

A modified orthodontic protocol for advanced periodontal disease in Class II division 1 malocclusion

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An interdisciplinary approach is often the best option for achieving a predictable outcome for an adult patient with complex clinical problems. This case report demonstrates the combined periodontal/orthodontic treatment for a 49-year-old woman presenting with a Class II Division 1 malocclusion with moderate maxillary anterior crowding, a 9-mm overjet, and moderate to severe bone loss as the main characteristics of the periodontal disease. The orthodontic treatment included 2 maxillary first premolar extractions through forced extrusion. Active orthodontic treatment was completed in 30 months. The treatment outcomes, including the periodontal condition, were stable 17 months after active orthodontic treatment. The advantages of this interdisciplinary approach are discussed. Periodontally compromised orthodontic patients can be satisfactorily treated, achieving most of the conventional orthodontic goals, if a combined orthodontic/periodontic approach is used. (*Am J Orthod Dentofacial Orthop* 2011;139:S133-44)

Orthodontic treatment is no longer a contraindication in the therapy of severe adult periodontal disease or in the maintenance of a healthy periodontium.¹ In fact, orthodontic treatment could enhance the possibility of saving and restoring a deteriorated dentition.

Advanced periodontal disease is primarily characterized as severe attachment loss and a reduction of alveolar bone support, and the periodontal condition is usually characterized by tooth mobility, migration, spacing, and marginal gingival recession. In the maxillary anterior region, functional discomfort is usually accompanied by compromised esthetics.^{1,2} Orthodontic treatment for realignment of migrated periodontally involved teeth is initiated only after control of the periodontal inflammation has been achieved.^{3,4} If the patient is

reasonably motivated and responds well to the initial periodontal therapy, adult orthodontic treatment has a role in providing complete rehabilitation in terms of both function and appearance, with a satisfactory long-term prognosis.⁵ Good oral hygiene at home and professional maintenance visits are important during and after active orthodontic treatment. In this periodontally compromised case, a successful result was achieved with improvement of oral hygiene, periodontal prognosis, esthetics, masticatory function, and self-confidence. This case report presents a modified (unusual) periodontal-orthodontic approach in an adult woman presenting with a Class II, Division 1 malocclusion with advanced periodontal disease (horizontal and vertical loss of alveolar bone), in whom 2 first maxillary premolar extractions were performed after forced extrusion. Both maxillary central incisors were also extruded to correct the bone and gingival levels, providing better esthetics and function.

INTRODUCTION

Diagnosis and etiology

A 49 year-old female patient with severe periodontal disease, came to the private orthodontic office of one of us (M.J.), with the chief complaint about her maxillary anterior dental appearance. She had no systemic problems. The initial examination demonstrated an acute nasolabial angle and a strained lip closure. Significant

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Fig 1. Pretreatment facial and intraoral photographs.

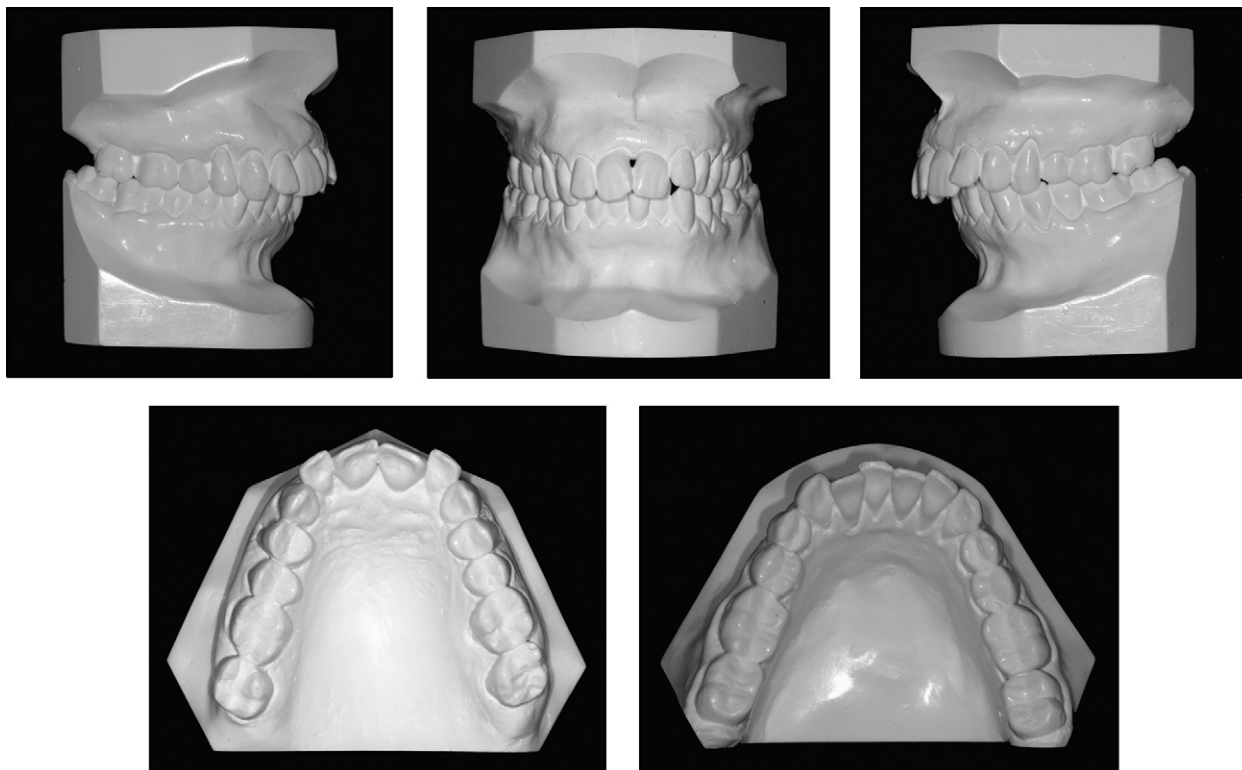


Fig 2. Pretreatment dental casts.



Fig 3. Pretreatment periapical radiographs.

gingival recession was noted labial to both maxillary first premolars, the maxillary and mandibular left molars, and the maxillary anterior segment (caused by previous periodontal surgery [resection]), with an open gingival embrasure (Fig 1) between the central incisors. A furcation defect was present on the buccal surface of the mandibular left first molar. A complete Class II molar relationship on both sides, with severe maxillary protrusion and an overjet of 9 mm was identified. The maxillary and mandibular incisors were crowded, with mild migration and moderate rotation (Fig 2).

Probing of the periodontal attachment has been and still is the gold standard for diagnosis of active disease or progression of disease.⁶ Pretreatment periodontal probing demonstrated depths ranging from 3 to 8 mm, except for the maxillary lateral incisors and canines and the mandibular canines. Examination of radiographs taken before periodontal treatment demonstrated generalized horizontal bone loss in both arches and vertical bone defects in the maxillary first premolars and in the maxillary and mandibular second molars (Fig 3). The

cephalometric analysis showed a skeletal Class II jaw base relationship (ANB angle, 7.4°), with mandibular retusion (SNB angle, 71.3°), a convex skeletal profile (NAP angle: 13.7°), a dolichofacial pattern with an increased SN-GoGn angle (41.6°), and protruded and labially tipped mandibular incisors (Table 1, Fig 4).

Treatment objectives

The main objectives were to reduce or keep the defects at the same level, eliminate primary and secondary occlusal trauma by providing a functional occlusion⁷ and fixed retention between the teeth with bone loss, reduce the maxillary incisor protrusion, achieve an ideal overjet and overbite, and achieve satisfactory facial esthetics. It was also desirable to eliminate crowding and to correct the mesial inclination of the mandibular molars.

Treatment alternatives

One of the treatment options was to align the teeth without extractions, reducing the vertical defects of

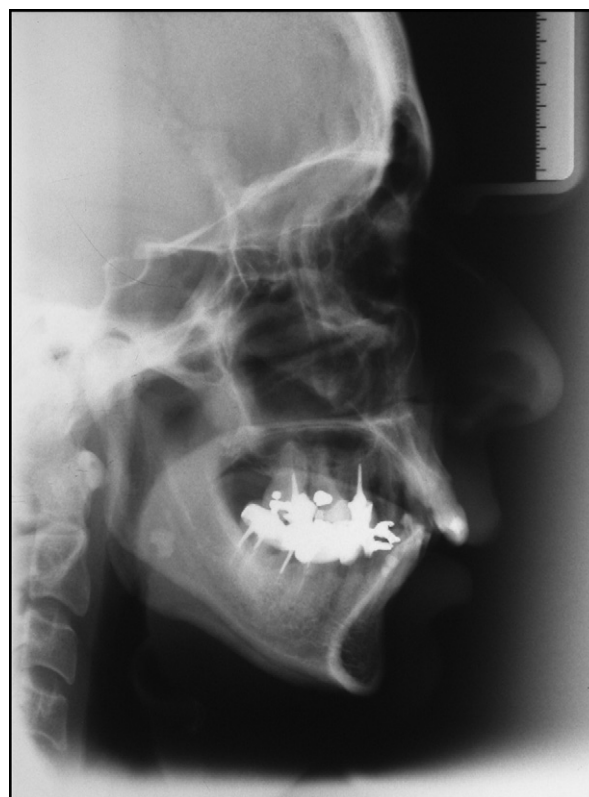
Table I. Cephalometric analysis

	49 y 03 mo 8/4/04	52 y 07 mo 5/25/07
Variables	Pretreatment	Posttreatment
Maxillary Component		
SNA angle (°)	78.8	78.3
A-Nperp (mm)	−1.8	−1.5
Mandibular Component		
SNB angle (°)	71.3	70.1
Pog-Nperp (mm)	−17.1	−18.4
Maxillomandibular Relationship		
ANB angle (°)	7.4	8.2
Wits appraisal (mm)	9.3	6.4
Growth Pattern		
FMA angle (°)	30.6	31.4
SN.OP (°)	19.0	22.6
SN.GOGN (°)	41.6	42.6
Facial Axis (°)	78.7	77.4
Lower anterior facial height (LAFH) (mm)	72.6	75.2
Profile		
Convexity (°)	13.7	14.6
NL Angle (°)	99.3	101.5
Dentoalveolar Component		
Upper 1 to NA (°)	20.0	7.3
Upper 1 to NA (mm)	5.8	−0.1
Lower 1 to NB (°)	31.8	37.0
Lower 1 to NB (mm)	8.3	10.1
Lower 1 to MP (°)	96.6	103.1
Dental Relationships		
Interincisal (°)	117.3	123.8
Overjet (mm)	9.0	1.6
Overbite (mm)	4.1	1.7

the maxillary premolars and the coronal height of central incisors by selective forced eruption and to perform interproximal enamel reduction in the maxillary arch to reduce the overjet. This option, although not ideal, would be more conservative, decreasing the root resorption risk of the anterior teeth.

The second option was extraction of the maxillary first premolars, but only after both teeth were forced to gradually extrude (“slow extraction”), inducing bone and gingival apposition and remodeling of the alveolar ridges. Subsequently, maxillary protrusion would be reduced. Endodontic root treatment, as well as extraction of the maxillary first premolars, would be the biological and additional cost of this alternative. This slow, forced eruption would also be applied to the maxillary central incisors to obtain a better crown-root proportion and to re-establish anterior esthetics with proper crown height.

The last treatment option was to reduce maxillary protrusion with orthognathic surgery and to reduce the periodontal pockets and bony defects of the maxillary

**Fig 4.** Pretreatment lateral cephalogram.

first premolars. The patient preferred and chose the second option.

Treatment planning

The key element in orthodontic management of adult patients with periodontal complications is to eliminate or reduce plaque accumulation and gingival inflammation. In this patient, this would imply an emphasis on oral hygiene instruction, appliance construction, and 3-month periodontal check-ups throughout treatment.⁸ The extraction of 2 maxillary premolars with more periodontal involvement would be performed only after both teeth were gradually extruded (forced extrusion), with concurrent occlusal trimming to allow gingival and bone apposition and remodeling of the alveolar process. Once leveling and alignment were completed, anterior retraction would be performed with maxillary and mandibular 0.018- × 0.025-inch stainless steel arch wires. After anterior retraction, forced extrusion would also be induced for the maxillary central incisors to achieve better gingival margin levels and create new papillae. After appliance removal, a modified maxillary Hawley retainer and a canine-to-canine mandibular retainer would be installed and bonded, respectively. Reinstructing the

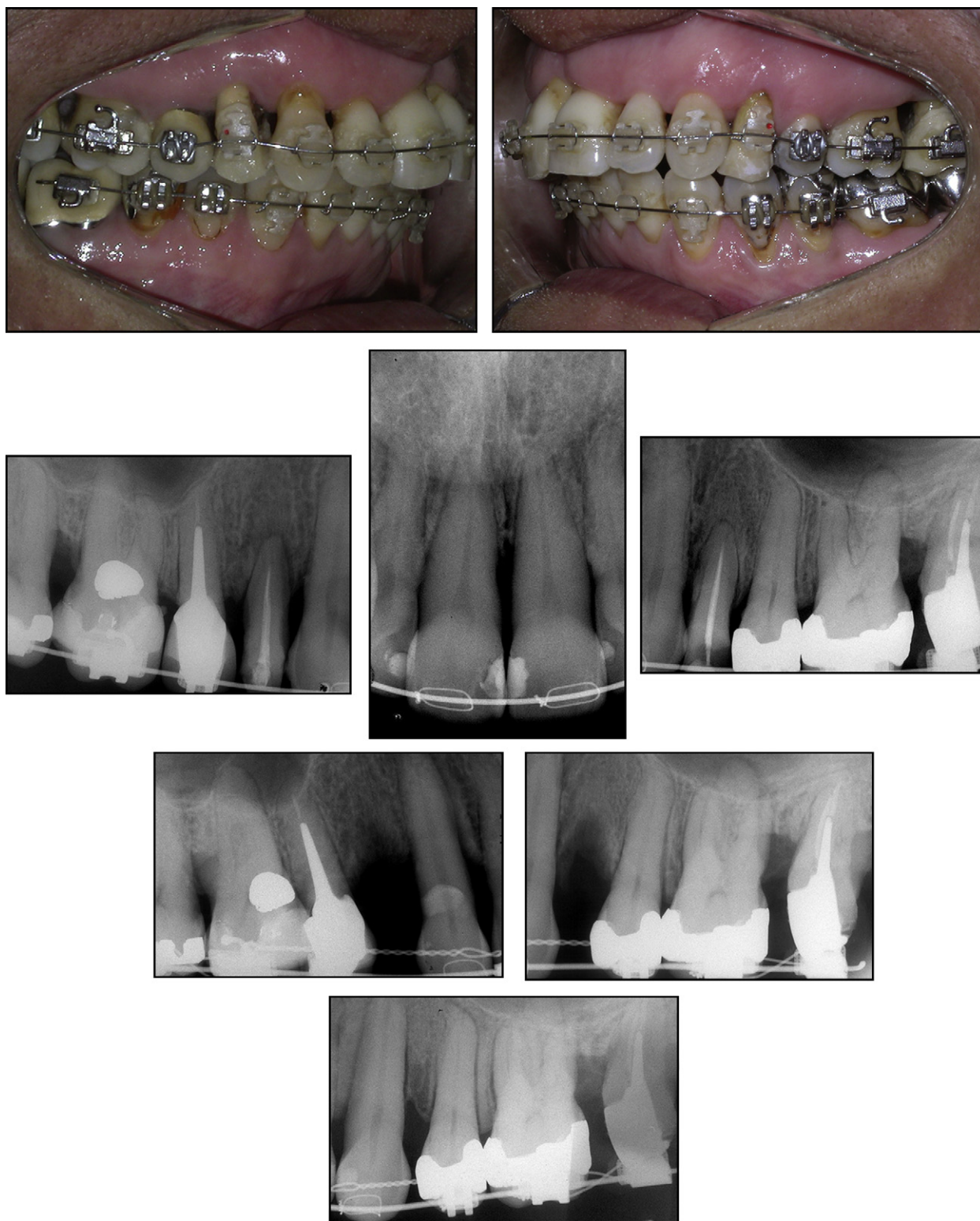


Fig 5. Intraoral progress photographs and periapical radiographs to show bone topography on maxillary premolars.



Fig 6. Posttreatment facial and intraoral photographs.

patient about oral hygiene measures would be carried out to prevent an increase of the labial gingival recession. Finally, she would be referred to her periodontist.

METHODS

Initial periodontal conditions were improved by scaling and root planing before starting the orthodontic treatment. After a 4-month observation period, a careful clinical examination and recording of the periodontal status were performed before orthodontic treatment was initiated. This examination consisted of probing every tooth and checking for mobility, bleeding points, and exudation. Treatment was simultaneously

initiated in the maxillary and mandibular arches, with 0.022- × 0.028-inch preadjusted appliances (Elation Esthetic Brackets, DENTSPLY GAC International, Bohemia, NY and Morelli Metal Brackets, Roth prescription, Sorocaba, SP, Brazil) progressively bonded 1 mm more gingivally in the first maxillary premolars than the other brackets to induce extrusion of these teeth during leveling and alignment, with increasingly thicker round nickel-titanium (NiTi) arch wires. As the teeth extruded, they were gradually equilibrated. After 5 months of treatment, leveling and alignment continued with progressively larger round stainless steel arch wires (0.014 to 0.018 inch) with an accentuated and reversed curve

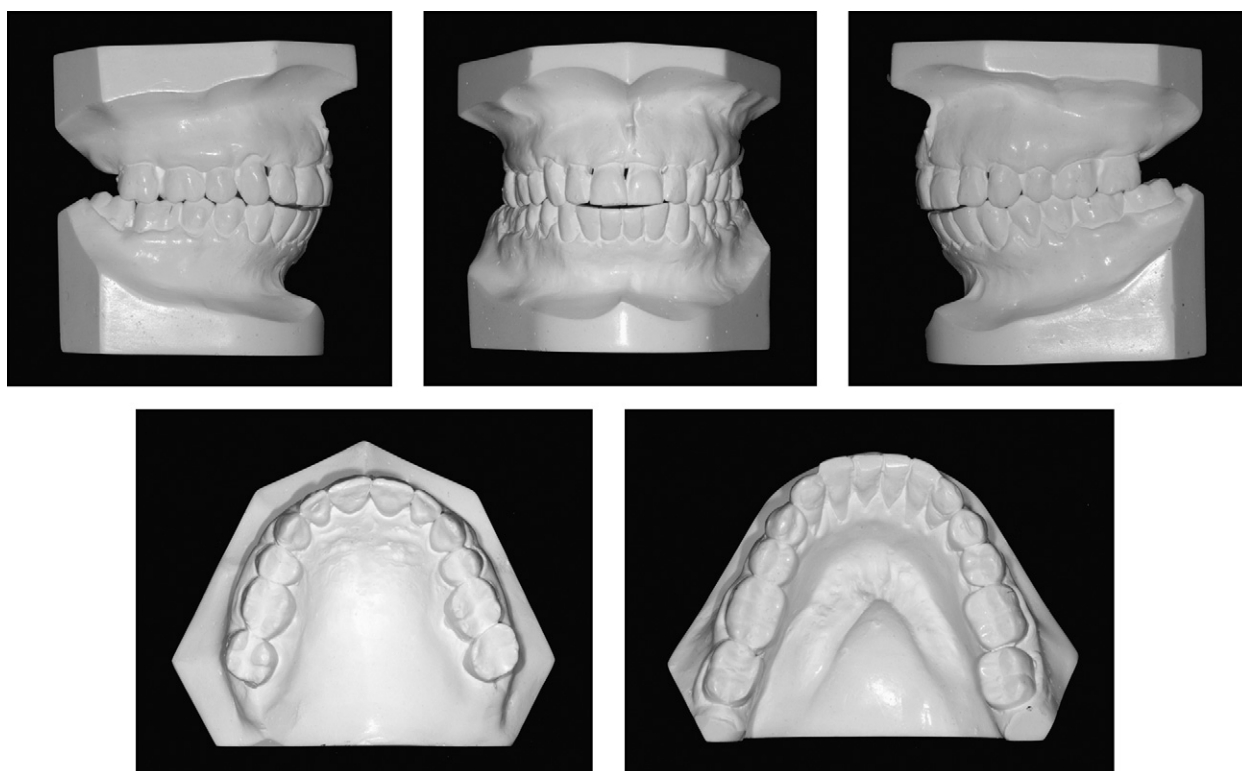


Fig 7. Posttreatment dental casts.

of Spee on the maxillary and mandibular arches, respectively. Extrusion of the maxillary first premolars continued with a step-down arch wire bend until normal gingival and bone levels were obtained (Fig 5). Retraction of the anterior maxillary teeth was performed with 0.018- × 0.025-inch stainless steel arch wires with sliding mechanics and without anchorage reinforcement and labial crown torque. Leveling and alignment of the mandibular teeth were obtained following the same wire sequence as the maxillary teeth. Slight proclination of the mandibular anterior teeth was allowed to correct crowding.

When retraction was completed, the maxillary central incisor brackets were rebonded more gingivally to also induce forced extrusion. Simultaneous and progressive incisal trimming was performed to obtain a better crown-root proportion, reducing the open gingival embrasure. Finally, vertical intermaxillary elastics were used 12 hours/day for 2 months to improve interdigitation. After fixed appliance removal, a modified Hawley retainer was temporarily installed in the maxillary arch until final esthetic restorations of the central incisors were performed. A fixed maxillary retainer was then considered. A mandibular canine-to-canine retainer was bonded to the lingual surfaces of the

teeth. During orthodontic treatment, professional cleaning by a dental hygienist was performed every month, and a clinical evaluation by her periodontist was made at 3-month intervals. Active treatment time was 2 years and 6 months.

RESULTS

The extraoral frontal and profile photographs show significant improvement. Posttreatment intraoral photographs show no increase in gingival recession, an ideal overjet, and good interdigitation of the lateral segments (Figs 6 and 7). A Class I canine on the left and a mild Class II relationship on the right side was obtained. The Class II molar relationship was maintained with slight deviation between maxillary and mandibular midlines. There is no evidence of significant root resorption, and the bone levels remain the same in most areas, excluding those where forced eruption was performed (Fig 8). The most significant cephalometric changes were the lingual tipping and retrusion of the maxillary incisors, labial tipping and protrusion of the mandibular incisors, and reduction in the overjet and overbite (Table 1, Figs 9 and 10).

The follow-up after 17 months shows maintenance of the bone level, sound gingival tissues, and stability of the



Fig 8. Posttreatment periapical radiographs.

final results (Figs 11 and 12). The final restoration of the maxillary incisors was concluded, and the maxillary right second premolar underwent a root fracture and was replaced by an implant. The patient did not choose permanent retention of the maxillary arch, but preferred instead to wear a removable Hawley retainer.

DISCUSSION

Obtaining a successful treatment outcome in this 49-year-old woman, who had advanced periodontal disease and a severe Class II, Division 1 malocclusion, was a challenge. This patient had moderate to severe adult periodontitis that led to gingival retraction in the maxillary anterior and posterior teeth. A complete Class II molar relationship, with 9 mm of overjet, mesial tipping of the mandibular molars, and proclination and extrusion of the mandibular incisors was aggravated by the periodontal condition. She had been undergoing periodontal maintenance for 5 years.

In this situation, periodontal preparation was very important before initiating orthodontic treatment. This included scaling and root planning in all 4 quadrants.

Surgical resection of the maxillary central incisors, although performed in this patient, is not necessary and is not a recommended procedure, since it causes esthetic problems in the anterior region.⁸ Additionally, a 4-month observation period before appliance installation was recommended to ensure that the tooth movement would occur in a healthy environment.⁸ In the present case, after the 4-month observation period, a careful clinical examination and recording of periodontal probing status was performed before orthodontic treatment was initiated.

In patients with advanced periodontitis, the crucial issue is often to what extent the osseous topography can be favorably influenced by orthodontic tooth movement.⁹ Previous experimental reports^{10,11} and clinical studies¹² have shown that a reduction in vertical bone height is not a contraindication for orthodontic tooth movement and that alveolar bone is recreated ahead of moving the tooth, since movement is performed with light forces.^{11,13} Therefore, it is possible to move teeth in a horizontal direction with a reduced healthy periodontium without attachment loss.^{11,14} In the present case, forced

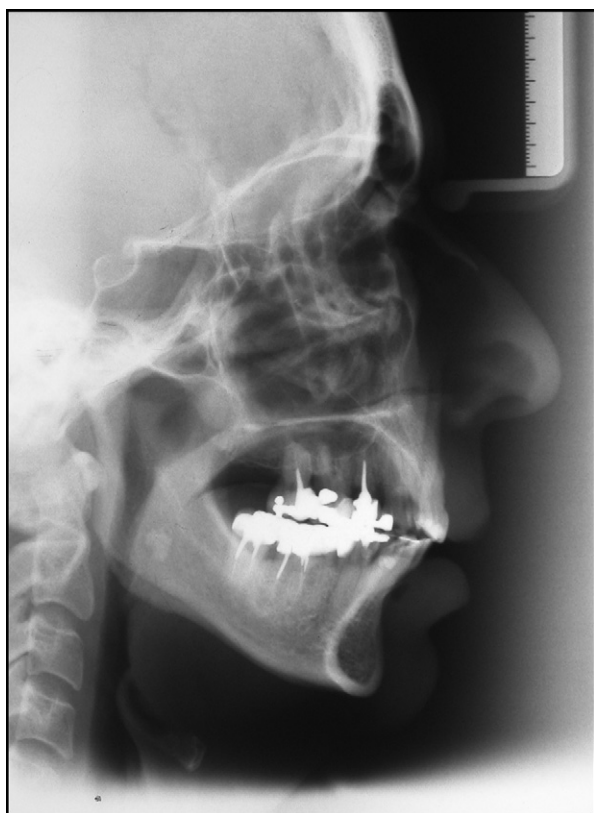


Fig 9. Posttreatment lateral cephalogram.

extrusion of both maxillary first premolars altered their vertical position before extraction was performed. Once the alveolar ridge was restored, anterior retraction was also performed using light elastic forces (Fig 5). When extrusive forces are applied, elongation of periodontal fiber bundles promotes bone deposition at the crest, at the walls, and at the apical alveolar area, dislocating alveolar bone and the tooth.¹⁵ Considering that supportive and protective tissues move together with teeth, this approach was performed to correct vertical bone defects, from the most apical bone defect to the crest of the alveolar ridge of adjacent teeth with forces less than 30 g.¹⁶ To determine how much extrusion is necessary, periodontal probing is conducted at the most apical area of the defect and then 2 mm is subtracted from that measurement, which corresponds to a normal gingival sulcus.¹⁷ Forced eruption might be considered only as an alternative to correct an isolated vertical defect with 1, 2, or 3 walls involved in each quadrant and when the neighboring bone structures are healthy or show only small changes.¹⁷ Computer tomographic analysis¹⁸ and human histological findings¹⁹ indicate that buccal or lingual bone dehiscences may be exacerbated by tooth movement into areas of reduced bone width. This possibility was prevented in this case

because the premolars were extruded before being extracted.

An open gingival embrasure between the maxillary central incisors was one of the main esthetic problems in this case. After maxillary anterior retraction, forced extrusion of both central incisors and incisal edge equilibration were conducted to increase the height of the alveolar crest and the gingival margin (Figs 5 and 7). A better crown-root proportion with reduction of the open embrasure between these teeth was achieved.^{17,20,21} The mesial surfaces of the central incisors were also recontoured and flattened to lengthen the interproximal contact toward the papilla.²² Although these procedures did not completely eliminate the open embrasure, they substantially improved the clinical appearance (Fig 6). It should be emphasized that both maxillary central incisors underwent periodontal surgical resection before orthodontic treatment was initiated, probably increasing the gingival recession that had already occurred (Figs 1 and 3). Recession can be improved with lingual movement of the teeth.²³ However, in this patient it did not seem that lingual tipping of the maxillary incisors helped to reduce the gingival recession. The patient had a furcation defect on the buccal surface of the mandibular left first molar that remained stable, with no increase after orthodontic treatment^{24,25} (Figs 1 and 6).

The most significant skeletal cephalometric changes consisted of minor increases in mandibular retrusion, the anteroposterior base discrepancy (ANB angle), the growth pattern angles, and facial convexity (Table 1). From a dental perspective, the maxillary incisors were tipped lingually and retruded, and the mandibular incisors were tipped labially and protruded, which decreased the amount of overjet and overbite. Increase in the lower anterior face height is a usual treatment consequence of this relationship.²⁶⁻³⁰ Lingual tipping of the maxillary central incisors may be regarded as excessive. However, one should also consider that application of lingual root torque on these teeth is not advisable because of the increased risk of apical root resorption.³¹ Most important in these cases is knowledge of which objectives should be obtained and what the biological costs are. It is common in periodontal patients to reduce osseous defects, increase tooth longevity, facilitate patient oral hygiene, and improve self confidence.⁸ However, small emphasis is given to the final anteroposterior relationship in these cases. An ideal Class I canine relationship may not be obtainable because of periodontal limitation. Therefore, one should strive to obtain satisfactory functional occlusion with anterior and canine guidance without striving for ideal anteroposterior canine relationships and labial incisor inclination. This philosophy will result in less horizontal body movement, less

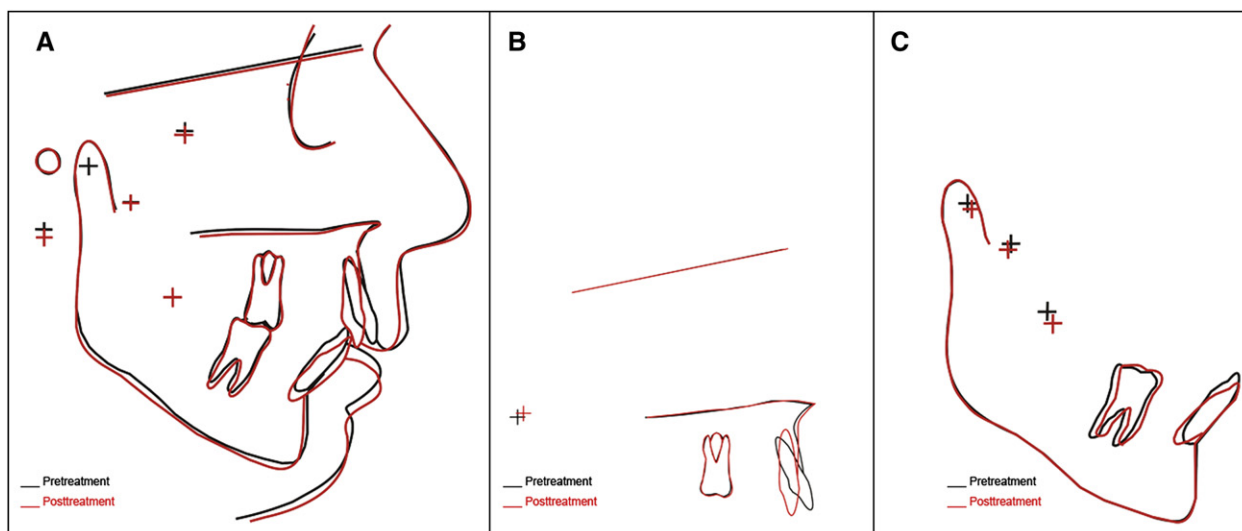


Fig 10. Pretreatment and posttreatment superimposition. **A**, lateral cephalometric tracing; **B**, individual cephalometric superimposition of the maxilla (palatal plane); **C**, individual cephalometric superimposition of the mandible (mandibular plane).



Fig 11. Follow-up intraoral photographs at 17 months.

treatment time (and consequently less root resorption risk) with similar facial esthetic results, while obtaining reasonable static anteroposterior relationships.^{7,32,33}

CONCLUSIONS

Periodontally compromised orthodontic patients can be treated satisfactorily if a combined orthodontic/

periodontal approach is used. An interdisciplinary treatment plan that included orthodontic movement to encourage bone remodeling and a strictly supervised oral hygiene program resulted in restoration of function to this periodontally involved dentition, correction of the malocclusion, and a marked improvement in esthetics for this patient.

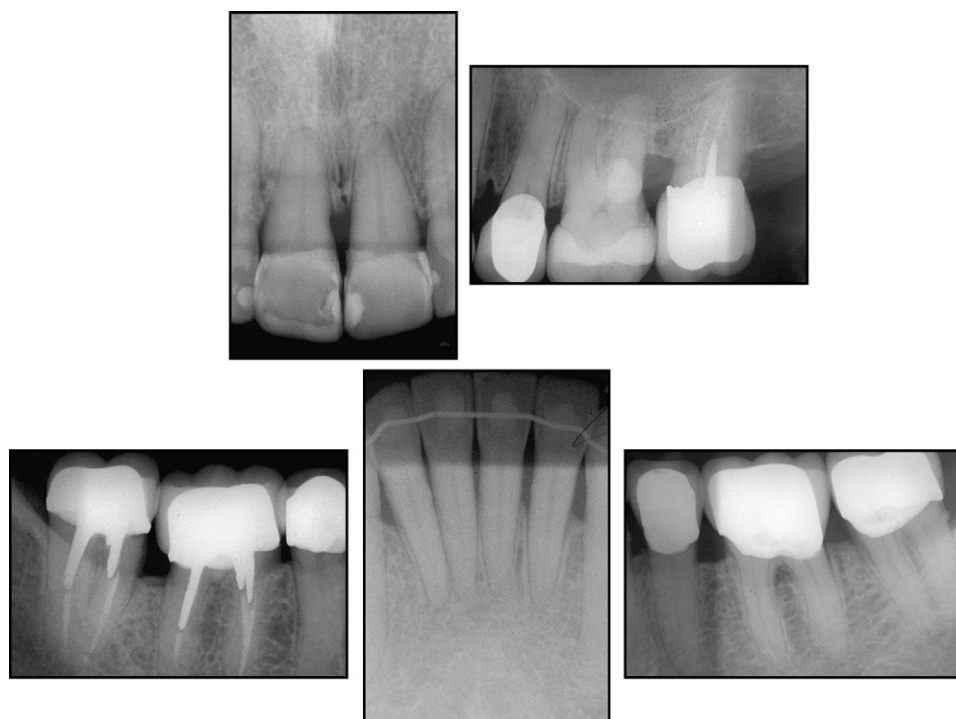


Fig 12. Follow-up periapical radiographs at 17 months.

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