



# Orthodontic Care of the Periodontally Compromised Patient Followed Long-Term: Part II. Evaluation of Unfavorable Outcomes

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**Aim:** To evaluate why some patients with advanced periodontal disease following initial periodontal and orthodontic treatment, when followed long-term, may continue to show bone loss. **Method:** Two cases, followed 21 and 25 years, are described. **Results:** The first patient's periodontium deteriorated because of failure to continue her periodontal maintenance program long-term. The periodontium of the second patient deteriorated despite excellence in home care and periodontal recall visits. She was considered refractory to treatment. In both cases, however, orthodontic treatment was considered helpful because it created favorable esthetic and functional alignment of teeth and allowed critical prosthetic reconstructions. **Conclusion:** Although bone loss occurred, orthodontic treatment was beneficial and contributed to the interdisciplinary treatment of these patients. *World J Orthod* 2001;2:244–252.

In part I, three periodontally compromised patients with favorable long-term outcomes following orthodontic treatment were described.<sup>1</sup> This is the usual outcome in patients under periodontal supervision, who are compliant with follow-up professional visits and home care, when orthodontic treatment is part of their rehabilitative program.<sup>2–5</sup> However, there are patients who fulfill the preceding criteria but continue to lose bone and may require extractions. There are also patients who have successful results short-term but falter in their periodontal maintenance long-term. Finally, for patients with less than favorable outcomes, the question arises whether orthodontic treatment is beneficial, or if it compounds the problems associated with periodontal disease.

To explore these issues, this article discusses two patients with long-term periodontal complications, with loss of bone support and extraction of teeth. The periodontal protocol and the measures for root resorption and bone loss were described in part I.<sup>1</sup>

## CASE 1

The patient was a Caucasian female, 53 years of age, with a severe Class II deep bite and an 8.5-mm overjet (Figs 1e to 1g and Fig 1j). There were spaces between teeth 11 and 12 and teeth 41 and 31.\* The mandibular right posterior teeth were lingual to their maxillary counterparts; that is, the maxillary teeth were in buccal crossbite (Fig 1e). Functional occlusion was limited to the premolars and first molars on the left side (Fig 1g). The mandibular incisors impinged on the palatal tissue lingual to the maxillary incisors. Cephalometric radiographs revealed maxillary dental protrusion, mandibular retrusion, and short lower face height (Fig 1j).

The maxillary incisors had advanced levels of bone loss—between 5 and 7 mm—and the mandibular

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incisors had between 3 and 5 mm of bone loss (Fig 1q). There were deep pockets of 5 to 7 mm, associated with the bone loss, around the maxillary incisors. The posterior teeth also had bone loss, generally between 3 and 5 mm. The periodontist and dentist referred the patient for orthodontic correction of the buccal crossbite. They feared that if the patient lost her maxillary incisors, reconstruction would be compromised by the unilateral malocclusion. The primary concern of the patient was the spacing and elongation of the maxillary incisors, which had increased in recent years.

Elimination of the deep pockets around the maxillary incisors would have exposed excessive root length, and this was esthetically unacceptable. Incisor maintenance depended upon periodic deep scaling by the periodontist.

Orthognathic surgery was recommended to correct the Class II sagittal relationship and the maxillary buccal crossbite. The patient, however, rejected orthognathic surgery and continued to seek orthodontic correction. After 2 years of hesitancy by the orthodontist—who hoped the patient would agree to orthognathic surgery—orthodontic treatment was started on a nonsurgical basis. Periodontal maintenance during this time was good. The maxillary buccal crossbite was corrected by considerable crown reduction of all posterior teeth on that side, since these teeth had erupted beyond the occlusal plane (Figs 1h and 1i). Teeth 15 to 17 were endodontically treated to expedite crown reduction. An anterior bite plate was used with cross elastics. Upon correction of the maxillary buccal crossbite of the right side, the left was noted to have an open bite. This was corrected by guided eruption with vertical elastics.

The overjet was only partially corrected (Fig 1j), as premolar extraction was contraindicated and the patient was satisfied with her profile (Fig 1c). The deep bite was somewhat reduced by the opening rotation of the mandible, associated with correction of the maxillary buccal crossbite (Fig 1j). The maxillary and mandibular incisors were moderately shortened and the maxillary incisors were also reduced in width. The pretreatment spacing and the width reduction of the maxillary incisors provided room for a moderate reduction in the overjet of 3 mm. Treatment time was 10 months. The maxillary arch was retained by cutting lingual grooves from teeth 13 through 23 and bonding a 0.030-inch wire into the grooves. The lower wire was bonded from teeth 42 through 33, without

cutting grooves. A full-coverage maxillary occlusal splint, to be worn at night, was prescribed.

Evaluation of posttreatment records revealed a downward and backward mandibular rotation of 4 degrees, with a corresponding 4-mm increase in face height (Fig 1j). The new mandibular position did not initiate temporomandibular joint problems. The maxillary incisors were retracted by rotation at their apex. There was no further loss of marginal bone during treatment; generally, bone heights appeared to have improved (Fig 1r). Root resorption was not apparent. Despite the gross undertreatment of the overjet, the patient was happy with the esthetic improvement (Figs 1c and 1d; Figs 1k to 1m).

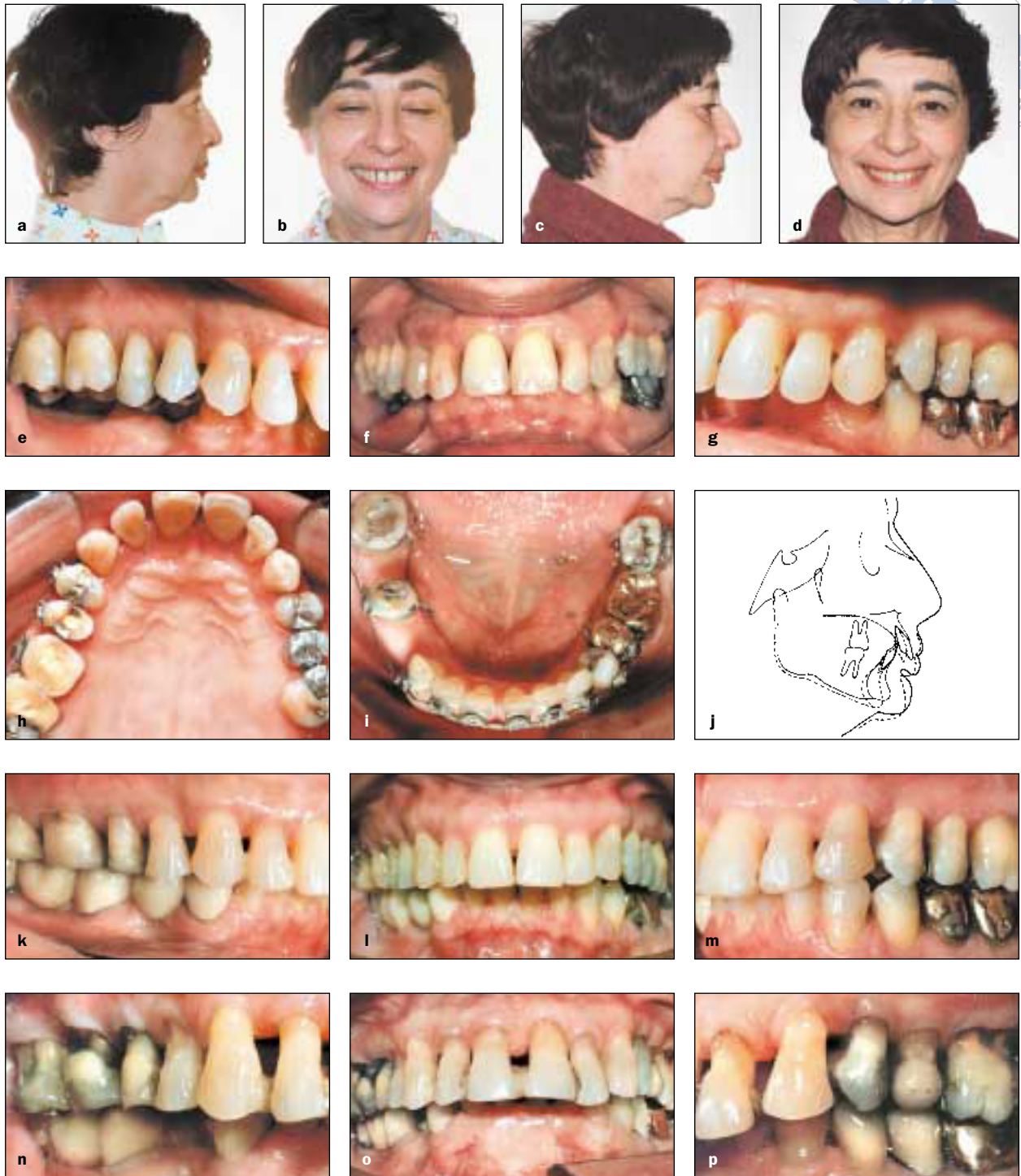
The periodontium was stable for the first 10 years after orthodontic treatment. Since that time, the patient has been inconsistent with periodontal maintenance visits because of personal life events; as a consequence, she has slowly lost periodontal support. Long-term, at age 75, 21 years after completion of orthodontic treatment, there has been 2 to 4 mm of further bone loss around the maxillary incisors (Fig 1s). The mandibular lateral incisors have lost between 1.5 and 2 mm of bone support. The maxillary canines and the right first premolar have also lost between 1.5 and 2 mm of bone. The molar bone heights have been stable.

The maxillary incisors have proclined about 1.5 mm, due to failure of the bonded wire splint without timely repair and failure to wear the bruxism splint. These incisors were unsightly due to excessive root exposure (Figs 1n to 1p). Her dentist had suggested—dating back 10 years—extraction of the maxillary incisors and their prosthetic replacement. The patient has finally agreed to this procedure. Figures 1t to 1y demonstrate the favorable functional and esthetic results of a maxillary reconstruction using teeth 13 to 17 and 23 to 25 as abutments.

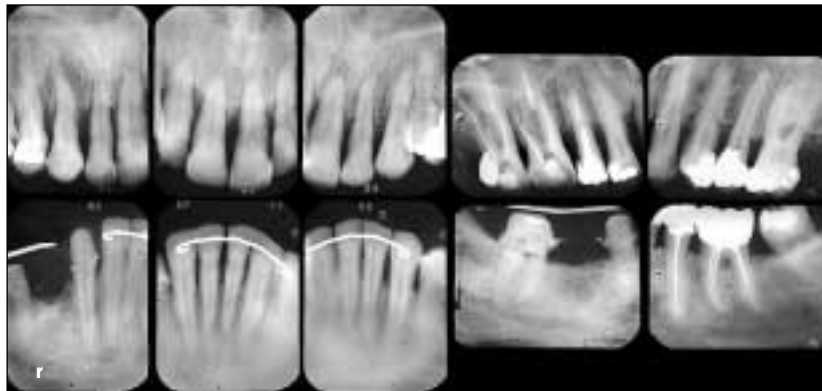
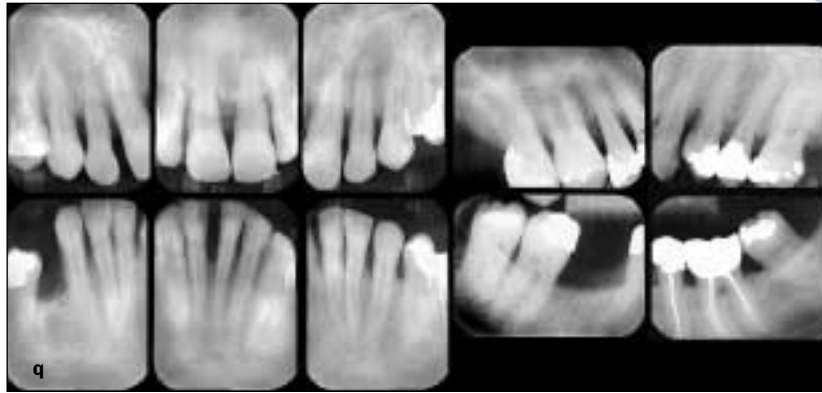
## CASE 2

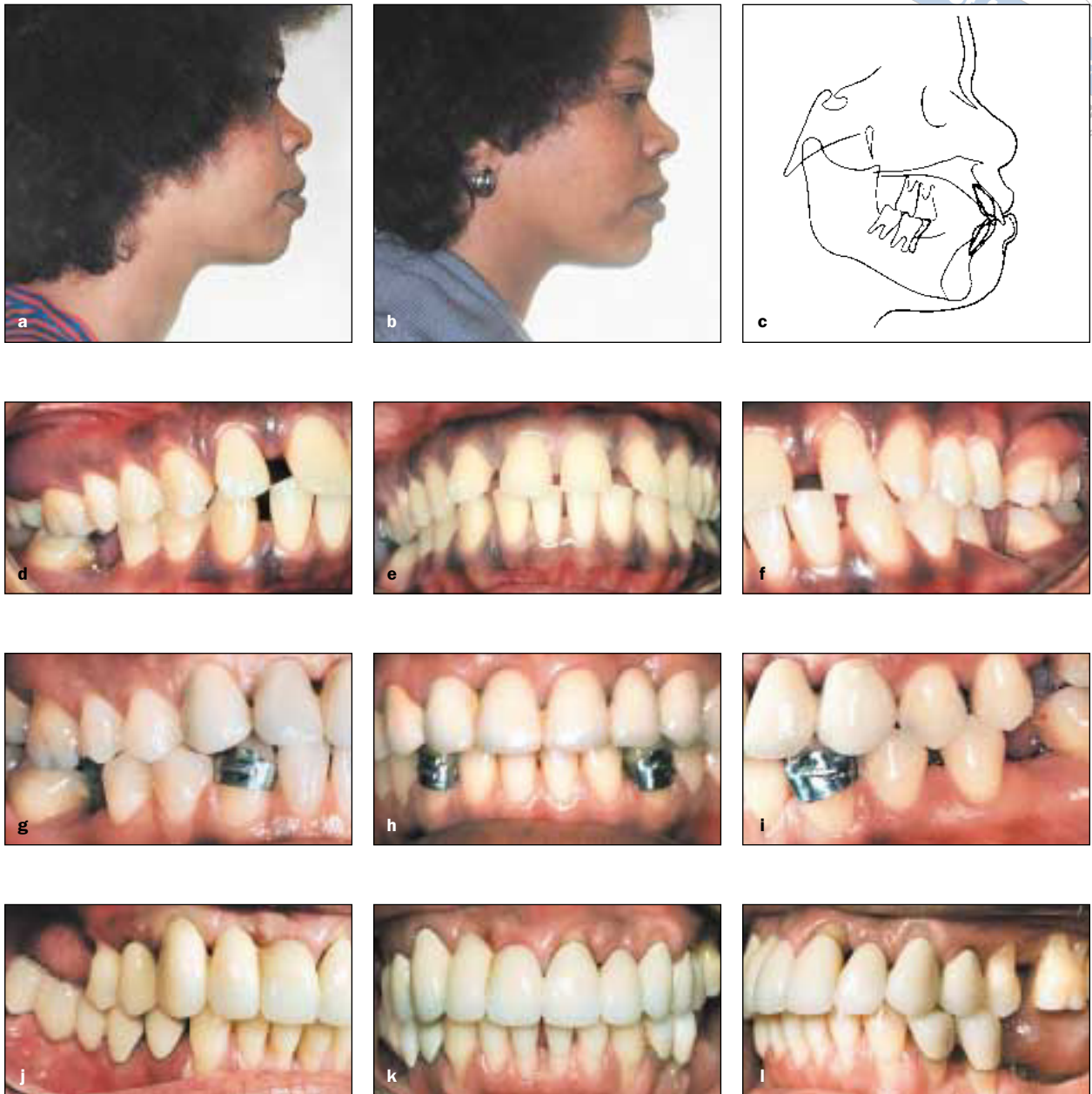
The patient was an African-American woman, 23 years of age, who was referred for orthodontic consultation because of flaring and large spaces between the incisors, most prominently in the maxillary arch (Figs 2d to 2f). The patient reported that some spacing was always present, but it had markedly increased in recent years and correction was desired. Bone loss was advanced, but localized to specific areas: vertical lesions mesial of teeth 11, 12, and 22, a crater-like lesion on tooth 36, and a vertical defect mesial to tooth 37 and between teeth 16 and 17 (Fig 2m). Prior to orthodontic treatment, tooth 36 was extracted. Maintenance of teeth 11

\*The international tooth numbering system is used. 1 = maxillary right; 2 = maxillary left; 3 = mandibular left; and 4 = mandibular right, followed by 1–8 for position from midline.

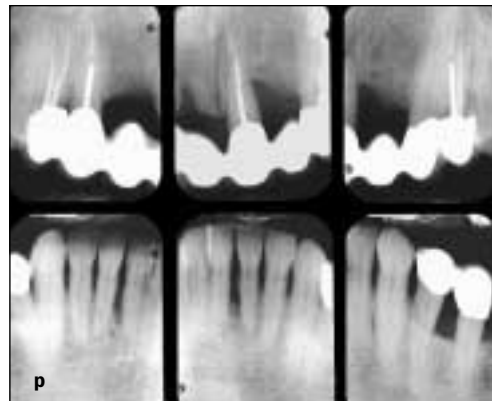
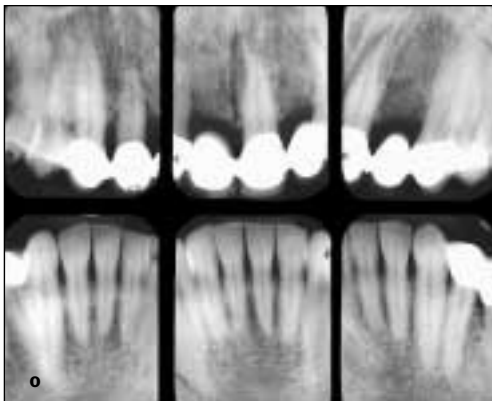
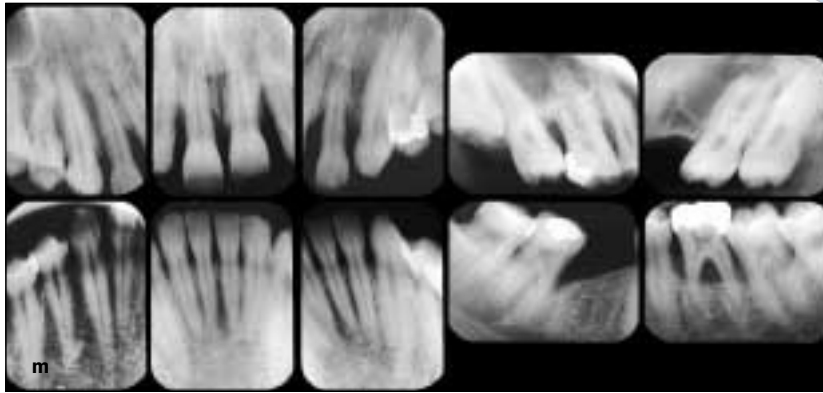
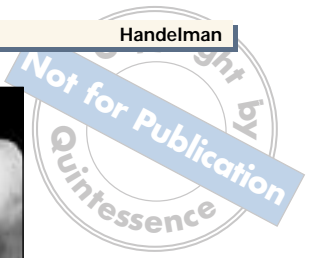


**Fig 1** Case 1. **(a,b)** Pretreatment photographs. **(c,d)** Posttreatment photographs, with improved esthetics of the smile. **(e to g)** Pretreatment intraoral views. Note the buccal crossbite of the maxillary teeth on the patient's right side. **(h,i)** Occlusal view at the start of treatment. The crowns of teeth 15 to 17 have been reduced and root-filled. **(j)** Cephalometric tracing. Note retraction of the maxillary incisors and downward rotation of the mandible following orthodontic treatment (*dotted line*). **(k to m)** Posttreatment. Note correction of the buccal crossbite. **(n to p)** Long-term (21 years) views. There has been periodontal breakdown of the maxillary incisors, but the correction of the posterior occlusion is stable. **(q)** (*facing page*) Pretreatment radiographs. Note advanced bone loss around the maxillary incisors. **(r)** Posttreatment radiographs. There was no bone loss during 10 months of orthodontic treatment. **(s)** Long-term radiographs (21 years). There has been bone loss due to failure to adhere to periodontal maintenance program. **(t to y)** Long-term (21 years). Following removal of maxillary incisors and a maxillary reconstruction, improved facial and dental esthetics have been achieved.





**Fig 2** Case 2. **(a)** Pretreatment photograph. **(b)** Posttreatment photograph. Note improved profile. **(c)** Cephalometric tracing showing posttreatment reduction in the bidental protrusion (*dotted line*). **(d to f)** Pretreatment intraoral views showing spacing between the incisors. **(g to i)** Posttreatment views showing maxillary reconstruction following extraction of teeth 11 and 22. **(j to l)** Long-term (25 years). A new maxillary reconstruction was necessary because of the loss of tooth 12. There has also been further loss of several posterior teeth. **(m)** (*facing page*) Pretreatment intraoral radiographs. Vertical bone loss is evident on the mesial surface of teeth 11 and 22 as well as a crater-like lesion around tooth 36 and bone loss on teeth 37, 26, and 27. **(n)** Posttreatment radiographs. There has been further loss of bone at the vertical defects of teeth 11 and 22. These teeth were extracted prior to dental reconstruction. The bone levels of tooth 21 were stable despite the periodontal pathology of the adjacent incisors. **(o)** Twelve years posttreatment. The bone levels of the anterior teeth were stable. **(p,q)** Long-term (25 years). Bone loss is seen for most teeth. Teeth 12, 16, 17, 37, and 47 have been extracted in this patient, who is refractory to periodontal treatment.



and 22 was doubtful and teeth 16, 17, 37, and 47 were questionable because of severe vertical defects associated with deep pockets. The patient's nocturnal parafunctional activity accentuated the mobility of the maxillary anterior teeth and mandibular second molars. The periodontal prognosis was unfavorable because of the advanced bone loss in a young adult, associated with minimal plaque, vertical defects, and occlusal trauma. The dentist and periodontist recommended orthodontic treatment because the expected loss of teeth 11 and 22 would necessitate their prosthetic replacement. Reduction of the protrusion and elimination of the spacing would allow esthetic reconstruction.

Fixed appliances in the form of bands were placed from second molar to second molar, as bonding was not available at the time. The arches were leveled, and the spaces between the incisors were closed. The incisors were then retracted on 0.016 × 0.022-inch two-loop archwires, with the center of rotation near the apex.

There were six periodontal maintenance visits during the 20 months of orthodontic treatment. This was one of the first patients with periodontal disease treated by the author; if treated today, the treatment time would be considerably shorter. At the termination of treatment, the vertical defects around teeth 11 and 22 had increased so that these teeth were judged nonmaintainable (Fig 2n) and were extracted. Bone was also lost around the mandibular second molars. With the exception of the sites just noted, the remaining dentition did not lose bone during the 20 months of orthodontic treatment. Blunting of the incisor apices was noted following treatment.

Permanent retention of the maxillary arch, as well as replacement of the two extracted maxillary incisors, was provided by a fixed full-coverage porcelain-on-gold reconstruction from teeth 13 to 23 (Figs 2g to 2i). In the mandibular arch, a fixed canine-to-canine retainer was worn for 5 years and then discontinued. A maxillary nightguard has been worn since completion of orthodontic treatment. The occlusion has been stable for 25 years (Figs 2j to 2l).

The patient has continued her periodontal recall visits at 3-month intervals and has maintained a high level of home care. The notes of the periodontist indicate excellent hygiene and the absence of obvious plaque. Following orthodontic treatment, the molars developed active sites of disease and bone loss. For the first 12 years following the completion of orthodontic treatment, the abutment teeth of the maxillary reconstruction and the mandibular incisors maintained their bone levels (Fig 2o). In the last 13

years, however, the patient has had repeated exacerbations of acute inflammation followed by bone loss. These unfavorable sequelae occurred, for example, with teeth 12, 16, 17, 37, and 47 (Figs 2p and 2q). These teeth were lost despite surgical procedures to control the disease. The patient has also continued to lose bone on most of the remaining teeth. A new maxillary reconstruction from tooth 14 to 24 was placed 2 years ago, and the patient now essentially has a premolar occlusion (Figs 2j to 2l).

## DISCUSSION

### *The periodontium at posttreatment*

Root resorption was an insignificant factor in these two cases. In general, the patients preserved their bone levels following orthodontic treatment. The patient in case 2 lost two teeth after orthodontic treatment, but these teeth had poor prognoses prior to treatment.

Compromised and even hopeless teeth are often maintained during the orthodontic phase of treatment for the following reasons:

1. Prediction of active disease recurrence at a specific site cannot be made with certainty using clinical parameters.<sup>6</sup> Many of these teeth stabilize; that is, they lose no further bone and can be maintained for many years.
2. Maintaining a compromised tooth is usually easier than replacing it with a pontic tooth or using a removable retainer with a denture tooth.
3. Retained compromised teeth, when periodontally treated, usually do not cause bone recession on contiguous teeth.<sup>7,8</sup>

Nevertheless, bone levels around doubtful and hopeless teeth that are maintained during orthodontic treatment for the above reasons frequently deteriorate because pocket depth, vertical defects, furcation involvement, or root anatomy make thorough professional cleaning virtually impossible. The pathogenic bacteria that remain behind after scaling and root planing quickly recolonize in the depth of the pocket.<sup>9</sup> It is imperative to clearly inform the patient of the possible loss of questionable teeth.

### *The periodontium long-term*

The long-term fate of the periodontium for most periodontally compromised patients who receive periodontal and orthodontic treatment is generally

favorable.<sup>1</sup> This is because the etiology of periodontal disease is dependent, in most instances, upon plaque formation, which is ameliorated by home care and professional treatment. Elimination of occlusal trauma, when present, is also important for long-term periodontal maintenance.

The two patients in this report lost periodontal support long-term, but for different reasons. The loss of periodontal support in case 1 was due to a failure to adhere to 3-month maintenance visits on a long-term basis. Case 2 has proven refractory to treatment, despite the best efforts by the periodontist and the patient.

### ***Why periodontal treatment fails***

Periodontal treatment has been shown to be ineffective in maintaining periodontal health unless supportive maintenance care is continued.<sup>10,11</sup> This is especially true for deep pockets (greater than 5 mm), as home care procedures are unlikely to reach the depth of the pocket (case 1, the maxillary incisors).

A small number of periodontal patients do not respond to plaque-removal programs and are considered "refractory" to treatment.<sup>12,13</sup> The percentage of patients with destructive periodontal diseases who are refractory to conventional treatment is difficult to determine, but estimates of 4% to 8% have been recorded.<sup>14,15</sup> Smokers are more likely to be refractory to treatment and have poor outcomes following a variety of periodontal therapies.<sup>16</sup> It has been proposed that patients with less observable plaque and inflammation but with advanced destructive disease are paradoxically at greater risk, presumably because of increased virulence of the bacteria, greater host susceptibility, or a combination of the two.<sup>17</sup>

Case 2 is an example of a patient who is refractory to treatment. She has maintained what would appear to be an environment with little observable plaque and has been consistent with her professional visits, yet her periodontium has deteriorated. Site-specific exacerbations of her disease over a period of 24 years have not responded to intense therapy and many teeth have been lost. Even in her case, the progress of the disease would have been more rapid—perhaps with the loss of her dentition—without the intervention of periodontal treatment.

### ***The benefits of orthodontic treatment***

Orthodontic treatment was beneficial even for the two patients with unfavorable periodontal outcomes.

In case 1, the reason for orthodontic treatment was the unilateral occlusion due to buccal crossbite. The maxillary incisors had advanced periodontal involvement from the start. Their loss 21 years later is not surprising, especially in light of the patient's discontinuance of periodontal care later in life. However, the orthodontic correction of the posterior occlusion allowed for a favorable reconstruction at age 74. She is now cooperating with her periodontal maintenance program.

Case 2 has deteriorated long-term. She has been consistent with home care and professional visits but has proven refractory to treatment. However, orthodontic treatment laid the groundwork for reconstruction of her maxillary teeth at age 25 and again at age 46. The psychological and professional benefits of maintaining her own teeth, which are esthetically pleasing, should not be underestimated. The orthodontic and prosthetic correction of her protrusive and spaced incisors, one may assume, has encouraged her to continue periodontal treatment for 25 years, despite the frustrations of bone and tooth loss. Without ongoing periodontal treatment, her natural dentition would have undoubtedly been lost.

As the results of these cases are analyzed, we must ask: Is there any hope for a bone-supported occlusion (as opposed to removable dentures) in patients who have lost most of their dentition as a result of refractory periodontal disease? Apparently there is hope, as osseointegrated implants have been successfully maintained in patients recalcitrant to periodontal treatment.<sup>18</sup>

## **CONCLUSION**

Two patients are presented to illustrate the nature of unfavorable sequelae. Prior to orthodontic treatment, individual teeth may be defined as compromised or hopeless due to advanced bone loss, vertical lesions, furcation involvement, etc, which complicates treatment because of the difficulty in removing adherent plaque at the depth of the pocket. The questionable periodontal status of these teeth is defined prior to treatment. Further bone loss around these teeth is likely.

Patients who do not adhere to ongoing periodontal care programs can expect their disease to reactivate with ensuing bone and tooth loss. Patients who continue to lose bone support despite rigorous home and professional care are rare and are defined as refractory to treatment. However, orthodontic-periodontic treatment may still extend the life of their dentition.



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