CASE REPORT

Management of a Periodontally Compromised Case Using Miniscrew Anchorage

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Mini-implants have become an accepted means of reinforcing anchorage in the treatment of a variety of malocclusions.[1-10] Orthodontic miniscrews are generally used in four types of cases:

1. Patients with insufficient teeth for the application of conventional anchorage.
2. Cases where the forces on the reactive unit would generate adverse side effects.
3. Patients with a need for asymmetrical tooth movements in all planes of space.

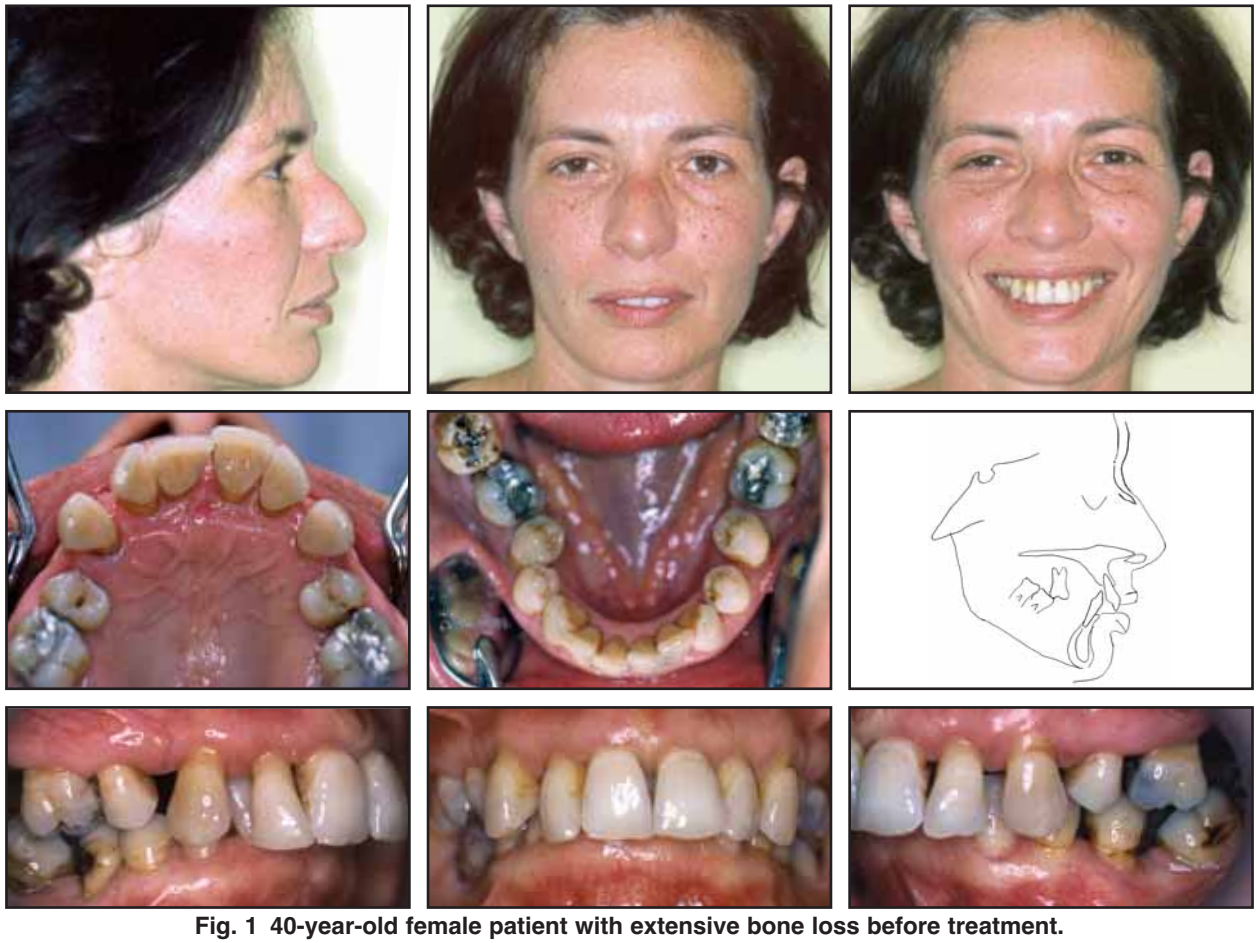

Fig. 1 40-year-old female patient with extensive bone loss before treatment.

4. As an alternative to orthognathic surgery.[11]

This article demonstrates the use of miniscrews in a case with extensive bone loss and a degenerating malocclusion, where orthognathic surgery was not an acceptable option.

Diagnosis

A 40-year-old female was referred by her dentist with the chief complaint of her front teeth being mobile (Fig. 1). Orthodontic treatment involving extraction of the upper first premolars had been attempted 20 years earlier, but was terminated within a few months because the patient could not tolerate the appliances. Periapical x-rays showed progressive, generalized bone loss compared with another set taken six years previously (Figs. 2,3). The maxillary second molars had been lost during that period because of periodontal breakdown.

Clinical examination revealed a deep overbite (12mm) with severe trauma to the palatal soft tissue, spacing in the upper arch, and mesially inclined mandibular second molars due to the loss of the first molars. The bone surrounding the maxillary premolars and molars was minimal. Cephalometric analysis (Table 1) indicated a mild mandibular retrognathism (SNB = 76.8°), but a severe Wits appraisal (7.7mm). Although the patient's lower facial height was normal (SN-GoGn = 32.6°), her face appeared short with the teeth in maximum intercuspation.

Because of the patient's generalized bone loss and deep pockets, she was referred to a periodontist. Treatment involved cleaning and scaling, as well as osseous grafting and membrane use at the premolar and molar sites. The maxillary molars and premolars were splinted together to reduce mobility and promote recovery. In consultation with the periodontist, we prescribed a mandibular stabilizing splint to

TABLE 1
CEPHALOMETRIC DATA

	Pre-treatment	Post-Treatment
SNA	80.2°	79.4°
SNB	76.8°	73.8°
ANB	3.4°	5.6°
SNPo	77.7°	75.1°
Po-NB	3.4°	3.0°
Wits appraisal	7.7mm	3.0mm
OP-SN	7.7°	16.3°
SN-GoGn	32.6°	35.5°
U1-NA	24.0°	11.1°
L1-NB	19.6°	34.2°
Interincisal angle	137.3°	132.9°
L1-GoGn	88.2°	98.2°

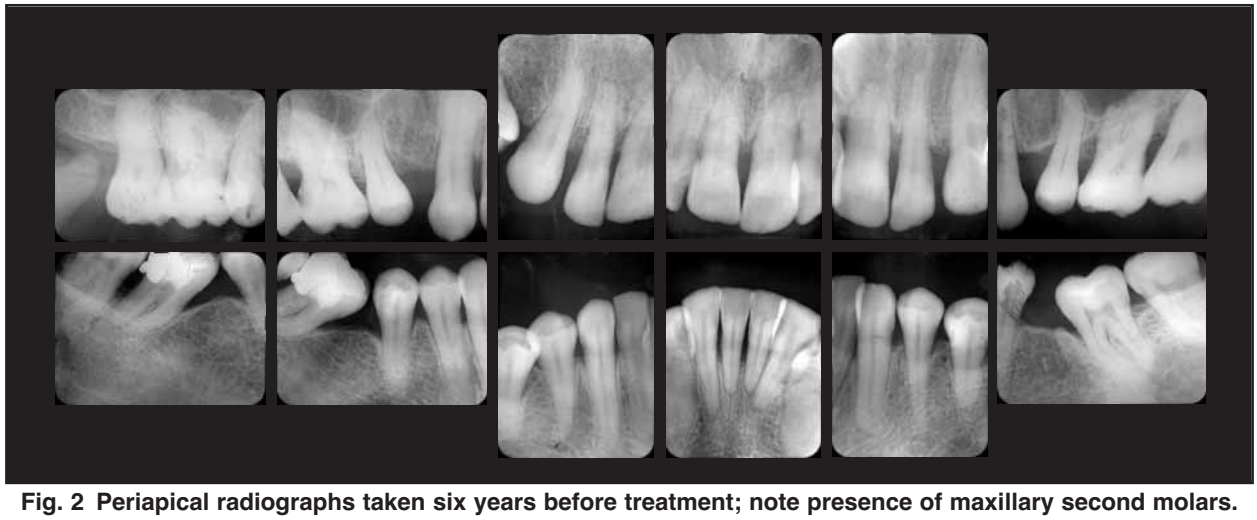

Fig. 2 Periapical radiographs taken six years before treatment; note presence of maxillary second molars.

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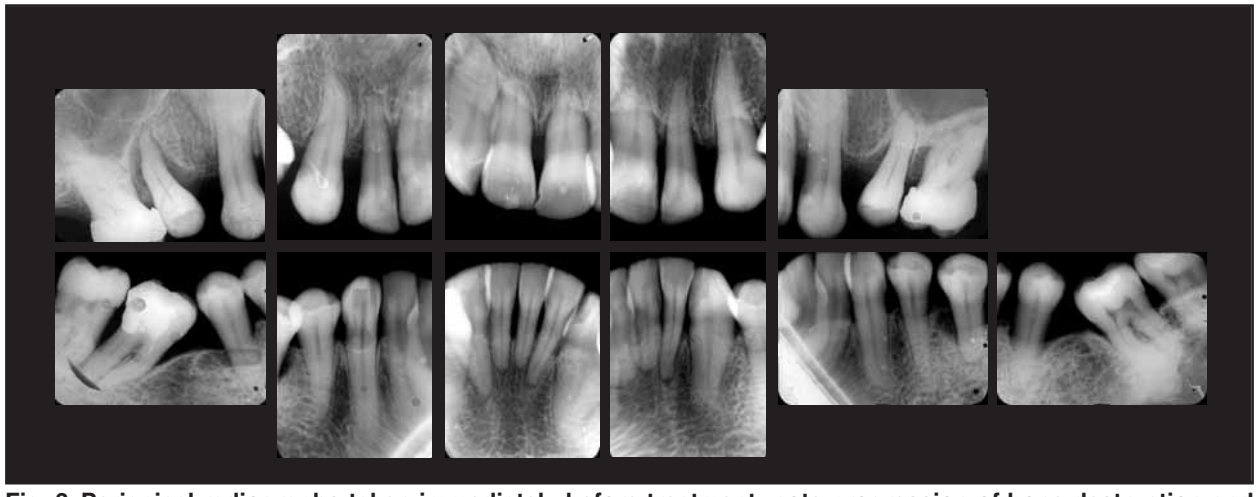

Fig. 3 Periapical radiographs taken immediately before treatment; note progression of bone destruction and loss of maxillary second molars.

eliminate the palatal trauma from the deep bite and enhance healing.

After adequate periodontal recovery, it was agreed to proceed with orthodontic treatment. The maxillary molars and premolars were to remain splinted indefinitely, but because of the inability of these teeth to provide adequate anchorage and the risk of provoking further bone loss, we decided to use skeletal anchorage from miniscrews.

Treatment Objectives

The treatment plan included retraction and intrusion of the maxillary canines and incisors, extrusion and uprighting of the mandibular molars, and a slight intrusion and proclination of the mandibular incisors. The patient agreed on a compromise regarding the final canine relationship and overjet, with the ultimate goal being an esthetic improvement and the establishment of a physiologic, rather than ideal, occlusion.

A free-body diagram analysis indicated the locations for placement of three miniscrews to allow bodily retraction and intrusion of the upper anterior teeth (Fig. 4). The centers of resistance of the maxillary canines and incisors were roughly estimated using guidelines from previous studies.[12-14] Hooks were then constructed to allow the forces to be placed on the same vertical level or even slightly above these centers of resistance, so that a counterclockwise moment could be created with a desirable uprighting effect (palatal root torque).

Treatment Progress

A small incision, about 2-3mm long, was made in the mucosa under local anesthesia. After cortical penetration with a twist drill, three Aarhus Anchorage System* miniscrews were inserted with the provided screwdriver. The amount of bone available distal to the maxillary left first molar was insufficient for screw placement because of the prolonged edentulism; therefore, the miniscrew on this side was inserted mesial to the molar.

After one week of healing, the buccal screws were loaded with 50g nickel titanium coil springs

*MEDICON eG, Tuttlingen, Germany; www.medicon.de. ScanOrto A/S, Charlottenlund, Denmark; www.aarhus-mini-implant.com.

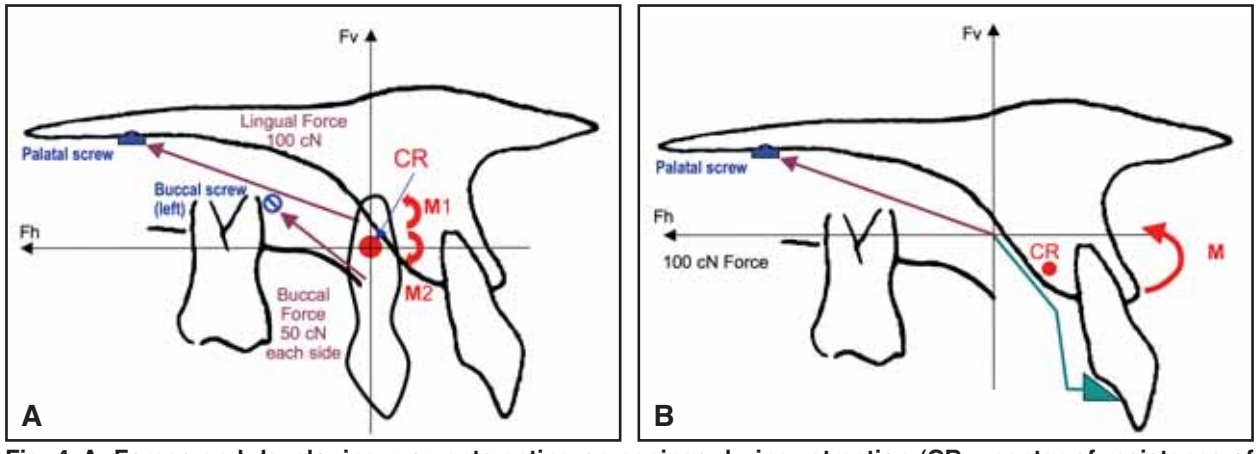

Fig. 4 A. Forces and developing moments acting on canines during retraction (CR = center of resistance of canine; M1 = moment developing from lingual force; M2 = moment developing from right and left buccal forces; Fv, Fh = vertical and horizontal components of forces). B. Applied force and developing moment during retraction of incisor segment (CR = center of resistance of incisor segment; M = moment developing from 100g palatal force; Fv, Fh = vertical and horizontal components of palatal force).

Fig. 5 Maxillary canine retraction. A. 50g nickel titanium retraction spring attached between right and left buccal miniscrews and .019" x .025" stainless steel lever arm, with point of force application below CR. B. 100g nickel titanium spring attached between palatal miniscrew and long lever arms for application of lingual force above CR; note sutures from interproximal osseous grafting around right molar and premolar, along with generalized chlorhexidine staining.

and the palatal screw with a 100g spring (Fig. 5). The initial retraction involved only the canines. Lever arms reaching below the estimated CR of the canines were inserted in the labial brackets, while custom-made lever arms reaching above the CR were bonded lingually. This mechanical system canceled out the developing moments, not only horizontally, but also vertically. The flat mandibular splint delivered during the periodontal treatment was continued during this phase because it unblocked the anterior occlusion by creating a clockwise mandibular rotation, thus producing an overjet that made the retraction possible. During the 10 months of canine retraction, the lingual arms were twice adjusted in length to avoid undesirable tipping due to the difference between the estimated and actual CR of these teeth.

Next, the four maxillary incisors were bonded, and a segment of .019" × .025" 37° thermal copper nickel titanium wire was inserted for alignment. Lever arms were bonded lingually to the lateral

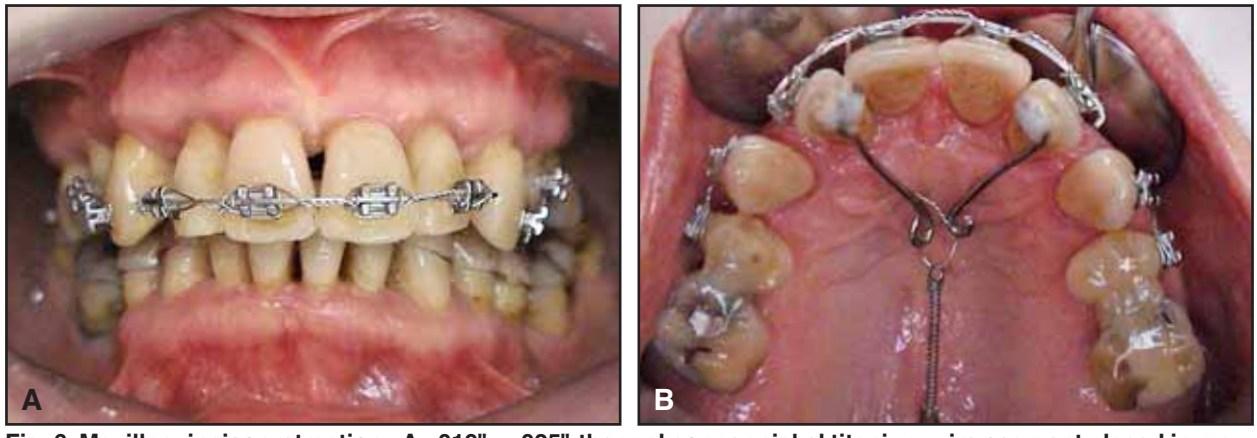

Fig. 6 Maxillary incisor retraction. A. .019" x .025" thermal copper nickel titanium wire segment placed in maxillary incisor brackets; note mandibular flat splint. B. Retraction force applied with 100g nickel titanium coil spring through long, 1mm stainless steel lever arms bonded to lingual surfaces of lateral incisors.

incisors, and retraction of the anterior segment was initiated with a 100g nickel titanium coil spring (Fig. 6). One and a half months later, the nickel titanium segmental wire was replaced with an .019" × .025" stainless steel wire.

After one year of anterior retraction, a segment of .017" × .025" D-Rect** braided stainless steel wire was inserted through all six anterior brackets for final leveling. Brackets were bonded to the premolars, and elastic chain was attached to prevent spaces from opening between the premolars and the anterior teeth during the leveling process. The canines were shortened by 1.5mm each to improve their crown/root ratios.

Treatment of the maxillary arch required a total of 22 months. At this point, the periodontist proceeded with the fixation of all maxillary teeth and consolidation of the arch, using fiber-reinforced composite.[15] The patient maintained a schedule of three-month periodontal checkups for cleaning and scaling throughout the orthodontic treatment period.[16,17] A flat stabilizing splint was delivered for night-time wear to avoid unwanted side effects to the periodontium and to prevent retainer breakage from bruxing or clenching episodes during sleep.

The mandibular arch was then bonded and treated with a wire sequence of .016" nickel titanium, .016" × .022" reverse-curve nickel titanium, and .016" Australian wire*** with open-coil springs mesial to the second molars. The periodontist recommended that premolar contacts be kept as light as possible to allow better healing of the supporting tissues. After 12 months of mandibular treatment, the patient received a removable wraparound retainer with acrylic between the second molars and premolars, where spaces had opened after uprighting of the mesially tipped molars.

Treatment Results

Although the canine relationship on the left side was corrected to Class I, the correction on the right was incomplete (Fig. 7). This was considered a reasonable outcome,[18,19] however, because both the overjet (3.5mm) and the traumatic overbite (2.5mm) were eliminated. Cephalometric analysis showed a clockwise mandibular rotation (SN-GoGn = 35.5°), an increase of 10° in lower incisor inclination, and a reduction in the interincisal angle from 137.3° to 132.9° (Table 1). Periapical x-rays confirmed maintenance of the alveolar bone around the teeth subjected to orthodontic move-

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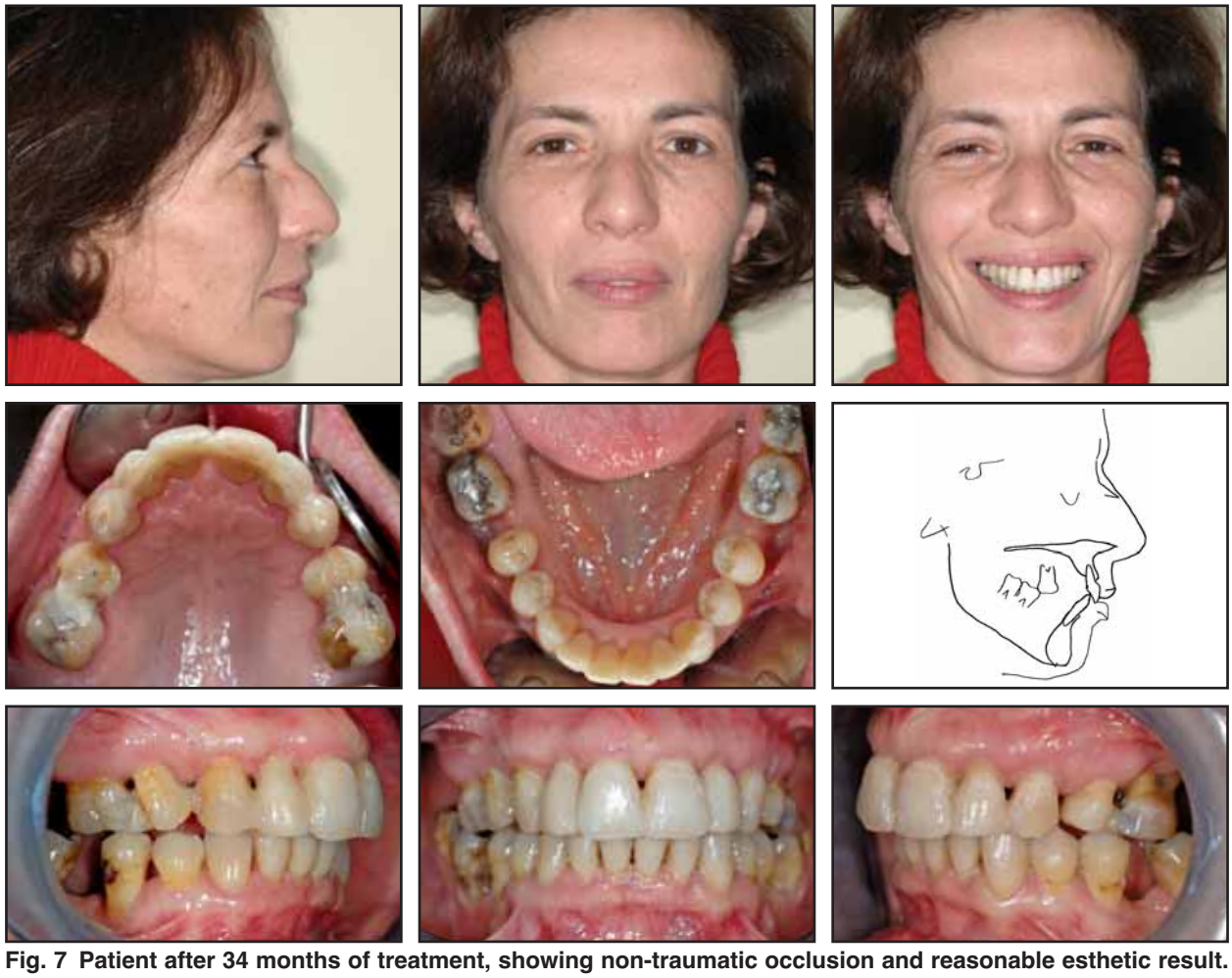

Fig. 7 Patient after 34 months of treatment, showing non-traumatic occlusion and reasonable esthetic result.

ment (Fig. 8), and clinical evaluation revealed a healthy periodontium with no pockets or mobility. The patient was pleased with the esthetic result.

Because the patient did not wear the removable retainer, it was replaced with fiber-reinforced composite bonded to the lingual surfaces of the lower incisors and canines. Prosthetic replacement of the missing teeth was unexpectedly declined by the patient. Therefore, where spaces had opened distal to the premolars, those teeth were stabilized by bonding fiber-reinforced composite and by building a bridge running infraocclusally from second molar to second premolar on each side, to avoid fracture from masticatory forces (Fig. 9).

A recall check 20 months after treatment—three years after the completion of maxillary tooth movement—showed a stable occlusal result and good esthetics (Fig. 9). The premolar occlusion had settled by this time, and interdigitation had improved. A new set of periapical x-rays showed that the lamina dura of teeth that initially had a poor prognosis, such as the maxillary molars, had been enhanced and was more distinct, and that the alveolar bone had been preserved (Fig. 10).

Discussion

Miniscrews provide a viable option when teeth that are ordinarily used for anchorage are severely compromised due to a loss of supporting tissues. With proper selection of the insertion sites, following careful evaluation of the mechanics to be employed, the clinician can achieve results that would be unattainable by conventional means.

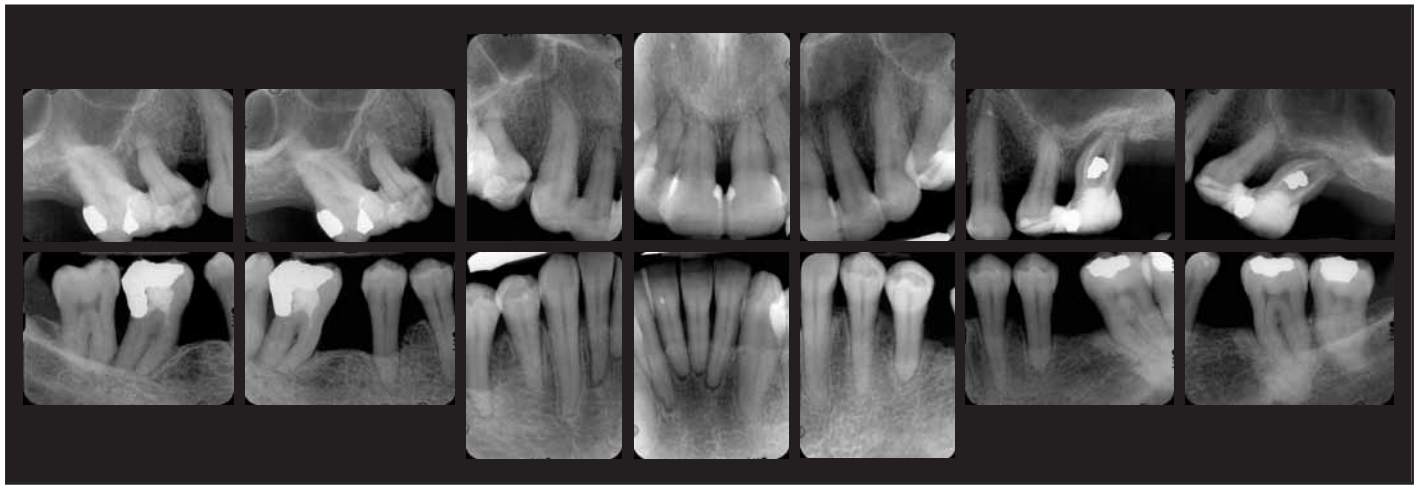

Fig. 8 Periapical radiographs taken at completion of treatment; note wide periodontal spaces in mandibular arch from recent orthodontic movements, along with well-preserved maxillary alveolar bone.

Fig. 9 Patient 20 months after treatment; note stability of orthodontic correction, along with composite fixations and stains from smoking.

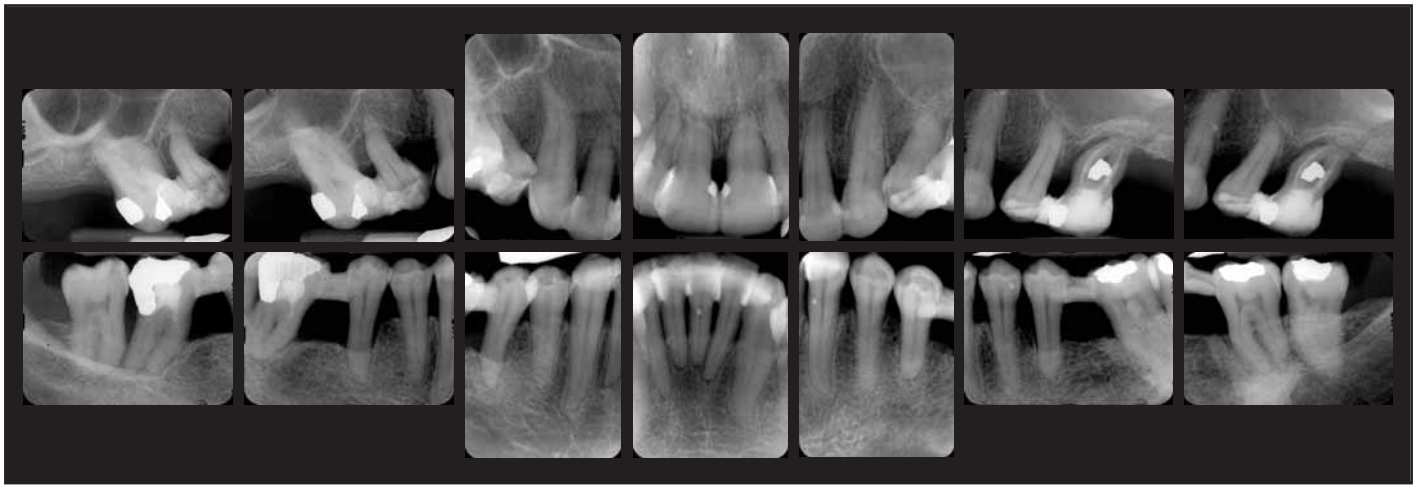

Fig. 10 Periapical radiographs taken 20 months after treatment; note preservation of alveolar bone and enhancement of lamina dura.

In the case shown above, thanks to proper periodontal advice and support, it was possible to attain a functional occlusion and good esthetics. As miniscrew materials improve, as self-drilling screws make insertion less invasive, and as orthodontists become more familiar with these procedures, the spectrum of cases in which skeletal anchorage allows orthodontic treatment to be performed will continue to expand.

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