

Interdisciplinary treatment of a periodontally compromised adult patient with multiple missing posterior teeth

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This article reports the comprehensive, interdisciplinary treatment of a 50-year-old periodontally compromised adult patient with multiple missing posterior teeth. After initial periodontal treatment, the maxillary first molars and right central incisor were intruded orthodontically. Miniscrews were used to intrude the maxillary first molars by 3 mm. The mandibular arch was restored with a tooth-supported overdenture. Root coverage of the maxillary right central incisor was performed using Alloderm (Biohorizons, Birmingham, Ala). At the end of the interdisciplinary therapy, the results were esthetically pleasing, with the patient's oral functions restored to the optimum. The emphasis of this report is to highlight the importance of integrating various specialties such as periodontics, orthodontics, endodontics, and restorative dentistry toward a common goal of improving the patient's oral health, function, and esthetics. (*Am J Orthod Dentofacial Orthop* 2014;145:238-48)

Recently, more adults have been actively seeking orthodontic treatment.¹ In these patients, loss of teeth and periodontal breakdown cause pathologic migration of teeth,² making the orthodontic treatment more complicated.³ Such patients should be treated with an interdisciplinary approach aimed not only to improve oral function and esthetics but also to prevent such problems later in life.⁴ Therefore, before initiating orthodontic treatment, the clinician should identify the various problems, establish specific treatment objectives, formulate a definitive treatment plan, and determine the exact treatment sequence involving the various specialties of dentistry.⁵

The orthodontist has a special place on the team of specialists involved in the comprehensive treatment

planning for periodontally compromised adult patients with missing teeth. Adjunctive orthodontic treatment⁶ can result in improved gingival and bone levels, traumatic occlusion,⁷ hemiseptal¹ and infrabony defects,⁸⁻¹⁰ excessive spacing, tipped abutment teeth, inadequate pontic or implant space, and supraeruption of teeth.²

Extrusion of the maxillary posterior teeth commonly results from a longstanding loss of mandibular antagonistic teeth. The elongated dentoalveolar segment can induce functional disturbances and interfere during prosthetic occlusal rehabilitation. Conventional options for removing such interferences include occlusal reduction with possible root canal treatment and posterior subapical osteotomy.¹¹ Orthodontic intrusion of molars was considered a difficult movement to achieve with conventional orthodontic techniques. Fortunately, the invention of various skeletal anchorage systems such as conventional prosthetic implants,^{3,12} miniplates,^{13,14} and miniscrews^{15,16} has made it possible to carry out such movements.

In this article, we report the comprehensive treatment with an interdisciplinary approach of a periodontally compromised adult with multiple posterior missing teeth. The emphasis was to highlight the importance of integrating various specialties including periodontics, orthodontics, endodontics, and restorative dentistry toward a common goal of improving the patient's oral health, function, and esthetics.

DIAGNOSIS AND ETIOLOGY

A 50-year-old woman was referred by a general dentist to the graduate orthodontic clinic of Manipal

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All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.

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Fig 1. Pretreatment facial and intraoral photographs.

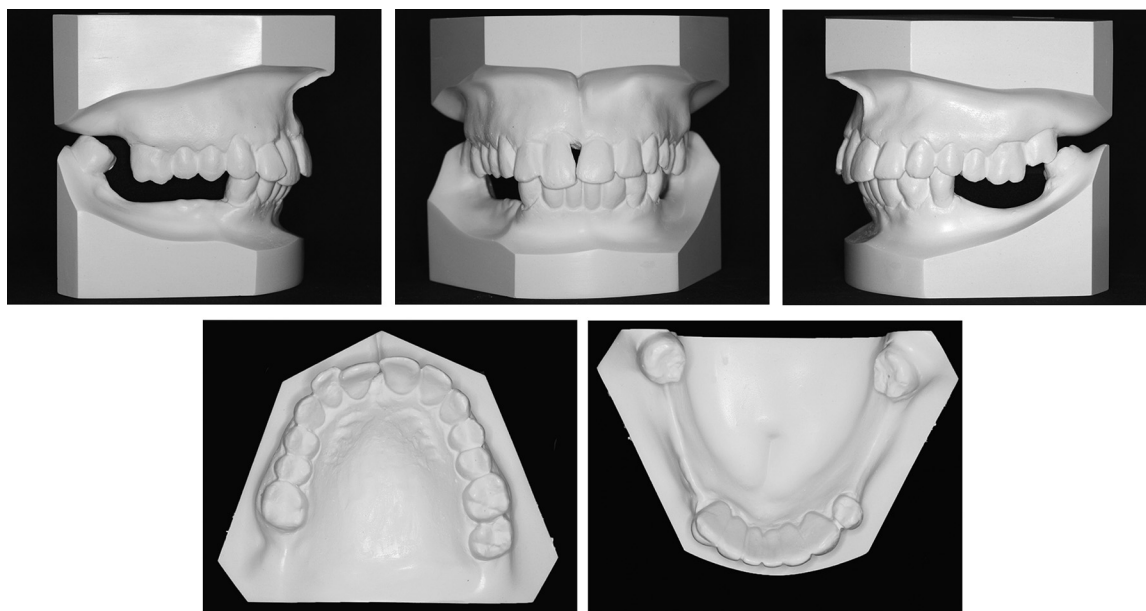


Fig 2. Pretreatment study casts.

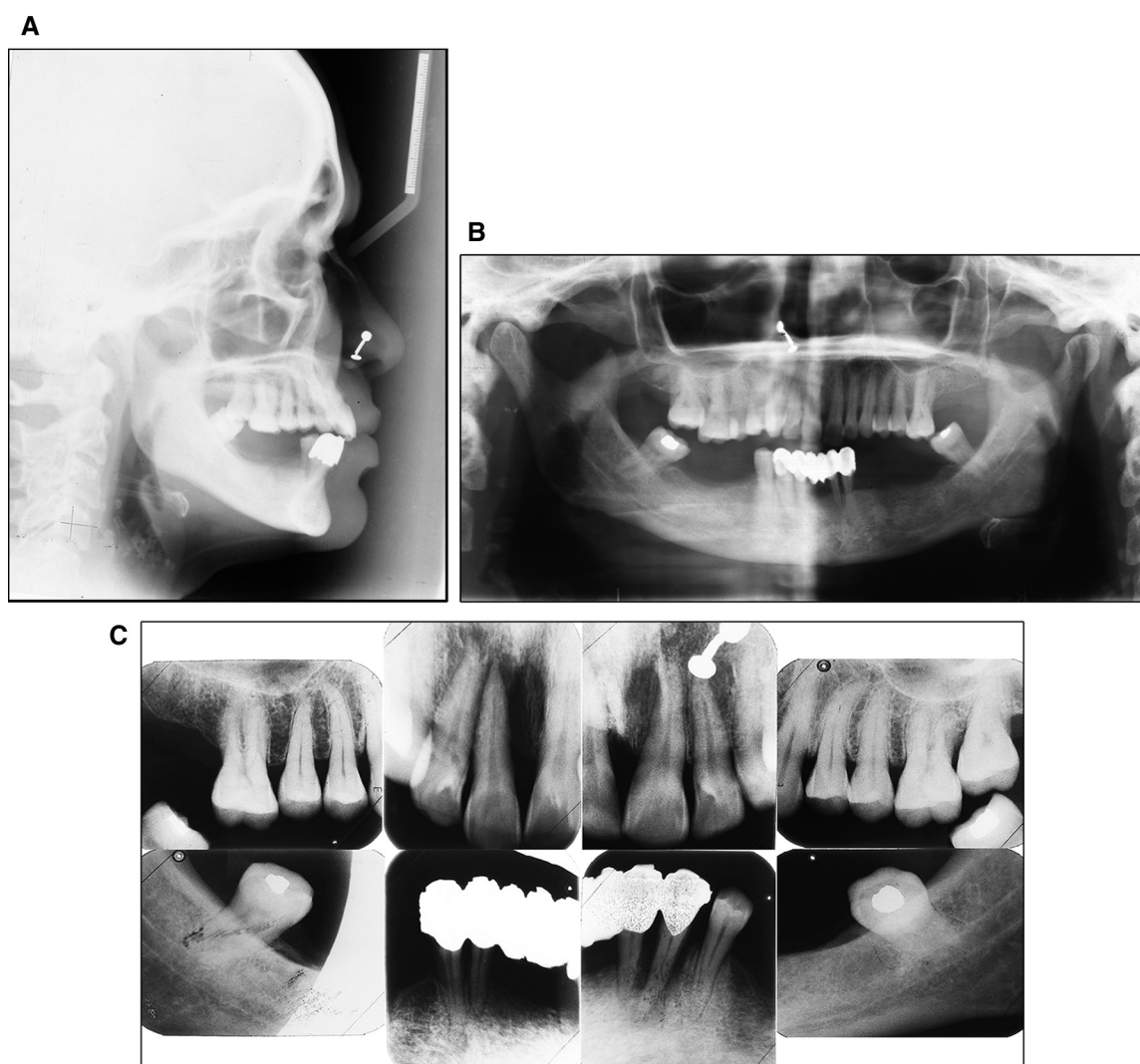


Fig 3. Pretreatment radiographs: **A**, lateral cephalogram; **B**, panoramic radiograph; **C**, full-mouth intraoral periapical radiographs.

College of Dental Sciences, Manipal, Karnataka, India, for assessment and possible correction of a pathologically migrated maxillary right central incisor and intrusion of the maxillary posterior teeth to facilitate prosthetic rehabilitation of her mandibular dentition. She had a history of multiple extractions and restorative work in the mandibular arch about 10 years previously. Her medical history did not contribute to underlying systemic conditions. The temporomandibular joint examination was normal, with an adequate range of jaw movements.

The pretreatment facial examination showed a brachycephalic facial pattern with a convex soft-tissue profile (Fig 1). The ratio of lower anterior facial height to upper anterior facial height was normal, and the ratio of lower facial height to throat depth was normal. The

nasolabial angle and the mentolabial sulcus were normal. The patient had competent lips; upon smiling, 50% of the occlusogingival length of the maxillary incisors was visible. The maxillary and mandibular dental midlines were coincident with the facial midline.

The intraoral examination showed that the maxillary right central incisor was extruded beyond the occlusal plane by 3 mm and was grade II mobile. There was a midline diastema of 2 mm in the maxillary anterior region. The maxillary first molars were extruded into the mandibular edentulous space by 3 mm bilaterally (Fig 2), and the right second molar was missing. In the mandibular arch, on the left side, the second premolar and the first molar were missing; on right side, both premolars and the first molar were missing. Both mandibular

Table. Cephalometric analysis

	<i>Norm</i>	<i>Pretreatment</i>	<i>Posttreatment</i>
SNA (°)	82 ± 2	80	80
SNB (°)	80 ± 2	79	-
ANB (°)	2	1	-
Facial angle (°)	88 ± 3	89	90
OP-FH (°)	8.7	6	5
Interincisal (°)	130 ± 5	124	-
Maxillary incisor-APg (mm)	6	9	10
FMA (°)	25	25	24
IMPA (°)	90	95	-
FMIA (°)	65	60	-
Maxillary incisor-NA (°)	22/4	28/9	32/10
(mm)			
Mandibular incisor-NB (°)	25/4	29/6	-
(mm)			
GoGn- SN (°)	32	31	30
U6-PP (mm)	24	25	23
U1-PP (mm)	30	30	28
Upper facial height (mm)	58	54	54
Lower facial height (mm)	75	68	66
UFH/TFH (%)	45	44.2	45
LFH/TFH (%)	55	55.8	55

-, The value could not be recorded because the landmark was eliminated after extraction of teeth.

UFH, Upper facial height; TFH, total facial height; LFH, lower facial height.

central incisors were missing and were restored with a 6-unit fixed partial prosthesis with the mandibular lateral incisor and canines as abutments. The fixed partial denture and all abutment teeth were grade II mobile. On the right side, there was no occlusion of the posterior teeth; on the left side, only the maxillary second molar occluded with the mandibular second molar. The canines were in a Class I relationship bilaterally, but the molar relationship could not be established.

Cephalometric analysis indicated a skeletal Class I relationship with an average vertical growth pattern (Fig 3, Table). The panoramic radiograph (Fig 3) showed long edentulous spaces and overall decreased alveolar bone support. The mandibular second molars were tipped mesially into the extraction spaces of the first molars. The intraoral periapical radiograph showed extensive vertical bone loss on the mesial aspect of the maxillary right central incisor (Fig 3). Although periapical radiolucency was apparent on the radiograph with respect to the maxillary right lateral incisor, clinically it was healthy and had a positive response to electric pulp vitality testing.

After thorough clinical and radiographic examinations, the patient was diagnosed with a skeletal and dental Class I malocclusion with chronic generalized moderate periodontitis, maxillary right central incisor extrusion, supraeruption of the maxillary first molars, and partially edentulous maxillary and mandibular arches.

TREATMENT OBJECTIVES

Because the patient's problems required a multidisciplinary approach, the overall treatment objectives were control of periodontal disease, relief of the trauma to the occlusion of the maxillary right central incisor, establishment of posterior occlusion, and long-term personal and professional periodontal maintenance. The specific orthodontic objectives were to intrude the maxillary right central incisor and the maxillary first molars to obtain a flat occlusal plane so that enough interocclusal space was created for replacement of the missing posterior teeth in the mandibular arch.

TREATMENT ALTERNATIVES

Based on the treatment objectives, the following treatment alternatives were presented to the patient.

1. Extraction of all remaining teeth in the mandibular arch and restoration with an implant-supported mandibular denture, intentional root canal treatment of the supraerupted maxillary teeth to reduce their clinical crown heights, and their restoration with crowns. Although this option had the advantage of the shortest treatment time, the patient wanted to retain as many of her teeth as possible, so she declined it. Moreover, for financial reasons, she did not choose the implant-supported overdenture.
2. Segmental osteotomy and intrusion of the maxillary posterior segment, and restoration of mandibular arch with a tooth-supported overdenture. The patient declined any major surgical procedure because of the associated risks and hospitalization expenses.
3. The third treatment option, finally chosen by the patient, was to orthodontically intrude the supraerupted maxillary teeth with miniscrews and restore the mandibular arch with a tooth-supported overdenture.

TREATMENT PROGRESS

The treatment was divided into the following phases.

Phase 1 was the initial disease control therapy. The patient underwent full-mouth scaling and periodontal curettage to control her active periodontal disease. Her periodontal status was reassessed after a rest period of 3 months, and it was found that the mesial aspect of the maxillary central incisor had a probing depth of 8 mm and showed spontaneous bleeding on probing (Fig 4). Therefore, a surgical treatment was planned for periodontal regeneration of the 2-wall bony defect using hydroxyapatite (Bio-oss; Geistlich, Wolhusen, Switzerland) and a guided tissue regeneration membrane

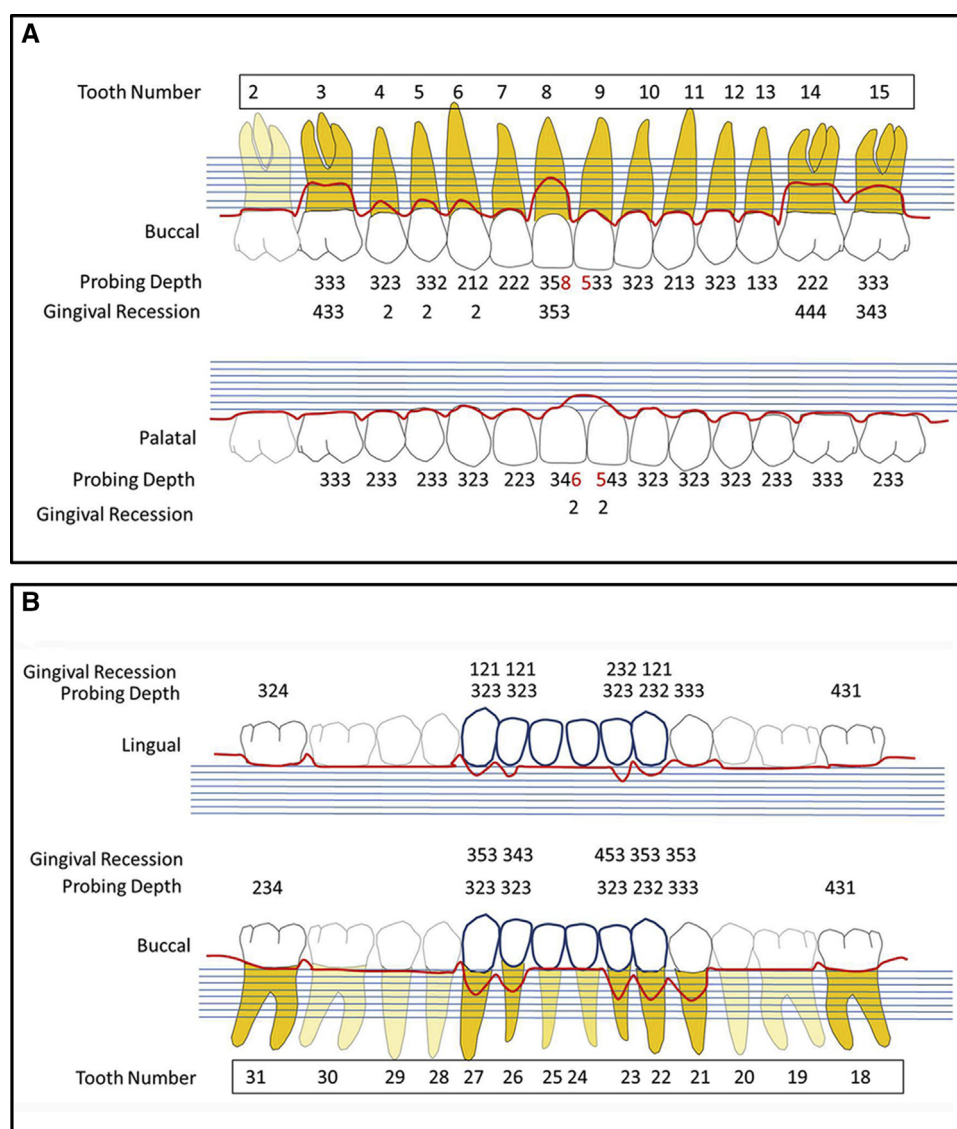


Fig 4. Pretreatment periodontal charting: **A**, maxillary arch; **B**, mandibular arch (red lines, gingival margin; blue lines, measurement from the cemento-enamel junction in millimeters; numbers in red, bleeding on probing; crown outline in blue shows fixed partial denture).

(GoreTex; W. L. Gore & Associates, Inc, Flagstaff, Ariz). The mandibular canines and lateral incisors were determined to have poor prognoses, so it was decided to extract them. The surgical sites healed uneventfully before the orthodontic treatment was initiated. Despite the periapical radiolucency, the maxillary right lateral incisor continued to show positive pulpal health readings upon electric pulpal testing, so it was decided to monitor it during the entire treatment period. Intentional root canal treatment for the mandibular second molars and the left first premolar were also initiated so that they could act as abutments for the mandibular overdenture.

Phase 2 was the active orthodontic treatment. After 3 months of rest, the orthodontic treatment began with a 0.022-in MBT (3M Unitek, Monrovia, Calif) appliance bonded to the maxillary arch. A transpalatal arch was bonded to the maxillary first molars. The left first molar was bonded with a wide Siamese standard (0° tip, 0° torque) edgewise bracket, and a bondable buccal tube was placed on right side. A bondable buccal tube was also placed on the left second molar. Initially, alignment was started with a 0.014-in copper-nickel-titanium archwire followed by a 0.016 × 0.022-in copper-nickel-titanium archwire. The archwire engaged

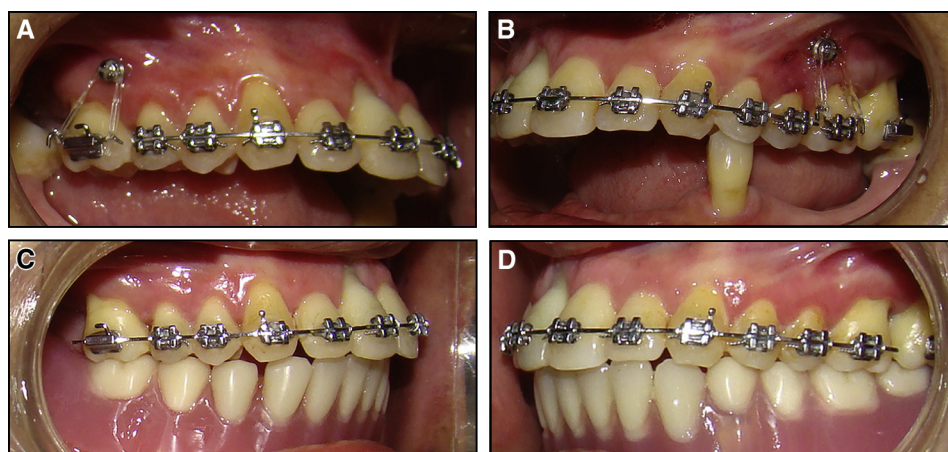


Fig 5. A and B, Intrusion of the maxillary molars with miniscrews; C and D, settling of the maxillary teeth to the mandibular overdenture.

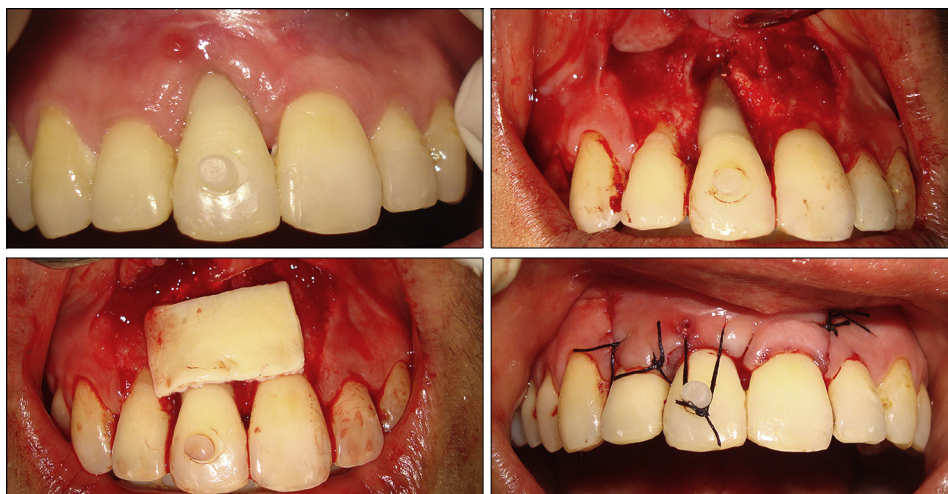


Fig 6. Gingival root coverage with Alloderm and a coronally positioned flap.

from second premolar to second premolar, and the first molars were not included because they were already extruded. After 3 months of initial alignment, self-drilling miniscrews (length, 8 mm; diameter, 1.6 mm; TOMAS; Dentaureum, Ispringen, Germany) were placed in the buccal cortical bone between the maxillary second premolar and the first molar on both sides. A small section of 0.019 \times 0.025-in stainless steel wire with hooks on the mesial and distal sides was ligated on both first molars. About 100 g of intrusive force was applied with elastic chains (Fig 5, A and B). After 6 months, sufficient intrusion of the molars was achieved so that the occlusal plane of the first molars was at the same level as the rest of the arch. A new archwire, 0.018 \times 0.025-in nickel-titanium, was ligated from

the first molar on the right side to the second molar on the left side. Later, the maxillary arch was stabilized with a 0.019 \times 0.025-in stainless steel archwire.

Phase 3 was restoration of the mandibular arch and finishing. After root canal treatment of the mandibular third molars and the left first premolar, the mandibular overdenture was fabricated with support from a custom-made cast metal coping stud attachment on the abutment teeth. Subsequently, the occlusion was matched with the overdenture (Fig 5, C and D), and the maxillary arch was debonded. The active treatment time was 10 months. The teeth were retained with the fixed bonded retainer from canine to canine.

Phase 4 was root coverage of the maxillary right central incisor. The patient was scheduled for root



Fig 7. Posttreatment facial and intraoral photographs (with the tooth-supported overdenture in place).

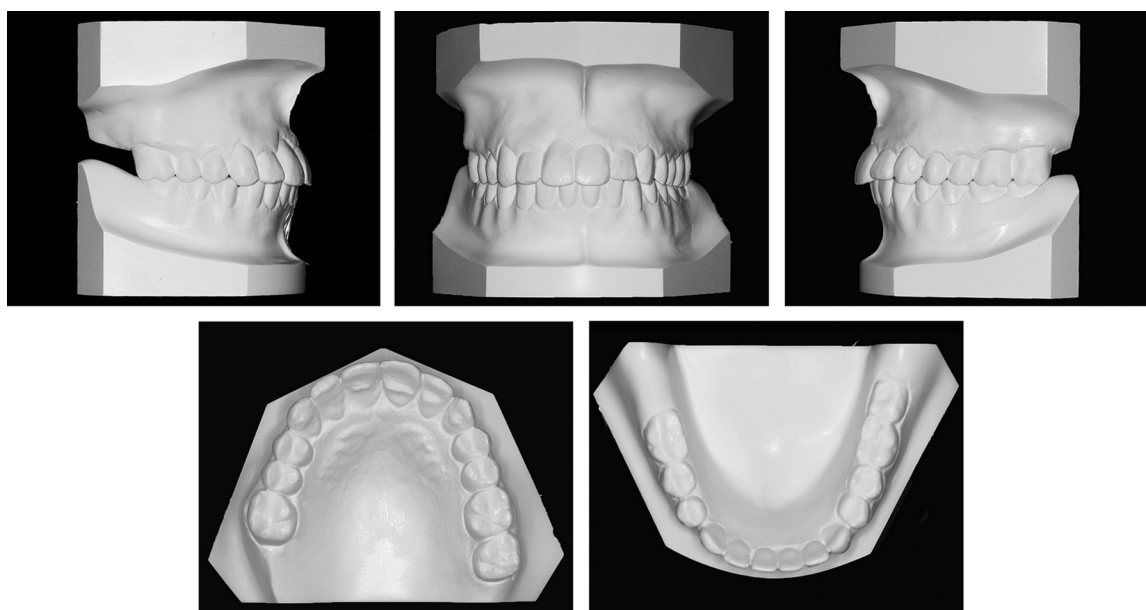


Fig 8. Posttreatment study casts (with the tooth-supported overdenture in place).

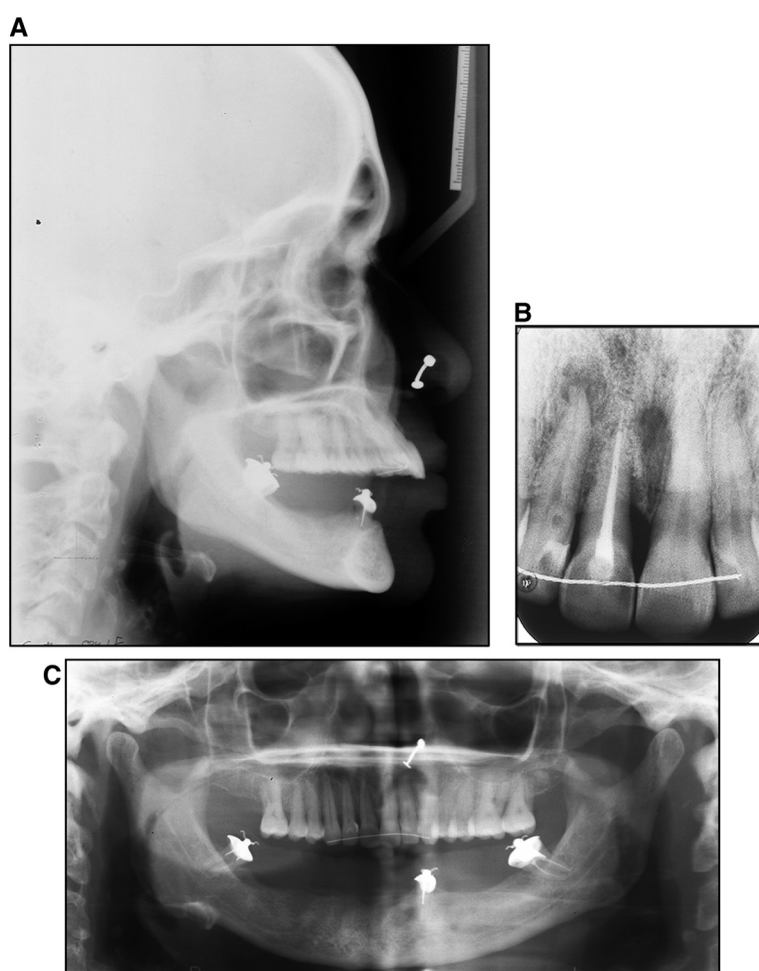


Fig 9. Posttreatment radiographs: **A**, lateral cephalogram (with the tooth-supported overdenture in place); **B**, panoramic radiograph; **C**, periapical radiograph of the maxillary right central incisor.

coverage of the maxillary right central incisor 3 months after debonding. During the examination, it was noticed that the patient had a soft-tissue fistula on the maxillary right central incisor (Fig 6), and the tooth was not responding to electric pulp vitality testing. It was diagnosed to be an endodontic-periodontic lesion; the infection had reached the periapical area through the periodontal pocket. Therefore, root canal treatment was performed. One month later, the soft-tissue fistula subsided, and the patient was rescheduled for gingival coverage. During the periodontal surgery, a full thickness flap was raised, the periapical area was curetted and filled with hydroxyapatite, the denuded root was covered with Alloderm (Biohorizons, Birmingham, Ala), and the site was closed by coronally positioning the flap. The surgical site healed uneventfully. The total treatment time was 18 months.

TREATMENT RESULTS

At the end of the interdisciplinary therapy, the results were esthetically pleasing, and the patient's oral functions were restored to the optimum (Fig 7). Periodontal therapy resulted in control of the active periodontal disease, and the pocket depths were stable and did not bleed on probing. A Class I occlusion was established with the mandibular tooth-supported overdenture, centric relation and centric occlusion were established at the same vertical dimension of the occlusion, and the balancing interferences were eliminated, resulting in a stable posterior occlusion (Fig 8).

The maxillary right central incisor was intruded, resulting in an improved crown-root ratio and relieving it from trauma in the occlusion. The bony lesion on the mesial aspect of the maxillary right central incisor also improved significantly (Fig 9). All these factors

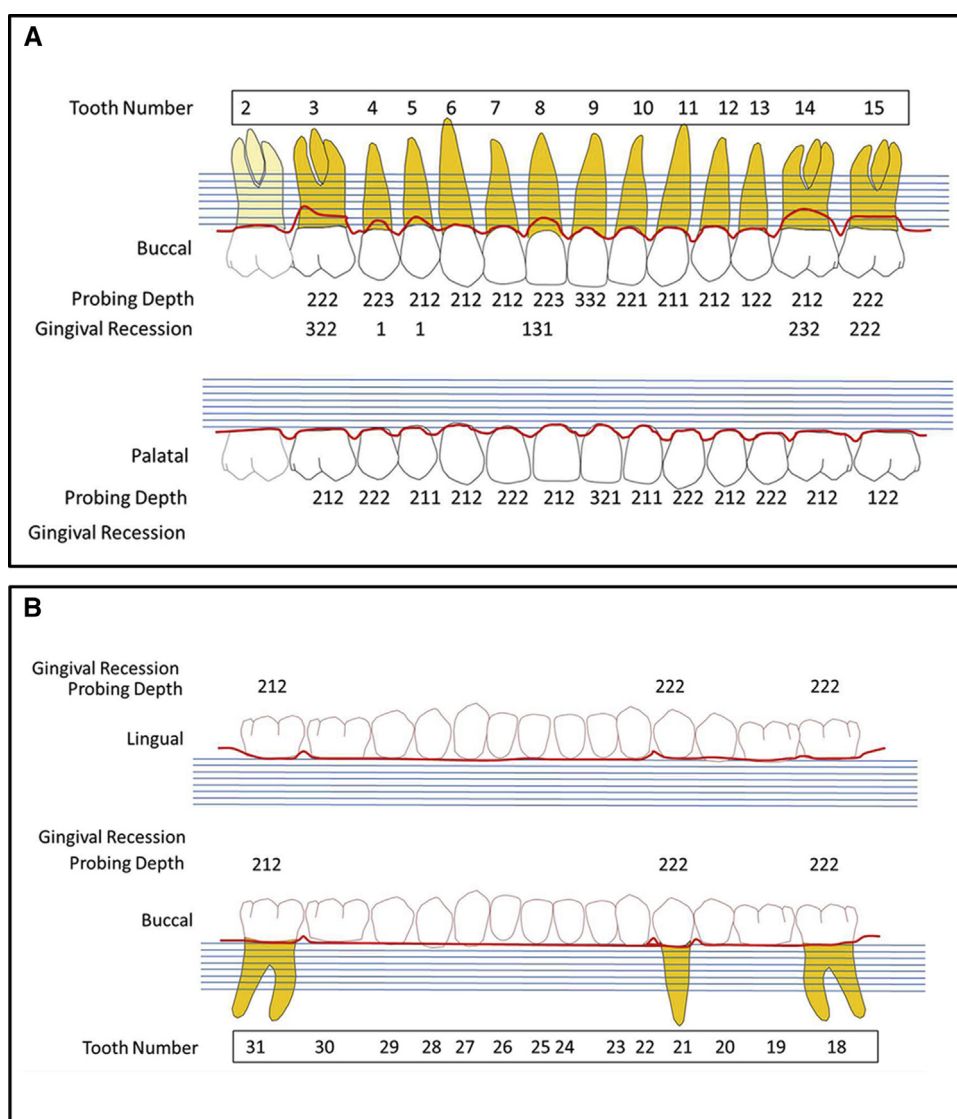


Fig 10. Posttreatment periodontal charting: **A**, maxillary arch; **B**, mandibular arch (red lines, gingival margin; blue lines, measurement from the cemento-enamel junction in millimeters; numbers in red, bleeding on probing; crown outline in red shows the tooth-supported overdenture).

resulted in reduction of mobility to grade I, and there was no bleeding on probing (Fig 10). Although there was some discrepancy in the gingival levels of the maxillary central incisors at the end of treatment, the patient had a low smile line, resulting in reduced incisor show.

The maxillary first molars were intruded without buccal flaring because both were also connected by the transpalatal arch. The cephalometric superimposition showed that the maxillary first molars were intruded by 3 mm, which resulted in enough interocclusal space for the replacement of the teeth in the mandibular arch (Fig 11).

DISCUSSION

If active gingival inflammation is controlled, intrusion can be a reliable therapeutic treatment in patients with reduced periodontal support because it does not result in a decrease of the marginal bone level.⁸ For optimum results, intrusion should be performed with light forces, and the line of action of the force should pass close to the center of resistance. In this patient, the maxillary right central incisor was intruded with the copper-nickel-titanium archwire with a 40°C transitional temperature, delivering the minimum force possible.

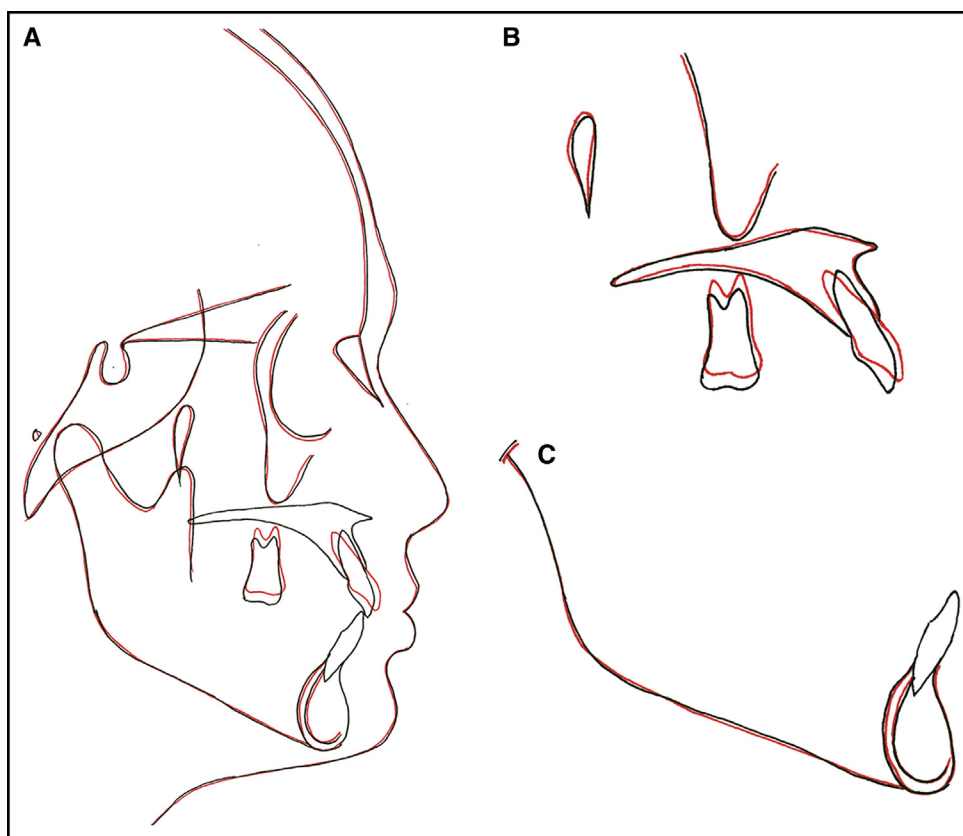


Fig 11. Superimpositions at pretreatment (*black*) and posttreatment (*red*): **A**, overall superimposition; **B**, maxillary regional superimposition; **C**, mandibular regional superimposition.

The patient's maxillary molars were intruded by connecting them to the miniscrews with elastic chains and applying an intrusion force of 50 g on each side (total of 100 g). During intrusion, the right and left first molars were connected with a bondable transpalatal arch, thus preventing buccal flaring and at the same time reducing the number of miniscrews needed. At the end of treatment, a 3-mm intrusion of the maxillary molars was achieved.

Re et al¹⁰ evaluated the role of orthodontic intrusion in the reduction of gingival recession and probing depth around maxillary incisors of adult periodontal patients and found that the mean reductions in gingival recession were 0.96 and 1.71 mm in the buccal and mesial sites, respectively. In our patient, the initial mucogingival defect with respect to the maxillary right central incisor could be classified as Class III according to Miller.¹⁷ Even though this kind of defect usually results in incomplete root coverage after mucogingival surgery, there was a marked improvement in the gingival level because of the orthodontic intrusion. The use of an acellular dermal allograft (Alloderm) along with coronally positioned flap

was aimed to cover the remaining gingival recession and change the gingival biotype from thin to thick,¹⁸ reducing the chances of further gingival recession in future.¹⁹

Nevins and Wise⁹ concluded that orthodontically moving teeth into infrabony defects might modify the defect's morphology, reduce probing depth, and resolve the bony defect. Vardimon et al²⁰ showed that the bony apposition was 6.5 times greater after orthodontic tooth movement into surgical bony defects in rats. Furthermore, Nemcovsky et al²¹ showed that enhanced bone healing occurred after orthodontic movement in the areas of periodontal defects. In our patient, the periodontal regeneration surgery was performed on the maxillary right central incisor 3 months before initiating orthodontic intrusion; this resolved the bony defect and eliminated the infrabony pockets. Subsequently, orthodontic intrusion might have positively impacted the periodontal defect and possibly enhanced the healing of the osseous defect.

Although implant-supported mandibular overdentures are now considered to be the standard of care for

mandibular edentulism, a recent systematic review by Fitzpatrick²² found no evidence for a single, universally superior treatment modality for an edentulous mandible. In our patient, a tooth-supported overdenture was chosen over an implant-supported overdenture because abutment teeth can provide sufficient support for the transmission of masticatory forces and help to maintain the alveolar bone. Moreover, receptors in the periodontal ligament around the abutment teeth are considered to be the primary stimulus for mandibular positional sensibility (proprioception) and initiating a jaw-opening reflex.²³

CONCLUSIONS

Success in treating a patient with complex restorative, periodontal, and orthodontic problems depends on the correct plan and the sequence of treatment rendered by different practitioners. In this patient, intrusion of the maxillary molars was achieved with miniscrews, and the mandibular arch was restored with an overdenture after extraction of hopeless teeth. An optimal oral function and an esthetically pleasing result were achieved.

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