Multidisciplinary management including periodontics, orthodontics, implants, and prosthetics for an adult

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This article describes the complex dental treatment of an adult patient with multiple missing teeth, mild chronic periodontitis, and a malocclusion with a cant of the occlusal plane. After periodontal treatment, titanium implants and a miniscrew were placed to correct the occlusal plane canting with orthodontic treatment. Prosthodontic treatment was completed by using osseointegrated implants to replace the missing teeth. (Am J Orthod Dentofacial Orthop 2012;142:235-45)

In adult patients, the loss of teeth or periodontal support can cause pathologic migration of a single tooth or a group of teeth. This can result in the development of a median diastema or general spacing of the teeth with or without incisor proclination, rotation, or tipping of premolars and molars and collapse of the posterior occlusion with decreasing vertical dimensions.[1] Treatment is complicated in patients with many missing and periodontally compromised teeth.[2-5] The primary objective of periodontal therapy is to restore and maintain the health and integrity of the attachment apparatus of the teeth. Adjunctive orthodontic therapy is necessary to solve these problems and can facilitate management of several restorative and esthetic problems or difficulties relating to fractured teeth, tipped abutment teeth, excess spacing, inadequate pontic space, malformed teeth, hypererupted incisors, and diastema.[1]

Fortunately, implants in edentulous areas can provide orthodontic anchorage and later serve as prosthetic abutments.[2-5] Implants are particularly helpful when many posterior teeth are missing and the teeth must be moved in 1 direction.[3] The benefit of implants is that, when several teeth are missing, the reciprocal effects of conventional methods can be minimized.[6] Miniscrew implants have also been used successfully.[7,8]

A LeFort I osteotomy with asymmetric maxillary impaction is often used to correct the cant of the maxillary occlusal plane.[9] However, canting caused by extruded teeth can be corrected easily with conventional orthodontic appliances and skeletal anchorage.[2] This correction occurs through intrusion of the extruded teeth on 1 side of the maxilla, thereby avoiding a more involved surgical approach.

DIAGNOSIS AND ETIOLOGY

A 43-year-old woman had lost several teeth and was unsatisfied with the esthetic and functional aspects of her dentition (Figs 1-3). She also wanted to maintain her natural teeth and improve esthetics and function.

A thorough examination, which included mounted diagnostic casts, was performed. The patient had a mixed dental-skeletal malocclusion. The vertical dimension of the occlusion appeared to be decreased, secondary to multiple missing posterior teeth and vertical overclosure, but she had an excessive vertical facial height.

The following diagnosis was established as a result of the clinical and radiographic examinations: Class II Division 1 malocclusion with maxillary incisor protrusion, high mandibular plane angle with vertical overclosure

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Fig 1. Pretreatment facial and intraoral photos.

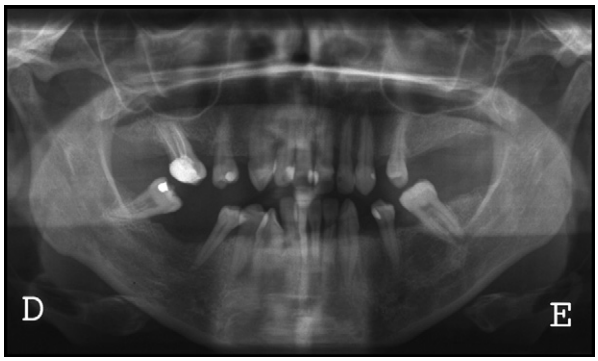

Fig 2. Pretreatment panoramic x-ray.

(Figs 4 and 5), chronic mild periodontitis (Figs 6 and 7), partially edentulous maxilla and mandible, and a canted occlusal plane. Her mandible was shifted to the right, and there was unilateral extrusion of the teeth on the maxillary and mandibular left sides. Her asymmetry was accentuated by this extrusion (Fig 8).

The mandibular midline was shifted 1 mm to the right of the midsagittal plane. No tooth size-arch length discrepancy was present in either arch. Both left and right canines were in a Class II dental relationship (Fig 3).

TREATMENT OBJECTIVES

The following treatment objectives were established for this patient: (1) treatment of her periodontal disease, (2) reestablishment of the correct occlusal plane, (3) improvement of smile asymmetry by intrusion of the maxillary left anterior teeth; and (4) dental implants and prosthetic rehabilitation of the posterior occlusion.

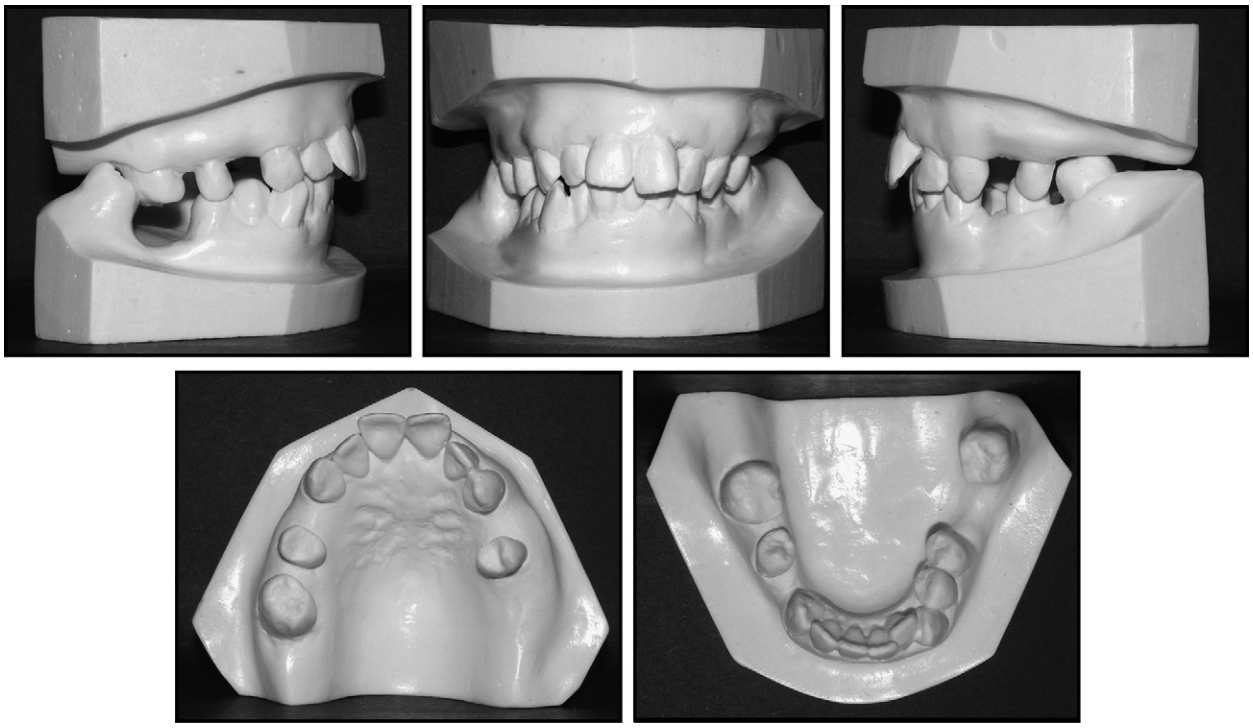

Fig 3. Pretreatment dental casts.

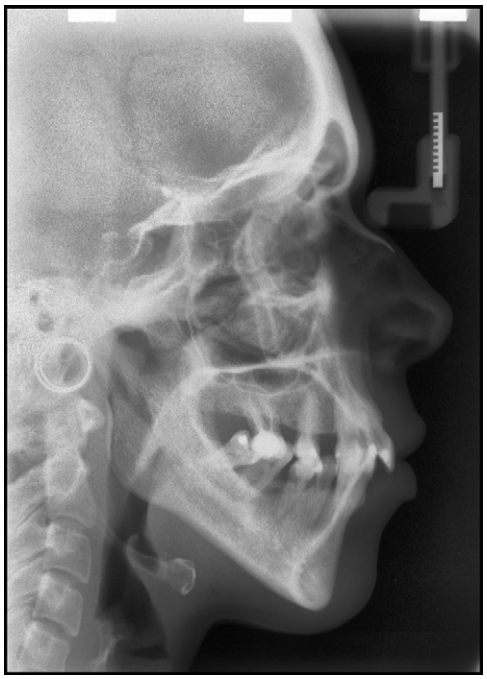

Fig 4. Pretreatment cephalometric radiogram.

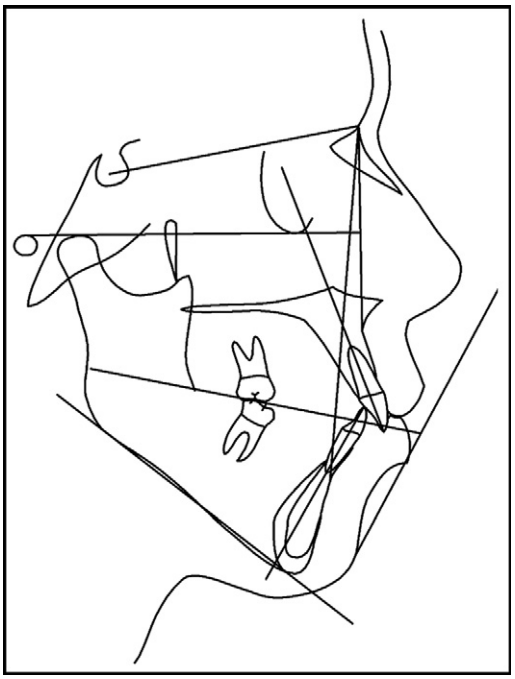

Fig 5. Pretreatment cephalometric tracing.

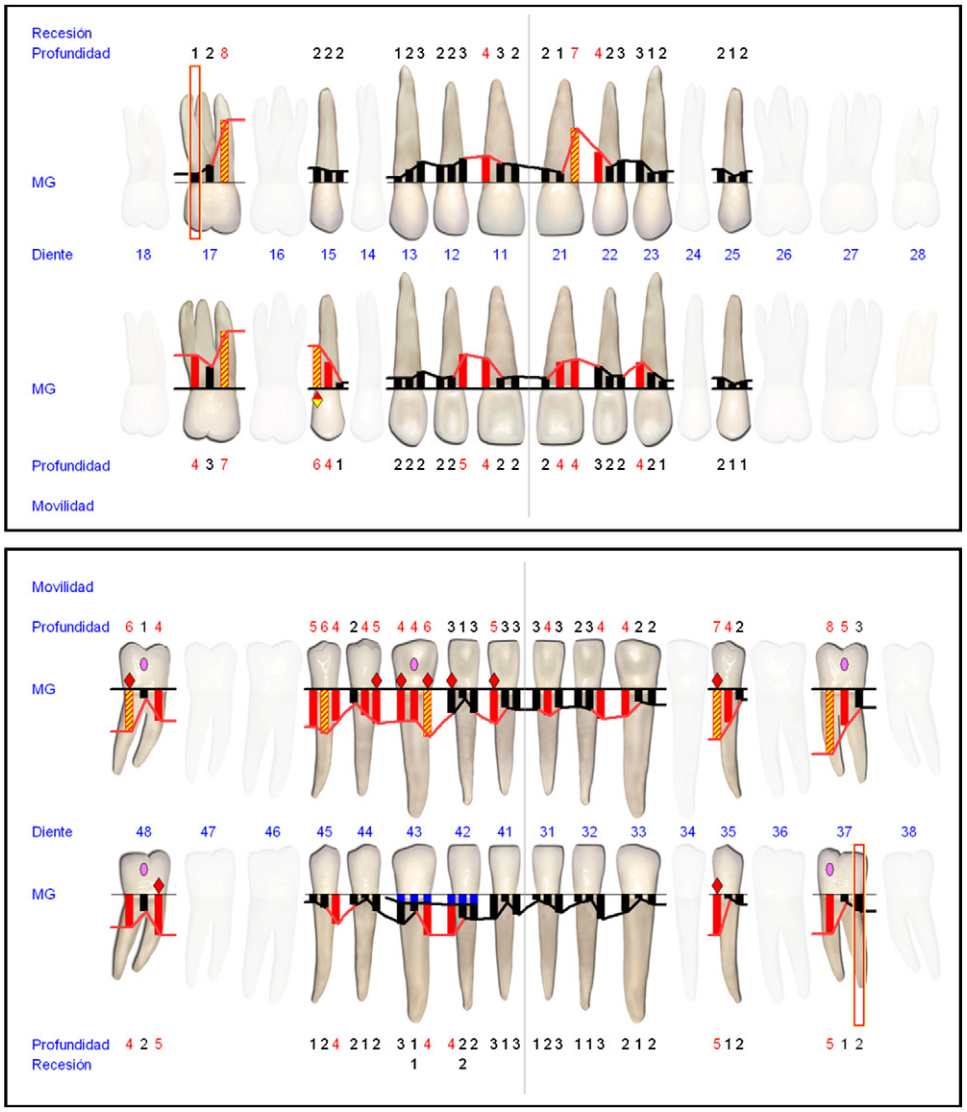

Fig 6. Initial periodontogram.

TREATMENT ALTERNATIVES

Based on the objectives, we could have chosen to reconstruct the occlusal plane by combined orthodontic and surgical treatment with maxillary impaction surgery (more in the left side) and mandibular rotation with advancement. However, the risks and the treatment costs would have been high, and the patient was reluctant to undergo surgery. She was willing to accept a compromise result, because she was more concerned about her dental problems and periodontal health than her facial appearance. Also, the surgery would not necessarily improve the periodontal problems.

TREATMENT PROGRESS

After the diagnostic workup was completed, a treatment plan was developed by using a team approach with orthodontics, periodontics, oral surgery, and prosthodontics. The initial treatment plan involved determination of which teeth were essential for prosthodontic treatment and which teeth had a hopeless periodontal prognosis or were not essential to the overall treatment.

The manbibular right second premolar was scheduled for extraction because of periodontal bone loss and high mobility. Because of a severe lack of bone,

Fig 7. Periodontal regeneration of the 2 wall bone defects.

Fig 8. Intraoral photos after the initial coronal alignment and the radicular leveling.

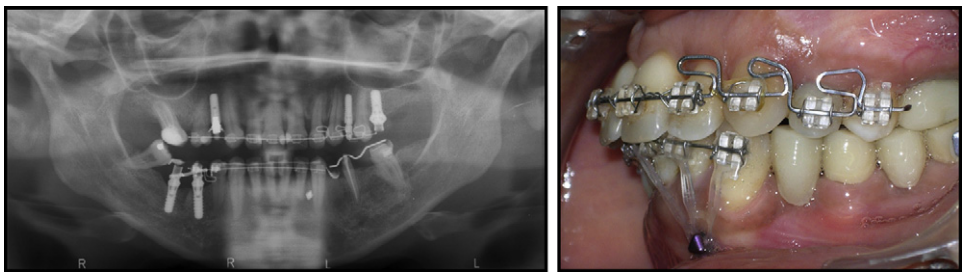

Fig 9. Panoramic x-ray and intraoral photos after the left-side maxillary and mandibular intrusion.

the mandibular left second premolar needed endodontic therapy, and a pontic replacement on this side was planned (Fig 8).

The periodontal disease was treated by nonsurgical and surgical methods (Fig 7). Full-mouth scaling and root planing were performed in 2 appointments. After

Fig 10. Facial and intraoral photos 2 years after orthodontic treatment.

a 2-month reevaluation period, pocket-depth reduction was achieved in almost every site. The distal face of the maxillary right central incisor and the mesial face of the mandibular left canine probed more than 5 mm with bleeding on probing.

A secondary surgical phase of periodontal treatment was scheduled for both of these sites. Periodontal regeneration of the 2 wall bony defects began by using enamel protein derivative (Emdogain; Straumann, Basel, Switzerland) and hydroxyapatite (Bio-oss; Geistlich, Wolhusen, Switzerland) in the anterior maxillary region and mesially on the mandibular right canine. These sites healed uneventfully before orthodontic treatment was started. Periodontal maintenance visits were scheduled every 3 months during orthodontic treatment.

Orthodontic therapy included intrusion of the left anterior teeth; this leveled the occlusal plane. Anchorage for orthodontic intrusion would be provided by an osseointegrated titanium implant in place of the left first maxillary premolar (Fig 9). Additional titanium implants would also be placed in several other positions after orthodontic alignment (Fig 9). After the malocclusion had been corrected, dental implants would be used for implant-fixed supported prostheses (Fig 10).

Because of a lack of bone to place an implant in the position of the mandibular left first premolar, intrusion was accomplished with a miniscrew implant (Fig 9). Also, interproximal incisor stripping was performed to minimize the open gingival embrasures between the anterior teeth.

The orthodontic treatment took approximately 18 months. Abutment screws retaining the 2-piece temporary healing abutments to the implants remained tight throughout the orthodontic treatment. After the treatment, the brackets were removed, and implants were

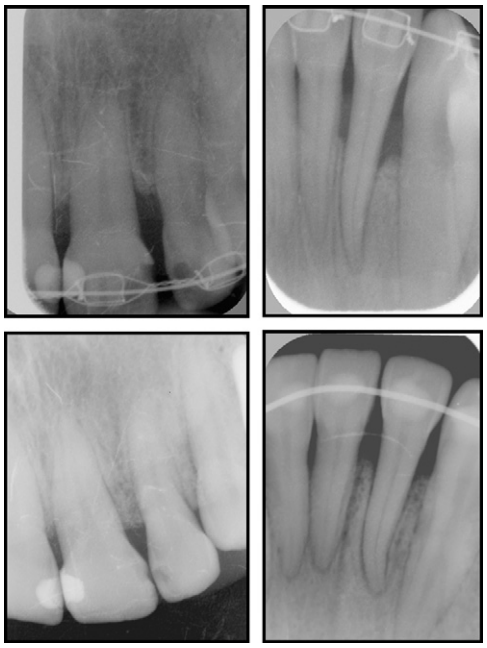

Fig 11. Periapical x-rays: *top row*, elongated teeth in the anterior left side at the start of orthodontic treatment; *bottom row*, significant improvement in the crown and root levels at the end of orthodontic treatment, after intrusion.

used for implant-retained prostheses. Once orthodontic treatment was completed, definitive restorations were placed. Pontics replacing the mandibular left first molar and the left first premolar were cantilevered (Fig 10).

TREATMENT RESULTS

A Class I dental occlusion was established only on the left side. However, it could not be restored to an ideal Class I relationship on the right side. The original collapsed posterior occlusion was corrected.

Periodontal control after the multidisciplinary treatment (Figs 11 and 12) showed stable pocket depths in all teeth, with a 6-mm pocket around the maxillary first premolar implant that did not bleed on probing.

In spite of the poor position of the maxillary right and mandibular third molars, (Figs 10, 13, and 14), the patient declined their extraction. A stable posterior occlusion was established, and the balancing interferences were eliminated.

Centric relation and centric occlusion were established at the same vertical dimension of the occlusion. The cephalometric analysis at the end of the treatment showed that the patient had improvements in overbite and overjet (Figs 15-17, Table).

DISCUSSION

Many researchers have concluded that orthodontically moving teeth into infrabony defects might modify the defects' morphology, reduce the probing depth, and resolve the radiologic bone defect.[10,11] Intrusion can be a reliable therapeutic treatment in patients with a healthy periodontal status, because it does not result in a decrease of the marginal bone level, if gingival inflammation is controlled.[12] The best results are obtained when tooth intrusion is performed with light forces (5-15 g per tooth) and the line of action of the force passes close to the center of resistance. In this patient, before orthodontic treatment, the maxillary incisors were elongated, especially on the left side. Significant improvement in the gingival margin relationships was obvious at the end of orthodontic therapy after intrusion of the mandibular and maxillary anterior teeth on the left side (Figs 10-12).

This case provides evidence that specific orthodontic treatment methods can have a significantly more favorable effect on the marginal gingival situation. Tooth intrusion in our patient not only reduced the potential for trauma to these teeth, but also improved the gingival relationships. Hence, we concluded that this combination is highly favorable when treating this type of patient.[13]

Periodontal regeneration surgery was performed to treat the bony defects 3 months before starting orthodontic intrusion (Fig 7). This resolved the periodontal defect with corresponding elimination of the infrabony pockets.[11]

A number of studies have demonstrated that orthodontic treatment can improve the periodontal situation in patients with pathologic migration by providing good function and improved esthetics after realignment. It is generally recommended that orthodontic treatment should be preceded by periodontal therapy, based on the belief that orthodontic treatment when there is inflammation can lead to irreversible breakdown of the periodontium.[1] In our patient, the corrective phase of periodontal therapy—ie, osseous or pocket reduction surgery—was completed before the orthodontic therapy.

Dental implants have become predictable and reliable adjuncts for oral rehabilitation.[14-16] Implant anchorage has been reported to be successful in many clinical situations, such as for intruding teeth.[7,17-19] Obtaining proper anchorage for orthodontic tooth movement frequently is a major problem in adults because of partial edentulism and reduced amounts of alveolar bone support. Also, in patients with severe periodontal involvement, there is the potential for further periodontal breakdown and tooth loss during treatment.

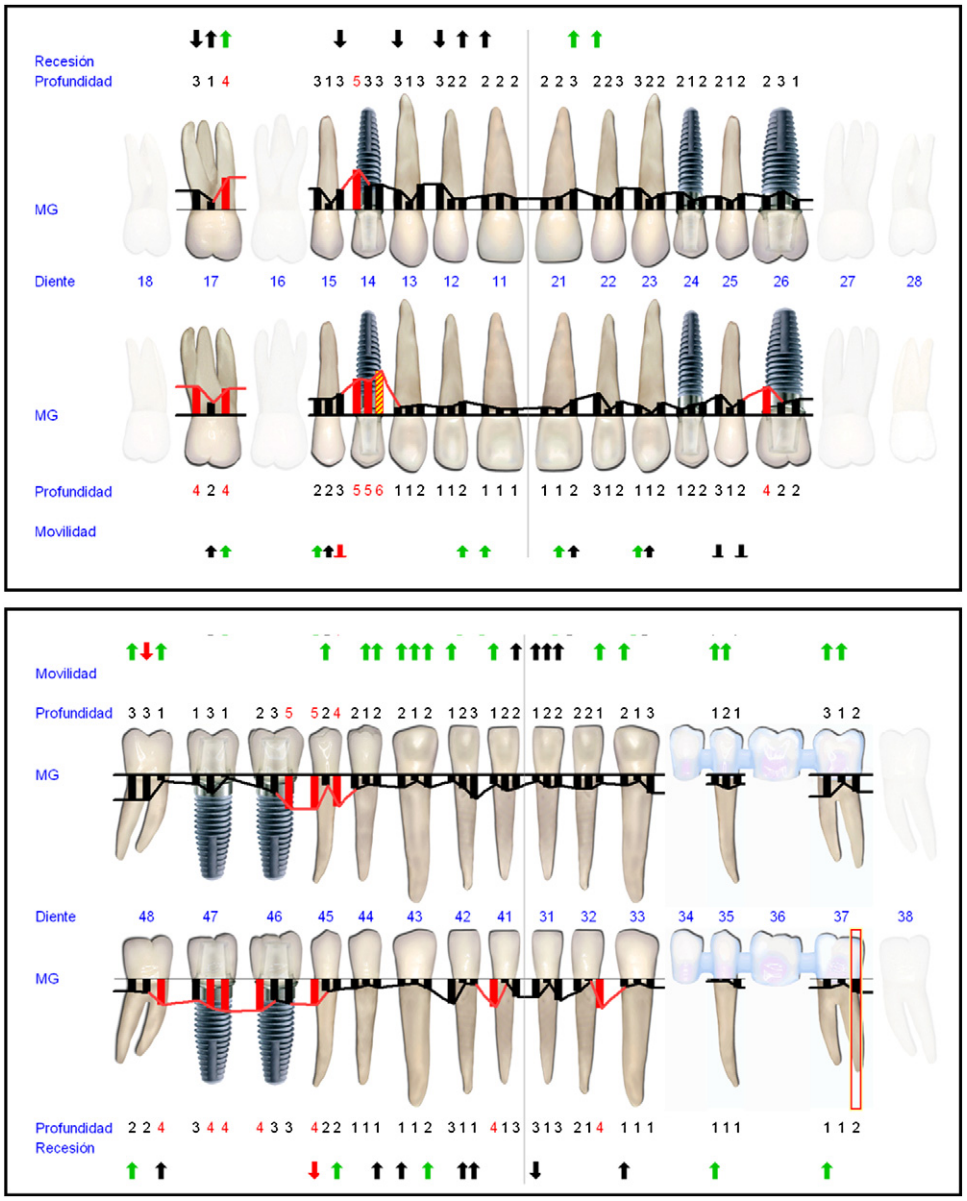

Fig 12. Periodontogram 2 years after orthodontic treatment.

Then the option of removing hopeless teeth and replacing them with implants provides the needed orthodontic anchorage. However, to make this type of treatment a clinical reality, the added financial costs must be considered, and extensive multidisciplinary treatment planning must be done. Miniscrew implant anchorage is a valid treatment option for tooth intrusion for patients for whom conventional implants are not indicated.[7,8]

Vardimon et al[20] showed that the bony apposition was 6.5 times greater after orthodontic tooth movement into surgical bony defects in rats. They concluded that orthodontic tooth movement is a stimulating factor for bone apposition. Furthermore, it was shown that enhanced bone healing occurred after orthodontic movement in the areas of periodontal defects.[21] This case report is in agreement with the possibility of bone apposition in bony defects after orthodontic movement.

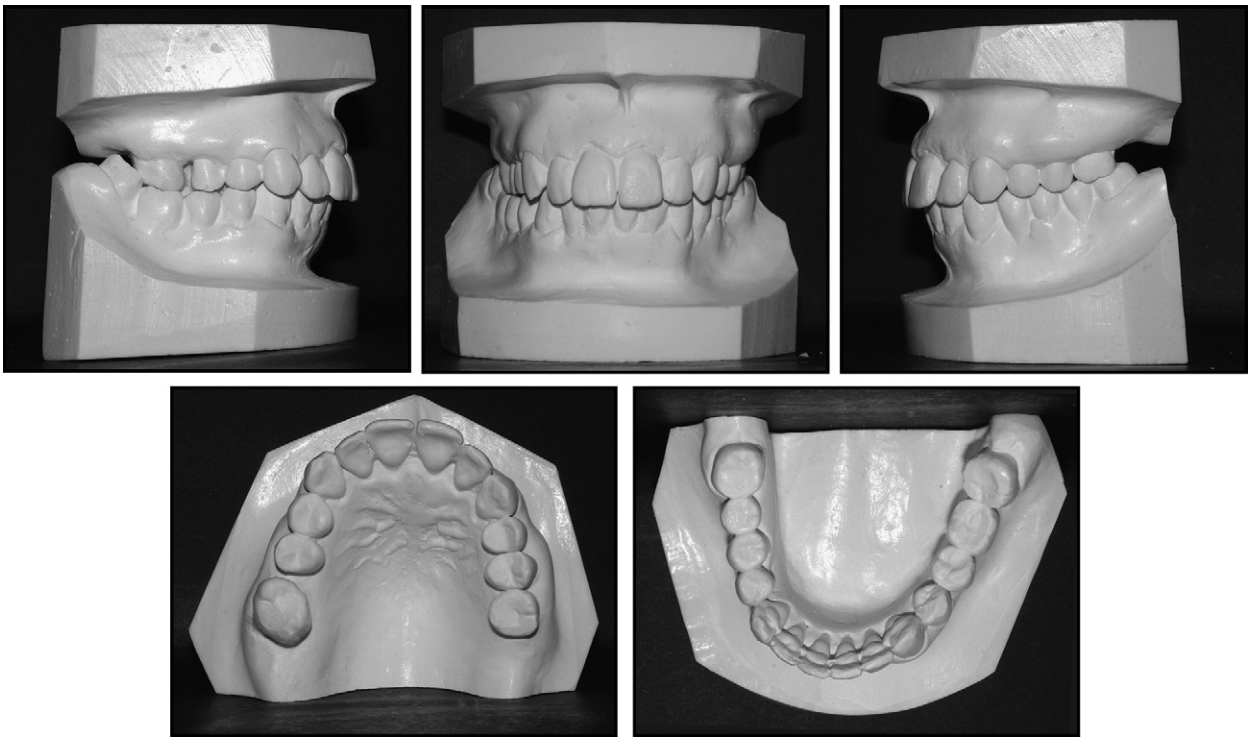

Fig 13. Posttreatment dental casts.

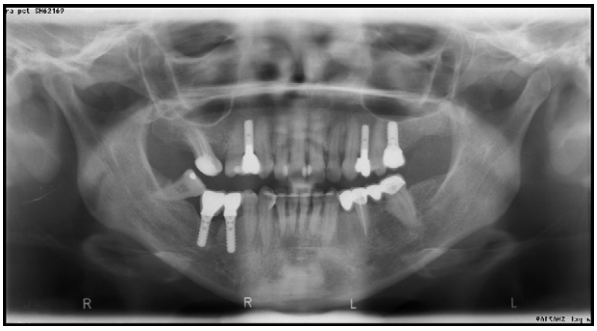

Fig 14. Posttreatment panoramic x-ray.

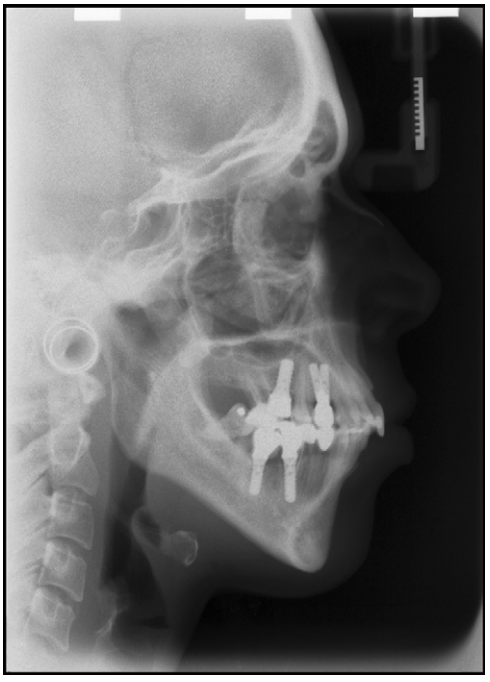

Fig 15. Posttreatment cephalometric radiogram.

In this patient, we used loops in the arch, because it was important to apply light orthodontic forces to the periodontally compromised teeth. In periodontally compromised teeth, the loss of alveolar bone results in the center of resistance of the involved teeth moving apically; thus, light controlled forces are important to minimize further attachment loss, tooth tipping, and root resorption.[22] In addition, the anterior maxillary and mandibular left teeth were intruded slightly, because it has been shown that gingival recession improves after intrusion of a tooth.[11] For this type of loop activation, an osseointegrated endosseous titanium implant was placed in the left first premolar position, and the miniscrew implants were extremely important for applying the orthodontic force to intrude the lower left teeth.

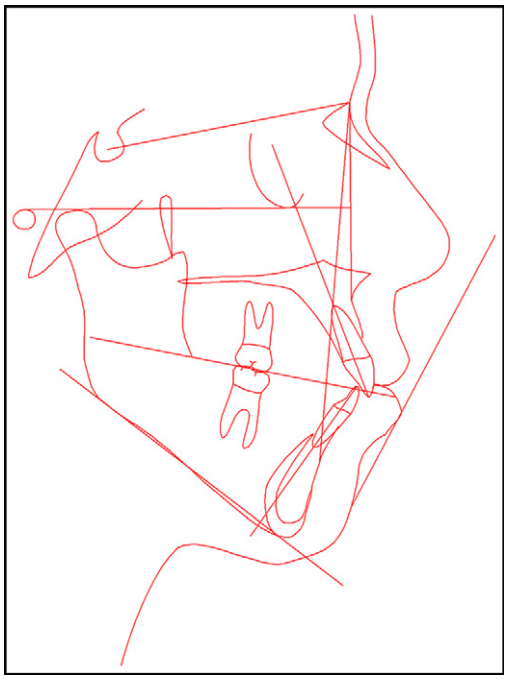

Fig 16. Posttreatment cephalometric tracing.

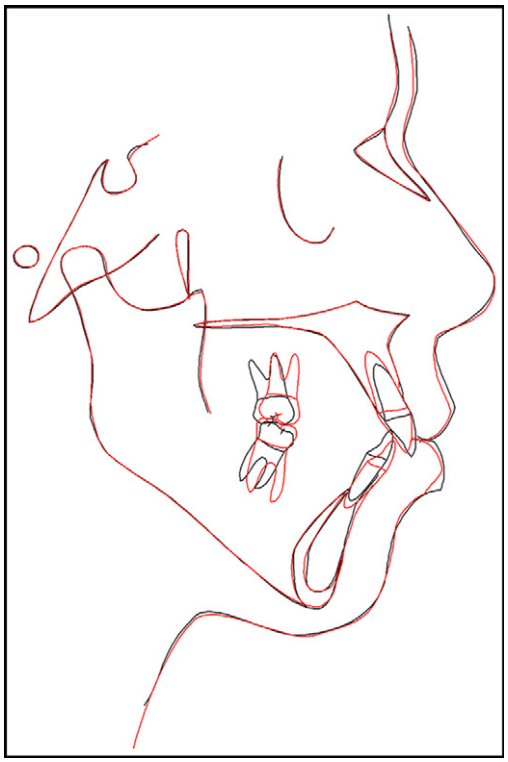

Fig 17. Pretreatment and posttreatment cephalometric tracings superimposed on the sella-nasion plane at sella. *Red lines*, posttreatment; *black lines*, pretreatment.

Table. Cephalometric analysis before and after treatment

Cephalometric analysis	*Norm*	*Before treatment*	*After treatment*
FMIA (°)	67 ± 3	60.2	53.9
FMA (°)	25 ± 3	38.8	38
IMPA (°)	88 ± 3	81.0	87.7
SNA (°)	82 ± 2	80.2	79.4
SNB (°)	80 ± 2	74.5	74.1
ANB (°)	1-5	5.6	5.3
Ao Bo (mm)	2 ± 2	0.8	0.5
Occlusal plane (°)	8-12	11.5	11.5
Z-angle (°)	75 ± 5	61.3	61.8
Facial posterior height (mm)	45	44.0	45.7
Facial anterior height (mm)	65	82.1	81.4
Posteroanterior index	0.69	0.5	0.6
Overjet (mm)	2.5 ± 2.5	7.4	4.3
Overbite (mm)	2.5 ± 2.5	6.3	2.9

Ao Bo, Sagittal disparity between Ao and Bo, orthogonal projections of A and B on the occlusal plane.

CONCLUSIONS

Multidisciplinary management, including periodontics, orthodontics, implants, and prosthetics, was used for a 43-year-old woman with multiple missing teeth, mild chronic periodontitis, and a malocclusion with a cant of the occlusal plane. The cooperation of the interdisciplinary fields and careful treatment planning were required, and a functional occlusion was achieved as a result. This patient also benefited esthetically from our combined treatment.

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