Orthodontic Distalization for Pre-Prosthetic Rehabilitation

FIORENZO FACCIONI, MD, DDS
DANIELE PAPADIA, DDS
ALBERTO LAINO, MD, DDS
SANTIAGO ISAZA PENCO, MD, DDS

An adult patient with missing teeth often presents with a reduced vertical dimension, a skeletal malocclusion, and some degree of temporomandibular disorder (TMD). Effective treatment of such a complex case often requires the collaboration of multiple dental specialists. In recent years, we have found that orthodontic tooth movement can facilitate prosthetic restoration.

In a case with a missing posterior tooth, the adjacent tooth can be moved distally into the edentulous area. An implant placement site with optimal vertical and buccolingual dimensions is thus created, taking advantage of the presence of a residual alveolar ridge and the absence of masticatory function, which would otherwise lead to resorption.[1] The healthy periodontal support around the distalized tooth ensures physiological regeneration of the alveolar process.

Research into the bone's reaction to dental movement through edentulous areas and at different levels of bone loss has demonstrated that periodontal health can be maintained given good oral hygiene, with no clinically significant damage to the supporting tissue.[2-4] The depth of alveolar bone and the attachment of connective tissue around the tooth remain stable. Therefore, bodily movement of a tooth along with its healthy periodontal support into an edentulous area allows the regeneration of lost alveolar bone. Even compromised teeth can be used for this purpose.

Controlled orthodontic extrusion has been used effectively to raise the gingival margin and the level of the alveolar crest prior to an extraction.[5] The stress on the periodontal fiber during tooth movement is transferred to the alveolar bone, stimulating bone deposition at the height of the crest.[6] Extrusion also increases the volume of periodontal tissue in the area, as the gingival margin moves upward while the mucogingival junction remains stable.[7]

The present article describes the use of orthodontic distalization prior to implant placement in two cases requiring orthodontic correction as well as prosthetic restoration.

Procedure

Before orthodontic treatment, each patient received periodontal therapy. Initial alignment was carried out with .022" × .028" edgewise appliances on light archwires. As soon as a rectangular archwire could be inserted, distal movement of the adjacent premolar into the edentulous region was begun. A 200g nickel titanium spring was compressed between the two premolars on an .019" × .025" stainless steel archwire to create the necessary sliding mechanics, using light, continuous forces. The premolars were also bonded lingually, and a lingual sectional arch and nickel titanium spring were placed to avoid rotations and reduce tipping of the distalized tooth.

Serial panoramic and buccal radiographs were obtained during treatment to monitor the marginal bone levels and check for possible root

TABLE 1
CASE 1 CEPHALOMETRIC DATA

	Norm	Pre-treatment	Post-Treatment
SNA	82°	80°	81°
SNB	80°	75°	78°
ANB	2°	5°	3°
FMA	25°	25°	22°
FMIA	67°	63°	73°
IMPA	88°	92°	85°
Occlusal plane	10-14°	4°	6°
Z-angle	75-78°	68°	73°
1-PFH	125°	100°	105°
Interincisal angle	135°	144°	148°

Dr. Faccioni is an Associate Professor and Dr. Papadia is an orthodontist, Division of Pedodontics, Department of Biomedical Morphologic Sciences, Dental Clinic, University of Verona, Italy. Dr. Laino is an Associate Professor, Department of Orthodontics, University of Naples "Federico II", and Dr. Penco is a Visiting Professor, Department of Orthodontics, University of Modena, Italy. Contact Dr. Faccioni at G.B. Rossi Hospital, Dental Clinic, Place L.A. Scuro 10, 37100 Verona, Italy; e-mail: fiorenzo.faccioni@univr.it.


Dr. Faccioni


Dr. Papadia


Dr. Laino


Dr. Penco

resorption. Regular ultrasound and manual cleaning was performed throughout the orthodontic treatment, and the vitality of the distalized tooth was periodically tested.

Case 1

A 30-year-old female presented with a Class II, division 2 dental and skeletal malocclusion (Fig. 1), following the loss of the upper right first

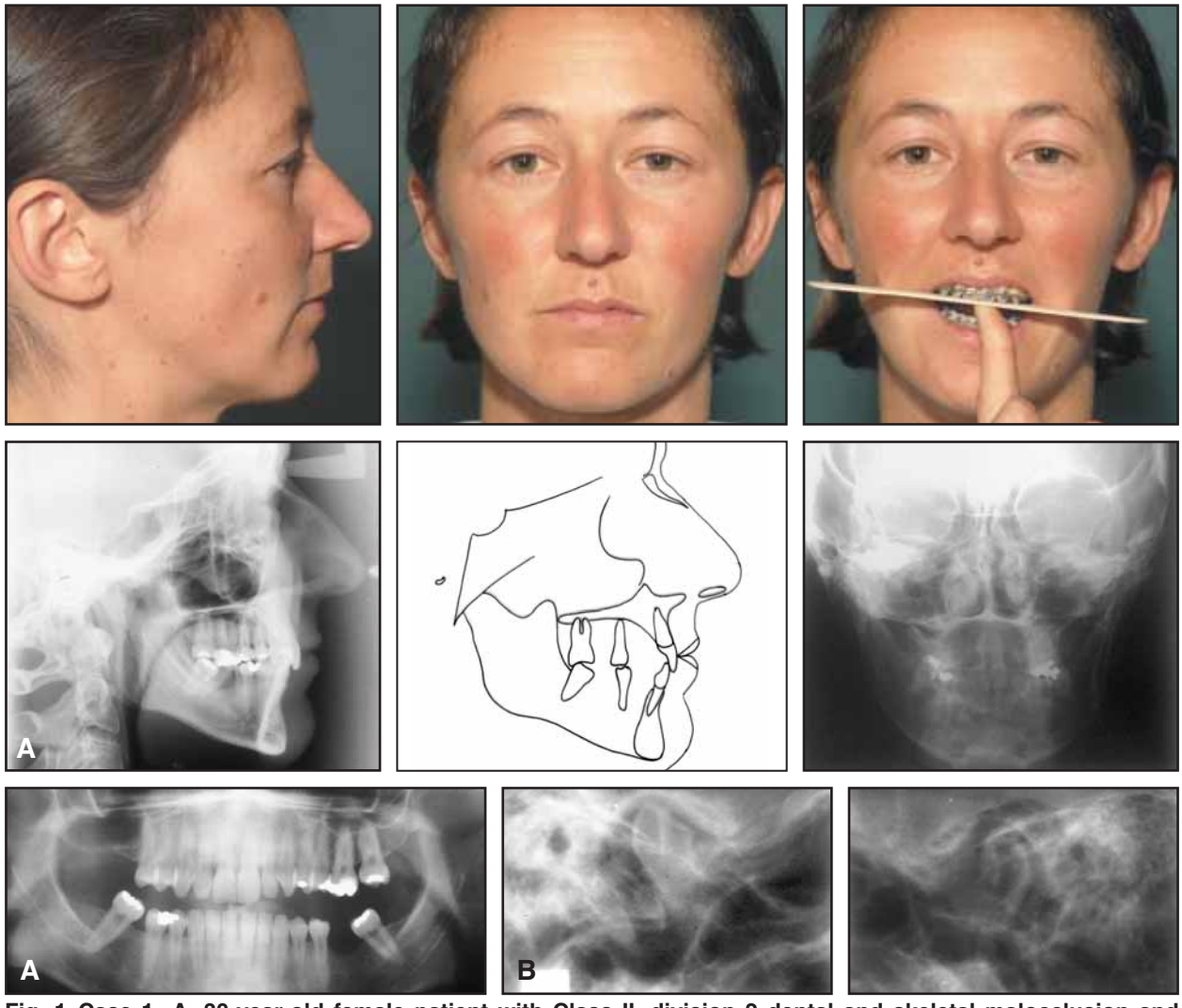

Fig. 1 Case 1. A. 30-year-old female patient with Class II, division 2 dental and skeletal malocclusion and missing upper right first and second molars and lower first molars before treatment. B. Computed tomographic scans of right and left TMJs before treatment.

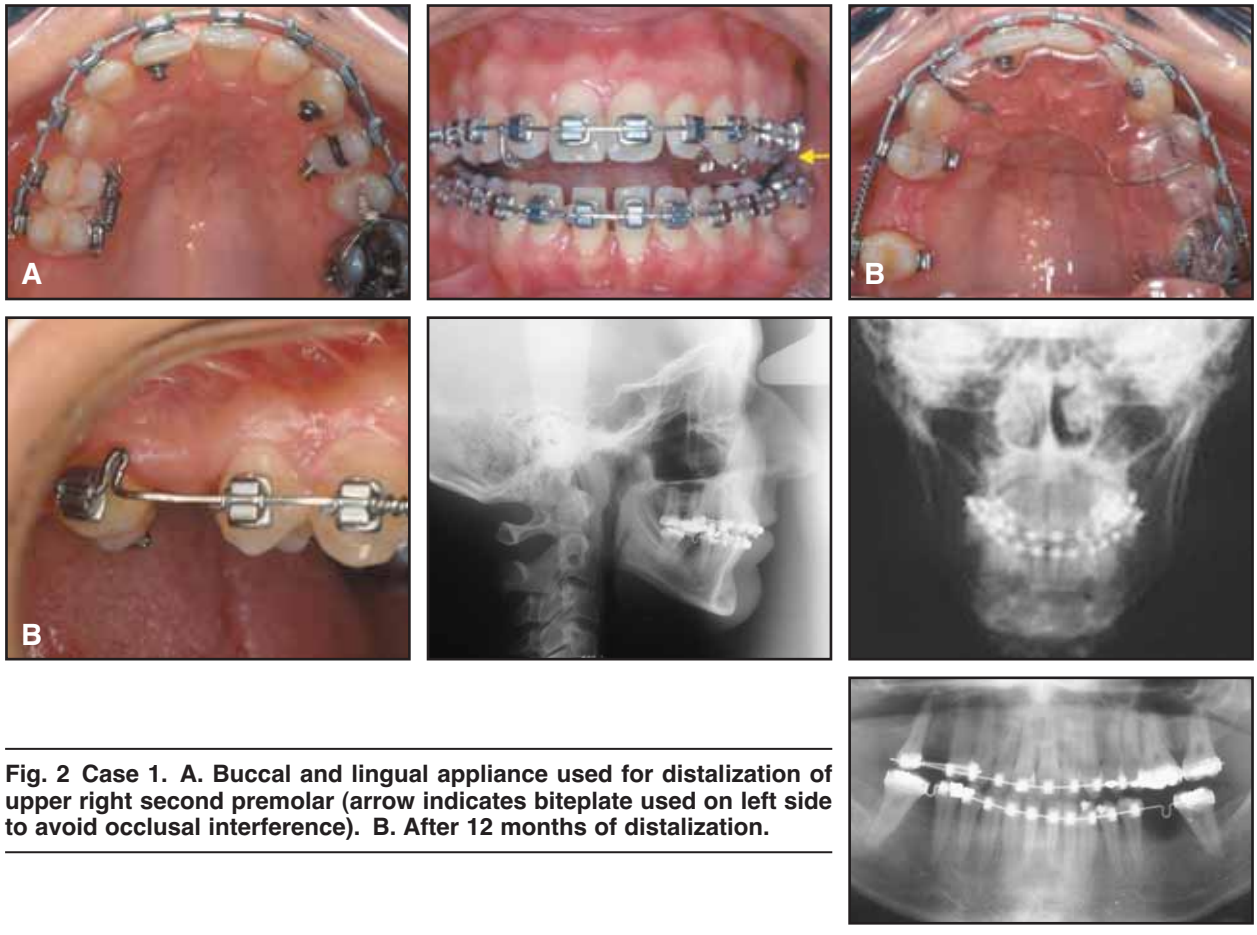

Fig. 2 Case 1. A. Buccal and lingual appliance used for distalization of upper right second premolar (arrow indicates biteplate used on left side to avoid occlusal interference). B. After 12 months of distalization.

and second molars and lower first molars. Examination and cephalometric analysis revealed an oblique occlusal plane, a maxillary asymmetry, a maxillary vertical deficiency on the right side, and a mandibular lateral deviation toward the right side (Table 1). The patient had been experiencing bilateral articular crepitation and periodic sudden pain in the left TMJ for about two years.

Orthognathic surgery involving both arches was planned, with the treatment goals of correcting the maxillary skeletal deformity, relieving the patient's TMD symptoms, and facilitating prosthetic restoration. A sinus prolapse usually limits the amount of bone available for implant placement. Instead of further complicating the treatment plan with a sinus-lifting operation, however, we decided to distalize the maxillary right second premolar to gain access to new alveolar bone between the two premolars for implant placement (Fig. 2). Had this failed, the two premolars could still have been used as abutments for a conventional three-unit bridge.

Distalization of the upper right second premolar did not increase the time required for presurgical orthodontic treatment, but a biteplate was needed to avoid occlusal interference during tooth movement. This phase was completed in 18 months.

Surgery consisted of a bilateral maxillary Le Fort I and mandibular angle osteotomy. The occlusal plane was corrected by impacting the right side and lowering the left side. The mandibular osteotomy was needed to correct the lateral devi-

Fig. 3 Case 1. Six months after bimaxillary surgery, prior to implant placement.

Fig. 4 Case 1. Placement of implant in upper arch.

ation and obtain a small amount of mandibular advancement (Fig. 3).

To ensure complete mineralization of the bone around the distalized second premolar, the implant was not placed until six months after surgery and 12 months after the completion of premolar distalization (Fig. 4). After 24 months of treatment, the dental and skeletal relationships had been normalized (Table 1), and a Class I occlusal relationship had been achieved (Fig. 5).

Case 2

A 50-year-old female presented with a Class II malocclusion within a Class I skeletal relationship, and a deep bite secondary to massive loss of posterior teeth: the right first premolar and second molar and the left second premolar and second molar in the upper arch, and all first and second molars in the lower arch (Fig. 6, Table 2). The loss of vertical occlusal space was indicated by the total anterior and buccal overbite.

Orthodontic treatment was planned to correct the dental malocclusion, achieve a normal incisal angle with optimal overbite and overjet, and facilitate subsequent prosthetic restoration with osseointegrated implants. These goals were achieved by distal rotation and uprighting of the upper molars,

TABLE 2
CASE 2 CEPHALOMETRIC DATA

	Norm	Pre-treatment	Post-Treatment
SNA	82°	86°	85°
SNB	80°	85°	85°
ANB	2°	1°	0°
FMA	25°	5°	12°
FMIA	67°	88°	70°
IMPA	88°	86°	98°
Occlusal plane	10-14°	–9°	3°
Z-angle	75-78°	95°	85°
1-PFH	125°	116°	114°
Interincisal angle	135°	153°	139°

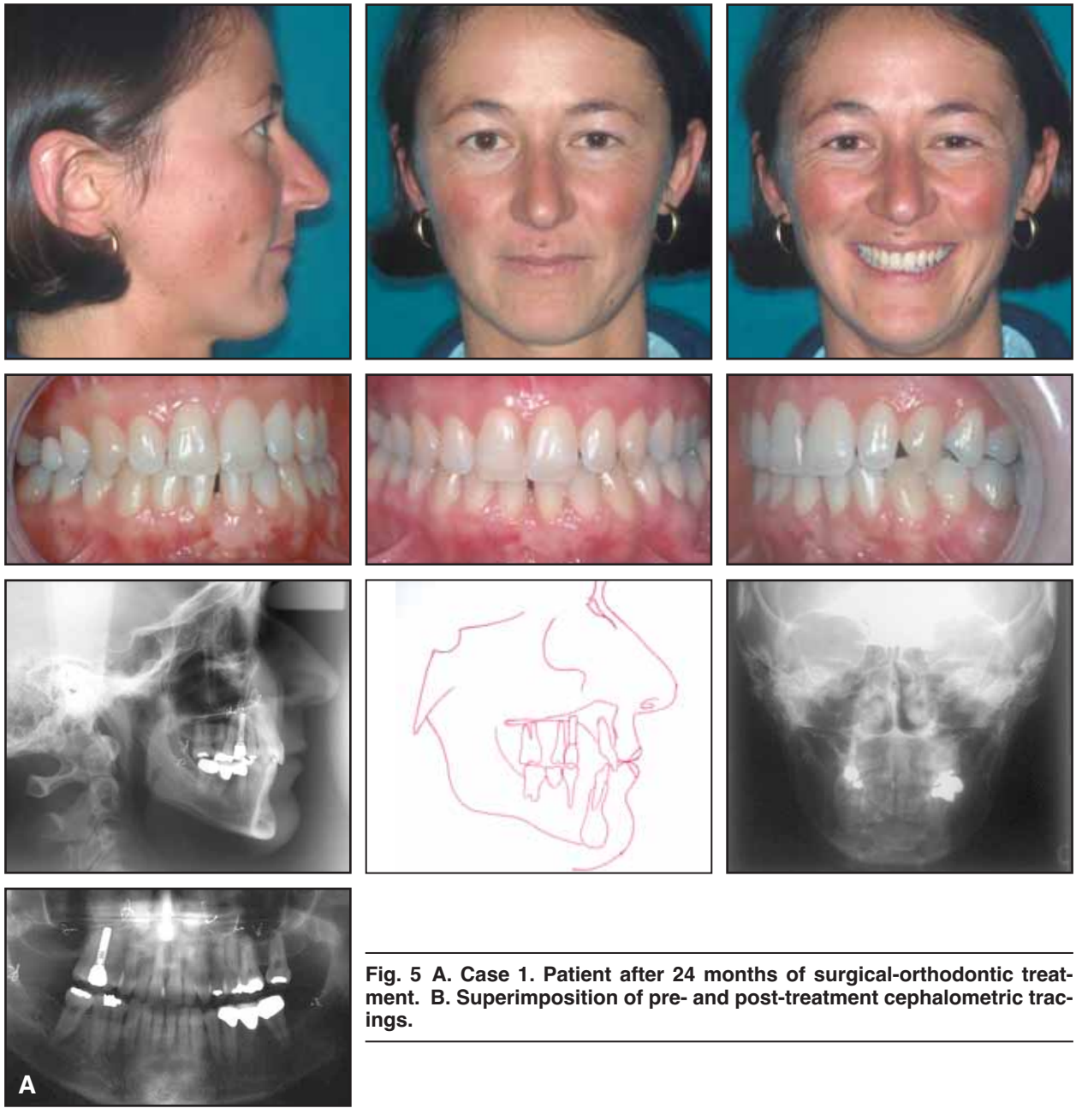

Fig. 5 A. Case 1. Patient after 24 months of surgical-orthodontic treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

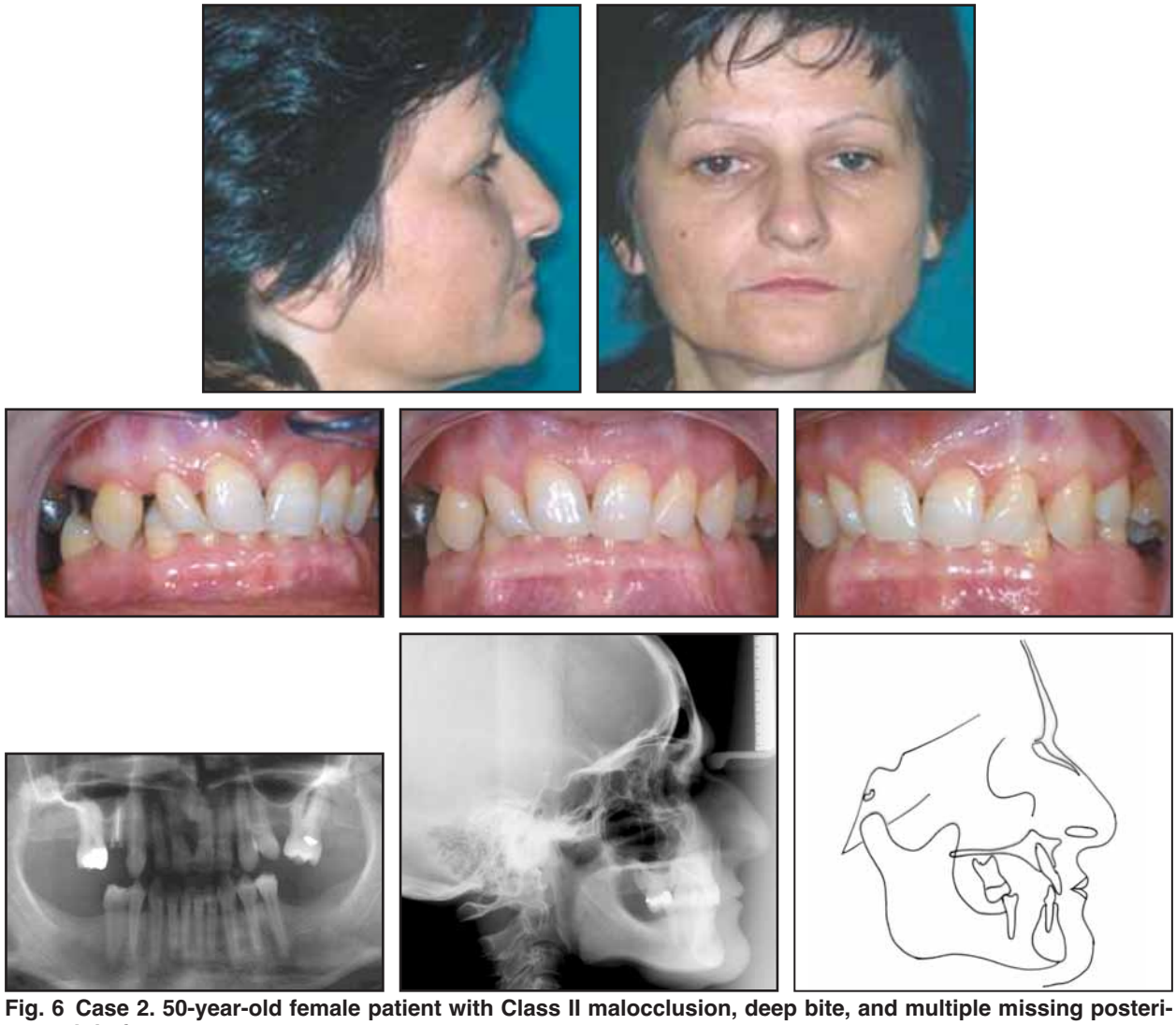

Fig. 6 Case 2. 50-year-old female patient with Class II malocclusion, deep bite, and multiple missing posterior teeth before treatment.

alignment of the prosthetic abutments (the right molar and canine and the left molar and premolar), and fitting of traditional metal-ceramic three-unit bridges. The lower second premolars were moved distally through the edentulous spaces to restore the surrounding alveolar process and prepare sites for placement of two osseointegrated implants. Sectional lingual arches were used, with 2nd-order bends placed on the buccal side to control root movement of the teeth being distalized (Fig. 7).

Implants were placed 20 months after the start of treatment, about six months after the completion of premolar distalization. Periodontal probing prior to implant placement showed adequate dimensions of the newly formed supporting bone (Fig. 8). At the end of treatment, a Class I occlusal relationship had been attained, and recovery of the vertical dimension allowed normalization of the overbite (Fig. 9, Table 2). The total treatment time was 24 months.

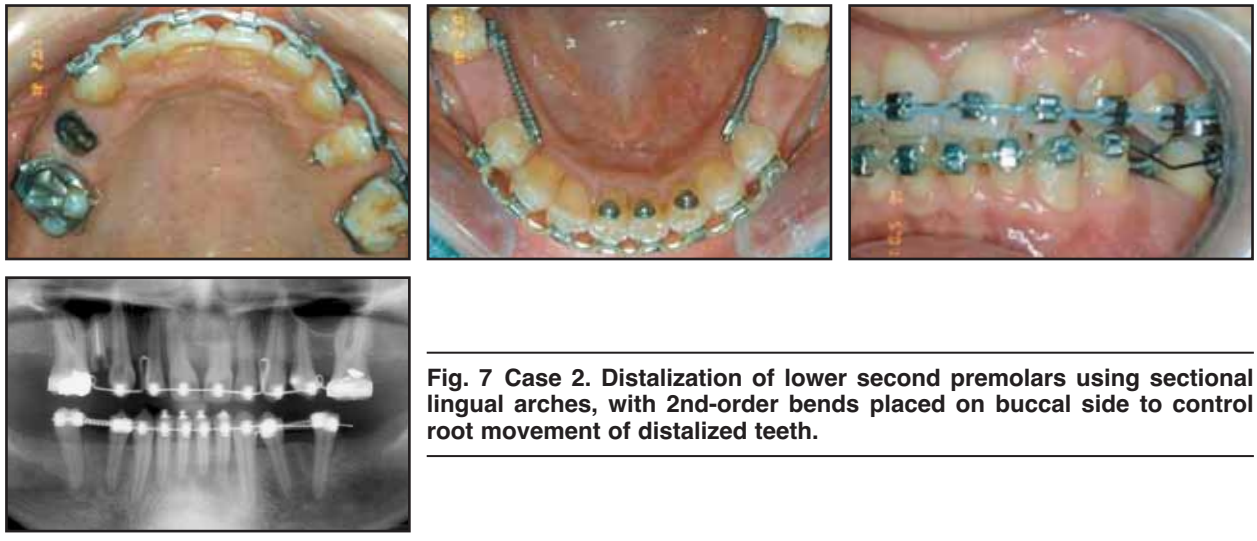

Fig. 7 Case 2. Distalization of lower second premolars using sectional lingual arches, with 2nd-order bends placed on buccal side to control root movement of distalized teeth.

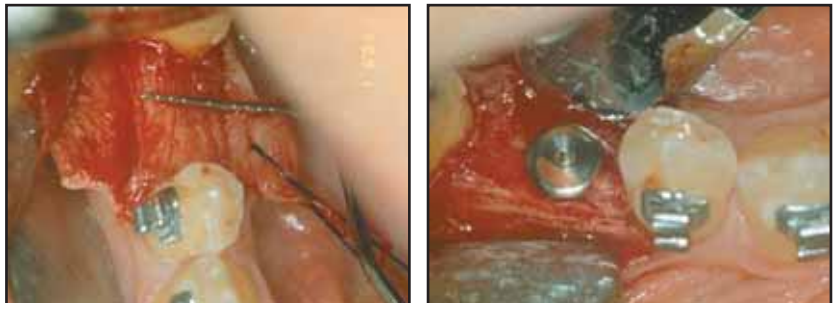

Fig. 8 Case 2. Periodontal probe shows adequate dimensions of supporting bone for implant placement.

Discussion

Implant placement is currently the best method of restoring edentulous areas in the permanent dentition. For prosthetic restoration to be successful, however, the supporting bone must have adequate dimensions and quality. Loss of bone at the edentulous site is a major problem in prosthodontics. The absence of the tooth and its periodontal support results in progressive resorption of the alveolar process. The atrophied areas often require surgery to increase the amount and quality of bone available for hosting the implant. The success of this procedure depends on a number of intrinsic and extrinsic factors, and the costs often outweigh the benefits.

Distalization of a tooth adjacent to the edentulous space is a valid alternative to surgical intervention in preparing a site for subsequent implant placement, particularly when orthodontic treatment is already required to correct a dental malocclusion. The distalized tooth retains its attachment to the alveolar bone and connective tissues, and the tooth movement facilitates regeneration of alveolar bone at the atrophied site. The site previously occupied by the healthy tooth will have adequate bone quality and vertical and buccolingual dimensions for implant placement. Ideally, the implant should be placed six months after the completion of distalization to ensure remineralization of the alveolar receptor site. Further delay may increase the likelihood of resorption.

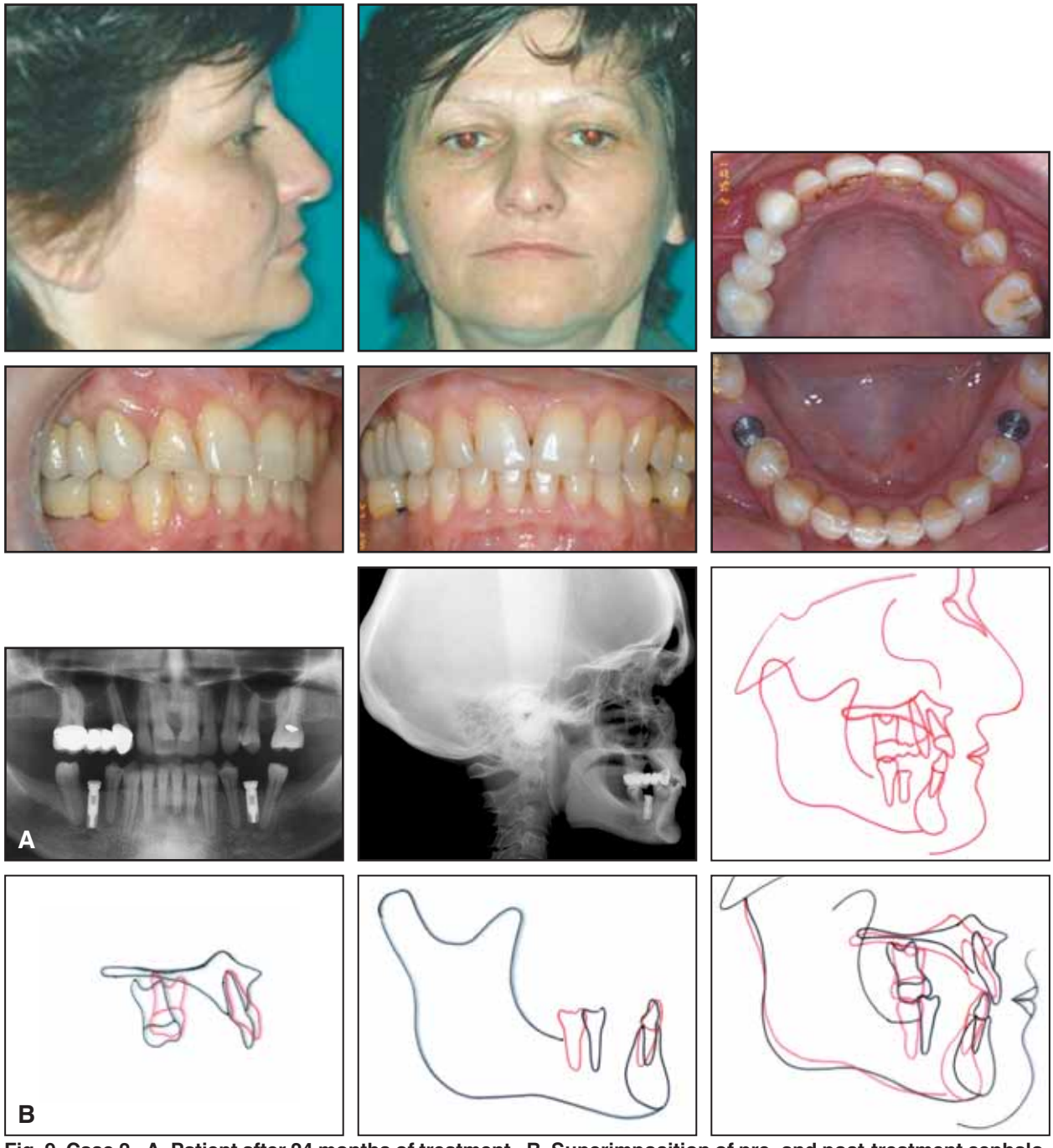

Fig. 9 Case 2. A. Patient after 24 months of treatment. B. Superimposition of pre- and post-treatment cephalometric tracings.

In the two cases described here, clinical and radiographic data demonstrated the vitality of the distalized teeth and excellent gingival conditions, with no loss of marginal bone. Before proceeding with this technique, however, it is important to ensure that there is adequate marginal soft tissue to prevent the formation of a recess. In addition, the periodontal health of the distalized tooth must be monitored before and during treatment. As in the cases shown here, light and continuous orthodontic forces should always be used.

REFERENCES

1. Faccioni, F.: Riabilitazione ortodontico-chirurgica-protesica della bocca: Rapporto di un caso, Attualità Dentale 5/6:32-37, 1999.
2. Lindskog-Stokland, B.; Wennström, J.L.; Nyman, S.; and Thilander, B.: Orthodontic tooth movement into edentulous areas with reduced bone height: An experimental study in the dog, Eur. J. Orthod. 15:89-96, 1993.
3. Cobo, J.; Argüelles, J.; Puente, M.; and Vijande, M.: Dento-alveolar stress from bodily tooth movement at different levels of bone loss, Am. J. Orthod. 110:256-262, 1996.
4. Wennström, J.L.; Stokland, B.L.; Nyman, S.; and Thilander, B.: Periodontal tissue response to orthodontic movement of teeth with infrabony pockets, Am. J. Orthod. 103:313-319, 1993.
5. Salama, H. and Salama, M.: The role of orthodontic extrusive remodeling in the enhancement of soft and hard tissue profiles prior to implant placement: A systematic approach to the management of extraction site defects, Int. J. Period. Restor. Dent. 13:312-333, 1993.
6. Pontoriero, R.; Celenza, F. Jr.; Ricci, G.; and Carnevale, G.: Rapid extrusion with fiber resection: A combined orthodontic-periodontic treatment modality, Int. J. Period. Restor. Dent. 7:30-43, 1987.
7. Baldassarre, V. and Susi, W.: Estrusione guidata ortodonticamente e allungamento chirurgico di corona, Dent. Moderno 5:143-151, 2004.