniscrew-assisted rapid palatal expansion (MARPE) and careful consideration of the applied force systems, both functional and esthetic concerns were addressed without causing adverse periodontal side effects. This highlights the importance of thoughtful treatment planning and integration of periodontal care during orthodontic tooth movement in treating individuals with reduced periodontal health for successful and esthetically pleasing results. (*Angle Orthod*. 2024;94:678–686.)

KEY WORDS: MARPE; Orthopedic expansion; Adult treatment; Periodontitis; Gingival recession

INTRODUCTION

Aging of the population has reshaped the landscape of orthodontic treatment in recent years, expanding the scope beyond traditional younger age groups to include middle-aged and senior patients. According to a study conducted in 2016, the proportion of patients over 40 years of age increased from 3.2% to 6.6% between 2008 and 2012.[1] While this provides valuable insights into shifting demographics, it is reasonable to anticipate a continued rise in the coming years, given the ongoing process of global population aging.[2]

In middle-aged and older patients, orthodontic treatment targets not only esthetic concerns, but also functional rejuvenation, with a focus on enhancing dental longevity and promoting periodontal health. While degeneration of periodontal tissues is a part of natural aging, it can be intensified to severe bone loss in the presence of periodontitis.[3] Such conditions are prevalent in older patients and pose challenges in orthodontic treatment planning. To prevent potential side effects and yield optimal outcomes, special considerations are required in the treatment of periodontally compromised dentitions.

Whether orthodontic treatment is beneficial for patients with a periodontally compromised dentition remains controversial in the literature.[4–6] Recent reports suggested that individuals with reduced periodontal support can derive significant benefits from orthodontic intervention.[6] The advantages extend beyond esthetic improvements to encompass functional and hygienic aspects, considering that periodontitis is often associated with irregularities of anterior teeth and discrepancies in anteroposterior and vertical dimensions caused by reduced periodontal support and pathologic tooth migration.[7,8]

This case exemplifies various clinical aspects in a middle-aged patient with periodontally compromised dentition accompanied by transverse discrepancy and anterior open bite.

Diagnosis and Etiology

A 52-year-old female patient with a history of generalized advanced chronic periodontitis was referred for

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Figure 1. Pretreatment facial and intraoral photographs.

preprosthetic orthodontic evaluation. Upon extraoral examination, 1.5 mm of dental midline deviation to the right in both arches and insufficient upper incisal display during smiling were noted (Figure 1). The patient presented with an acceptable straight profile and minor lower lip protrusion. Notably, the upper left canine was in supra-occlusion, showing 3 mm of discrepancy to the adjacent teeth. The upper right canine and second premolar had drifted into the space of the missing first premolar, which was lost 2 years ago. The anterior teeth showed a negative overbite of −1.5 mm and partially negative overjet (Figure 1).

A panoramic radiograph revealed a floating tooth appearance of the lower right first molar and severe vertical bone loss between the upper left lateral incisor and canine, with pathologic migration of the canine (Figure 2). Additionally, bone loss beyond the bifurcation areas of the upper left second and lower left first molars was observed, correlating with an overall increase in probing depths. Cephalometric analysis indicated a mild skeletal Class III relationship with hyperdivergent facial type (Figure 2, Table 1).

Clinically, the patient showed bilateral crossbite in the posterior area, indicating an apparent transverse discrepancy. Accordingly, intermolar width was 42.6 mm for the upper arch and 43.0 mm for the lower arch, resulting in an intermolar width difference of −0.4 mm (Figure 3). Model analysis indicated an arch length discrepancy of 7 mm in the upper arch and 1 mm in the lower arch, considering an implant for the missing premolar (Figure 3).

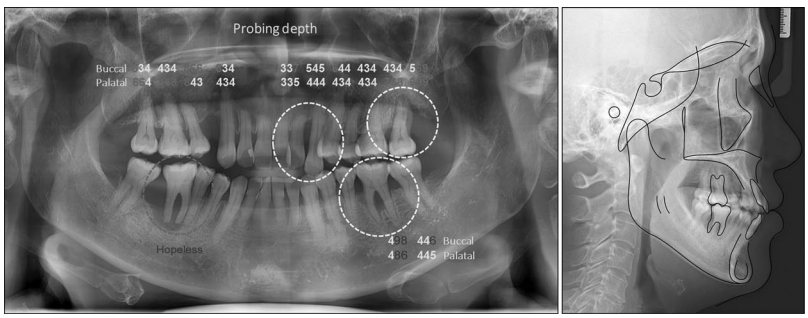

Figure 2. Pretreatment panoramic radiograph and lateral cephalogram.

Table 1. Cephalometric Analysis

Measurements	Pretreatment	Posttreatment
SNA (°)	75.3	75.4
SNB (°)	75.3	75.2
ANB (°)	0	0.2
Wits (mm)	−7.3	−7.9
SN-GoMe (°)	40.1	40.4
U1 to SN (°)	105.0	103.4
L1 to GoGn (°)	95.9	98.3
Upper lip to E-line (mm)	−3.5	−3.7
Lower lip to E- line (mm)	2.1	1.2

Treatment Objectives

Treatment objectives were: (1) correct the transverse discrepancy and posterior crossbite, (2) establish a bilateral Class I molar relationship with normal overbite and overjet, while maintaining the facial profile; and (3) prevent additional loss of periodontal support and facilitate effective self-cleaning for improved oral hygiene.

Treatment Plan

Prior to active orthodontic treatment, comprehensive periodontal treatment was crucial. The periodontal treatment plan included extraction of the hopeless lower right first molar, full-mouth scaling, and root planing. Furcation tunneling of the lower left first molar and implantation in sites of the upper right first premolar and lower right first molar were scheduled for after completion of orthodontic treatment.

As an initial step of orthodontic treatment, transverse correction by miniscrew-assisted rapid palatal expansion (MARPE) was planned. Considering that the normal range of intermolar width difference is 8.43 ± 2.22 mm,[9] 40 activations of MARPE were required to achieve 8 mm of expansion and 5.5 mm of space gain.

Alternatively, arbitrary arch expansion using appliances with dental anchorage could be considered. However, this mechanism of transverse expansion causes buccal tipping of the posterior teeth without a significant increase in the width of the basal bone. Consequently, it would not only be difficult to achieve sufficient expansion, but also be periodontally detrimental, especially in a periodontally compromised dentition.

Surgically assisted rapid palatal expansion allows skeletal expansion in adult patients with presumably nonpatent sutures. However, it involves multiple surgical procedures, along with associated risks and additional costs. Considering these aspects and the patient's preference, nonsurgical skeletal expansion was chosen as the primary option. After transverse correction, distalization of the left posterior teeth was planned in both arches for dental midline correction and space gain for anterior decrowding and alignment.

Treatment Progress

Treatment began with the delivery of a MARPE appliance (KBE; BioMaterials Korea Inc., Seoul, Korea), which was anchored using bands on both second premolars and first molars, along with a total

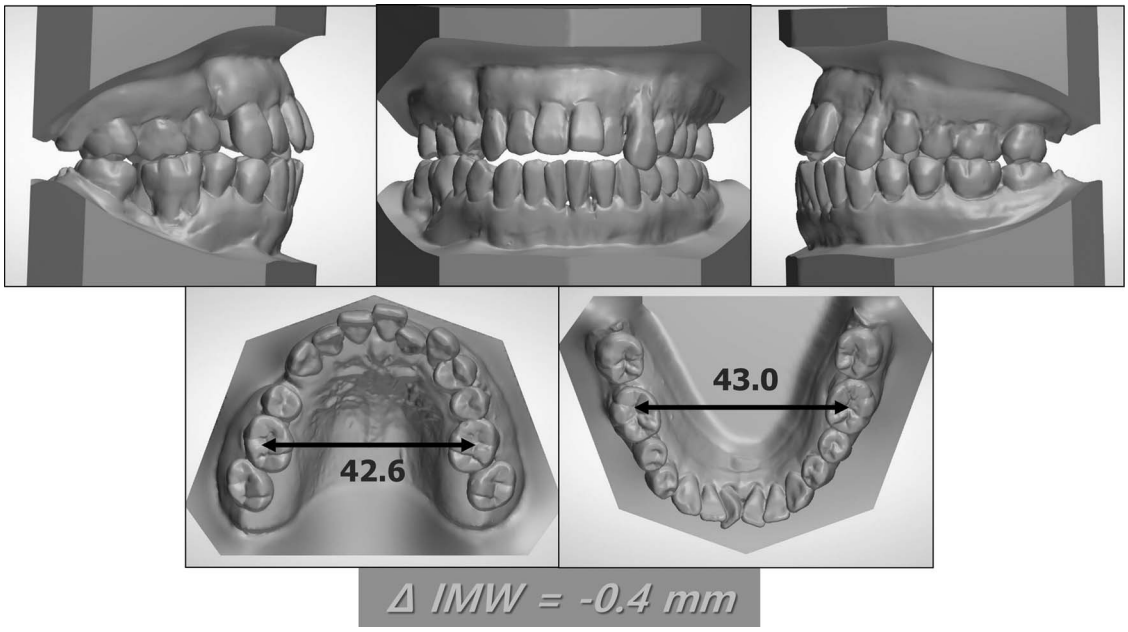

Figure 3. Pretreatment dental casts and intermolar widths.

Figure 4. 4 weeks after MARPE delivery. Suture separation is evident both clinically (A) and in the periapical radiograph (B). MARPE indicates miniscrew-assisted rapid palatal expansion.

of four miniscrews (9 mm in length; 2 mm in diameter, BioMaterials Korea Inc., Seoul, Korea), including two in the anterior region and two in the posterior region of the expansion screw. The patient was instructed to activate the expansion screw once a day, equivalent to 0.2 mm/day. After 4 weeks of activation, diastema opening was noted (Figure 4A) and suture separation was confirmed on a periapical radiograph (Figure 4B). The expansion was completed after a total of 42 turns. Considering the wide nasal base and esthetically pleasing amount of buccal corridor, further overcorrection was not planned.

A posteroanterior cephalogram obtained after 3 months of consolidation showed an improvement in the maxillomandibular width from 31.5 mm to 27.5 mm, which fell into the normal range suggested by Hwang et al. (Figure 5).[10] Although measured values might not precisely reflect actual dimensions due to variations in head angulation during radiography, an apparent increase in transverse width of the maxillary basal bone was evident.

After correcting the transverse discrepancy, self-ligating 0.018-inch slot brackets with Roth prescription (Clippy C, Tomy, Tokyo, Japan) were bonded to the mandibular posterior teeth for segmental distalization using miniscrews on each side (1.6 mm in diameter, 6.0 mm in length, Osstem Orthodontics Inc., Gyeonggi-do, Korea). At the end of the consolidation period of 3 months, the upper arch was aligned using the same type of brackets as the lower arch. After initial alignment and space gain, the migrated upper left canine was leveled using a 0.012-inch nickel-titanium overlay wire (Figure 6A). Meanwhile, alignment of the lower anterior teeth was initiated as sufficient space was available through distalization of the posterior teeth (Figure 6A).

At 8 months of treatment, leveling of the upper left canine was almost complete. However, gingival recession was observed on the buccal side of the upper left first premolar, which was then closely monitored throughout treatment (Figure 6B). At 14 months, miniscrews were inserted between the upper second premolar and the first molar for midline correction and improvement of the canine relationship. Toward the end of treatment, furcation tunneling on the lower left first molar was performed in the periodontal department for better access and cleaning of the affected furcation area.

Toward the end of treatment, dental implants were placed in regions of missing teeth. After implantation, some gingival recession was evident around adjacent

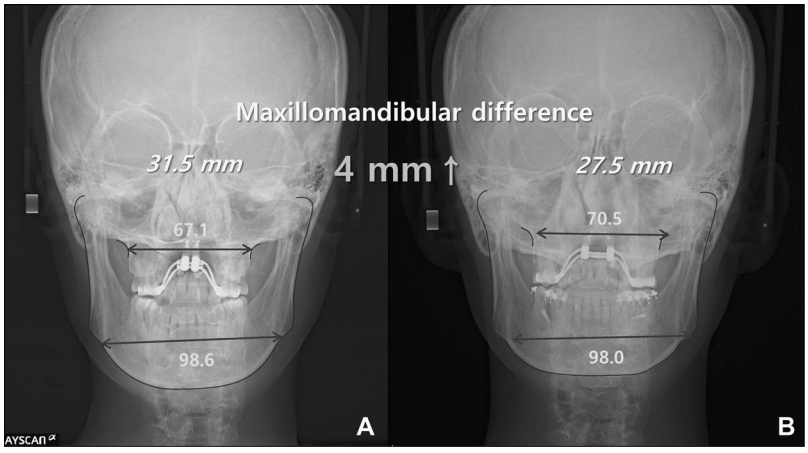

Figure 5. Anteroposterior cephalogram directly after MARPE delivery (A) and at 3 months after completion of expansion (B). Maxillomandibular difference increased by 4 mm.

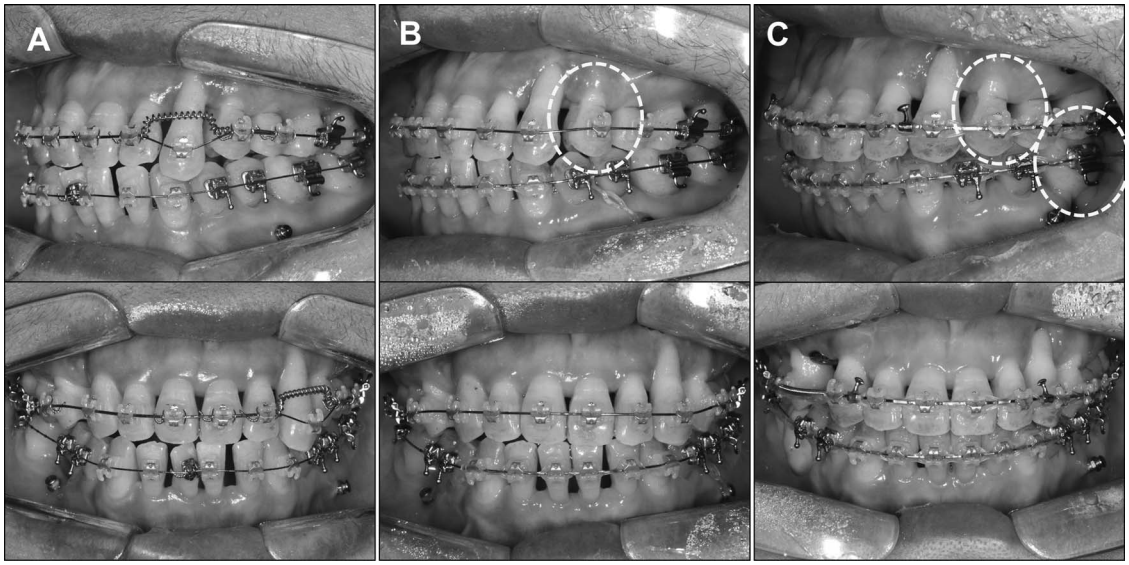

Figure 6. Intraoral photos at 6 months (A), 8 months (B), and 26 months (C) of treatment.

teeth. After delivering implant supported crowns, all fixed appliances were removed. The active treatment lasted 31 months in total.

Treatment Results

Transverse discrepancy and posterior crossbite were successfully resolved without significant periodontal side effects (Figure 7). The maxillary intermolar width increased by 6.3 mm, from 42.6 mm to 48.9 mm. A coronal section through first molars of the posttreatment digital cast revealed maxillary expansion primarily through bodily movement without excessive buccal tipping of the anchor teeth (Figure 8). Measurements of transverse width from cone-beam computed tomography (CBCT) images acquired at 22 months

Figure 7. Posttreatment facial and intraoral photographs.

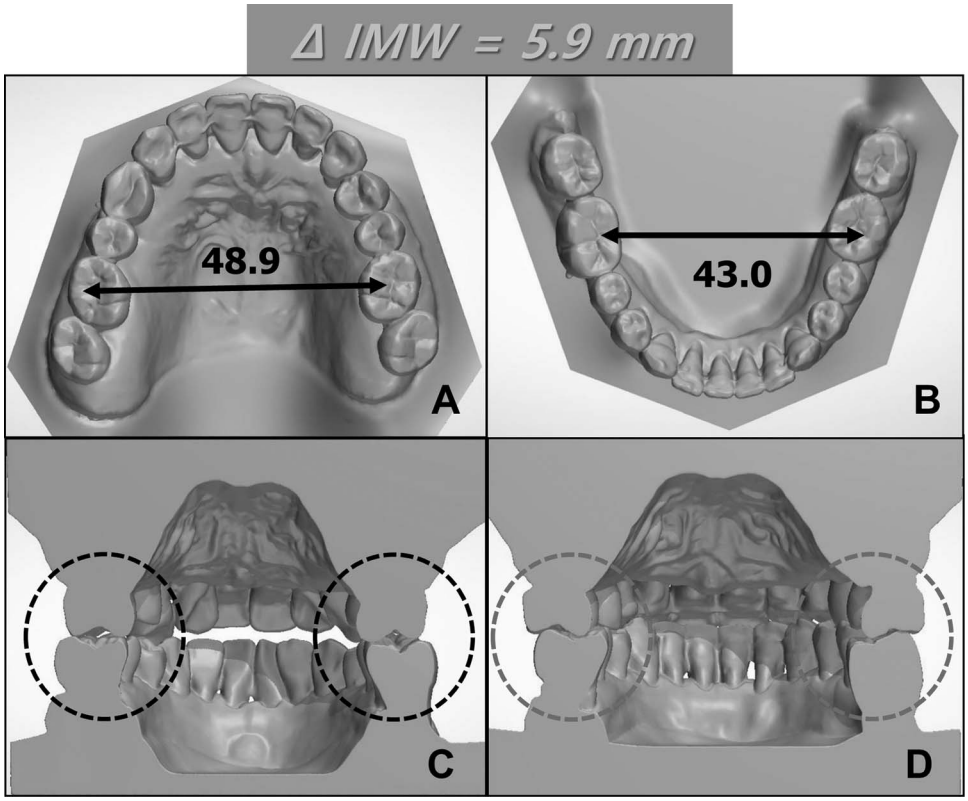

Figure 8. Posttreatment dental casts, showing an increase in the intermolar width difference (A, B) and comparisons between pretreatment (C) and posttreatment (D) molar angulation and transverse relationship.

after expansion showed similar dimensions at the height of the central fossa and bifurcation area of the first molars (Figure 9). The buccolingual inclination of the first molars was further assessed using measurements according to Alkhatib et al. (Figure 9A).[11] The measured value was 3.5° for the right side and 2.9° for the left side, falling within the normal range reported in the literature.[11]

The dental midline coincided with the facial midline in both arches. A molar Class I relationship was established bilaterally with a normal overbite and overjet. Upper and lower anterior crowding was relieved, while the facial profile was largely maintained as planned. Some minor improvement of the lower lip profile was noticed as a result of upper incisor retraction, alleviating pressure on the lower lip (Figures 7, 10). Root parallelism was confirmed in the posttreatment panoramic radiograph (Figure 10A). Periapical radiographs of the anterior teeth revealed only minor root blunting of upper and lower lateral incisors, showing no significant reduction in the alveolar bone level (Figure 10B).

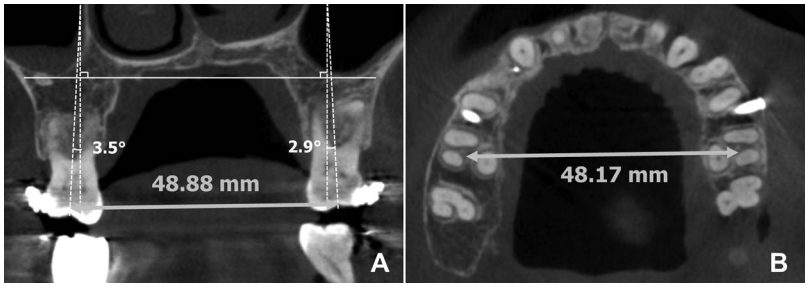

Figure 9. CBCT showing coronal section of the maxillary first molars at 22 months after the completion of rapid palatal expansion (A). The intermolar width measured between central fossa of the first molars aligned with the measurement of the posttreatment dental cast. Buccolingual inclination of the first molars was measured as the angle between the tooth axis and the sagittal reference line, which was perpendicular to the line passing through the inferior border of the orbital rims.[11] CBCT showing axial section through the bifurcation area of the upper first molars (B). CBCT indicates cone beam computed tomography.

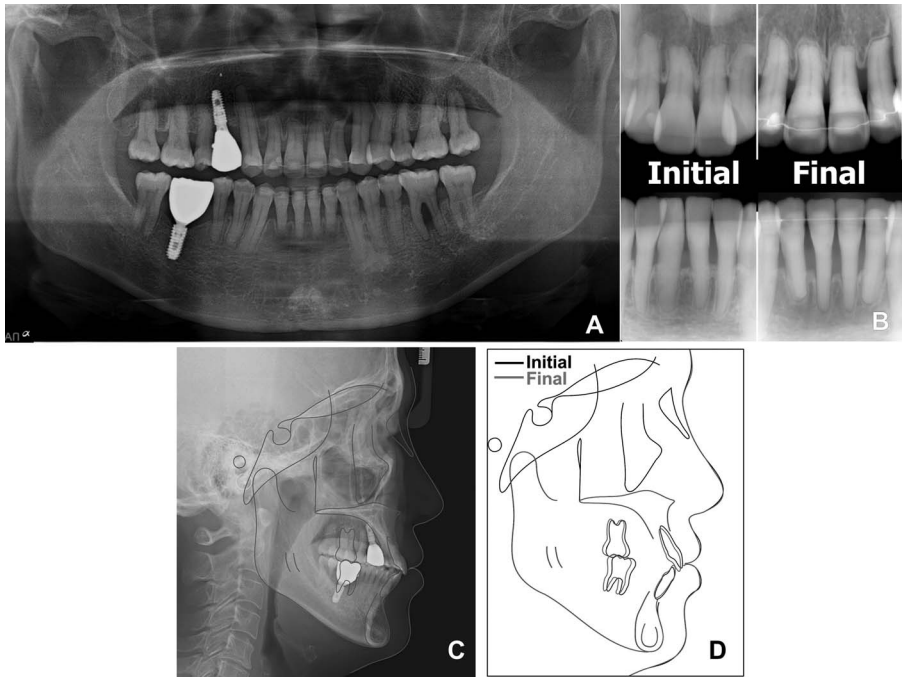

Figure 10. Posttreatment panoramic radiograph (A). Comparison between pre- and post-treatment periapical radiographs of the anterior teeth (B). Posttreatment lateral cephalogram (C) and superimposition (D).

The increase in the clinical crown height of the upper left first premolar observed during alignment at 8 months of treatment was maintained until the end of the treatment and remained stable at 20-month follow-up (Figure 11). Cephalometric analysis and superimposition showed that treatment goals were achieved without causing any major skeletal, dental, or soft tissue changes as planned (Figures 10C, D; Table 1). Smile esthetics improved significantly due to some extrusion of the upper incisors to increase incisal display. The patient expressed great satisfaction with the treatment results.

DISCUSSION

Periodontal implications of orthodontic intervention in patients with a periodontally compromised dentition have been a subject of active investigation and controversy in the literature.[12] Various studies have explored potential adverse periodontal effects, such as bone dehiscence,

Figure 11. Intraoral photographs at 20-month follow-up.

attachment loss, and gingival recession.[13,14] However, existing evidence does not strongly support increased susceptibility in the periodontally compromised dentition.

A controlled clinical study by Boyd et al. showed that comprehensive orthodontic treatment in patients with reduced but healthy periodontal tissues did not result in statistically or clinically significant attachment loss compared to controls.[15] This emphasizes the importance of good oral hygiene and absence of active periodontitis for successful treatment outcomes. Similarly, a study that investigated effects of orthodontic treatment with removable appliances revealed no significant attachment loss in patients with reduced periodontal support when the periodontium remained free of inflammation and applied forces were within physiologic limits.[16] A systematic review by Erbe et al. supported these findings, concluding that orthodontic treatment did not adversely affect periodontal status in the studies analyzed.[6]

In the present case, the entire course of orthodontic treatment was accompanied by regular periodontal check-ups and cleaning to ensure that periodontal tissues were free of inflammation during tooth movement. Consequently, no significant attachment loss was observed at the completion of active treatment. Although long-term prognosis requires further follow-up, the maintenance of good oral hygiene is expected to prevent additional periodontal destruction, as evidenced in a 12-year follow-up study.[5]

Synergistic effects of combined orthodontic-periodontal treatment on periodontal tissues have been widely acknowledged. Interdisciplinary approaches not only offer esthetic benefits, but also effectively address functional concerns in complex clinical situations.[17] For instance, traumatic occlusion resulting from pathologic migration of periodontally compromised teeth can exacerbate periodontal destruction.[18] Orthodontic intrusion allows for long-term improvement of attachment level, with the gingival margin moving approximately 60% of the distance of intrusion, as observed in an experimental study with monkeys.[17,19] This leads to reported reduction of clinical crown height at a rate of 40% of intrusion.[19]

According to Melsen, periodontal reaction to intrusion of periodontally compromised teeth depends on the magnitude of applied force and the stress distribution in periodontal ligaments.[20] Intrusion by light continuous force in a strictly controlled, hygienic environment can enhance the attachment level.[19] Additionally, a recent systematic review highlighted positive effects of combined orthodontic–periodontal treatment in terms of probing depths and attachment gain.[6] Similarly, extrusive movement of teeth affected by periodontitis has been reported to be feasible without detrimental effects on periodontal tissues. An animal study conducted by Venrooy et al. with beagle dogs concluded that extruded teeth did not undergo attachment loss. Instead, they showed an overall improvement in periodontal status, with new bone formation noted after extrusion.[21]

In addition to biomechanical and hygiene considerations, the direction and extent of tooth movement should be carefully planned in periodontally compromised dentitions. While transverse discrepancy is frequently observed in adult patients, correction by dental compensation involving excessive tipping can be periodontally detrimental. Dentoalveolar expansion relies on displacement of the posterior teeth in the buccal direction. It is often associated with bone dehiscence, gingival recession, and consequent loss of periodontal support.[22] Potential periodontal issues can be minimized by orthopedic expansion of the maxilla with incorporated miniscrews.[23]

Nonetheless, suture separation in adult patients by nonsurgical means has been questionable, given the observed increase in the degree of suture interdigitation and obliteration with age.[24,25] However, recent case reports and studies have confirmed the feasibility of nonsurgical skeletal expansion in adults.[23,26,27] This feasibility is attributed to large individual variations in the timing and pattern of suture interdigitation and obliteration.[28] Considering these factors, orthopedic expansion by MARPE was attempted in the present case. It was successful, significantly contributing to the correction of the maxillary transverse deficiency while minimizing periodontal side effects.

According to a study by Choi et al., an average expansion of 4.43 mm was measured upon removal of MARPE, of which 10% relapsed after 30 months.[29] While the long-term stability in the present case is yet to be confirmed, the substantial increase in the maxillary intermolar width prompted the recommendation for the patient to wear a removable retainer every night for at least a year.

CONCLUSIONS

- The present case exemplifies successful resolution of functional and esthetic concerns in a middle-aged patient with periodontally compromised dentition through orthodontic treatment.
- Beyond meticulous planning of the biomechanical force system, an interdisciplinary approach to integrate comprehensive periodontal care was essential for minimizing adverse side effects and achieving optimal outcomes.
- The strategic use of MARPE effectively addressed the transverse discrepancy without detrimental effects on periodontal tissues.

- This case not only highlights the viability, but also underscores the advisability of orthodontic treatment for patients with periodontally compromised dentition.

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