Reconstruction of a collapsed dental arch in a patient with severe periodontitis

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This case report describes the significance of orthodontic treatment in reconstruction of a collapsed dental arch and a malocclusion associated with severe periodontitis. A Japanese man (age, 40 years 7 months) had an anterior crossbite, a collapsed occlusion, and severe periodontitis. Orthodontic treatment included the following steps: (1) correction of the anterior crossbite, labial movement of the maxillary incisors, and intrusion and retraction of the mandibular incisors; (2) correction of the posterior crossbite on the left side, buccal movement of the maxillary left canine and first premolars, and intrusion and retraction of the mandibular first premolar into the space of the mandibular left canine; (3) correction of the crowding of the mandibular right buccal segment and alignment of the teeth after extraction of the mandibular right first molar with a periapical lesion; and (4) improvement of the occlusion, with reconstruction of an acceptable occlusion. When combined with restorative and prosthetic treatment, a fairly good occlusion was obtained. Reevaluation of the treatment after 11 years showed that the occlusion and periodontal condition were maintained well without deepening of the pockets and further bone loss. Orthodontic treatment with a systematic approach helped to recover the occlusion and prevented the recurrence of periodontitis by acquiring a good oral environment and motivating the patient to maintain oral health. (Am J Orthod Dentofacial Orthop 2013;143:704-12)

In advanced periodontal disease, collapse of the dental arch often occurs with increased tooth mobility.1,2 The situation worsens if there is an anterior crossbite. The traumatic occlusion could cause further breakdown of the periodontium as toothbrushing and maintaining oral hygiene become difficult.3 Consequently, the situation further exacerbates the periodontal destruction. The loss of teeth would lead to collapse of the occlusion and a reduced quality of life, because oral health is critical for food intake and communication. Reconstruction of the occlusion and alignment of the malposed teeth with orthodontic treatment become necessary not only to prevent disease progression, but also to satisfy patients’ functional, esthetic, and communication demands. This case report describes the favorable and stable outcome of a multidisciplinary approach involving orthodontic and periodontal management for treating a patient with advanced periodontitis, severe tooth mobility, anterior crossbite, and collapse of the occlusion.

DIAGNOSIS AND ETIOLOGY

A Japanese man (age, 40 years 7 months) was referred by a periodontist (K.G.) to our clinic at Tsurumi University in Yokohama, Japan, to discuss the possibility of orthodontic treatment. His chief complaints were an anterior crossbite and a collapsed occlusion. The patient reported that he had periodontal inflammation at an early age; it gradually caused collapse of his occlusion. On his first visit to the periodontist, the clinical examination showed that the pocket depth was 15 mm on the maxillary right central and lateral incisors, and most of the pocket depths of the other teeth exceeded 5 or 6 mm. The apical area of the mandibular left canine was exposed to the oral cavity, indicating the severity of his periodontitis (Figs 1 and 2). Before the orthodontic examination, the patient received periodontal treatment aiming at complete exclusion of the infection source and reduction of deep periodontal pockets to a depth of less than 3 mm.

At the time of the orthodontic evaluation, the periodontal condition had improved considerably, and there were no signs of gingival inflammation. The periodontal
examination showed that most of the pocket depths were within 3 mm (Fig 2), which indicated that the periodontal condition was favorable for orthodontic treatment. The periodontal condition was routinely monitored by a periodontist.

The patient had a concave profile (Fig 3). The dental examination showed an anterior crossbite with an overjet of 2.0 mm and an overbite of 1.5 mm (Fig 4). The anterior teeth had severe mobility because of the loss of supporting tissues, which made mastication difficult in the anterior segment. The posterior segment showed an Angle Class III molar relationship and a crossbite between the maxillary left canine and premolar, and the mandibular first premolar. There was spacing in the maxillary arch. In the mandibular arch, the left canine had been extracted because of periodontitis, and there was moderate crowding in the mandibular right buccal segment. Severe gingival recession was observed, especially in the anterior teeth with severe tooth mobility.

**Fig 1.** Intraoral photographs before periodontal treatment.

**Fig 2.** Pocket depth charts.
Fig 3. Pretreatment facial and intraoral photographs.

Fig 4. Pretreatment dental casts.
The radiographic examination showed severe alveolar bone loss in the maxillary and mandibular anterior regions. The mandibular anterior teeth and the maxillary lateral incisors on both sides showed alveolar bone losses of 80% to 90% (Fig 5). There were periapical lesions in relation to the mandibular right first molar (hemi-sectioned) and the right canine, and periodontal space widening at the maxillary right and left lateral incisors. Lateral cephalometric analysis showed the following values: ANB angle, 0.9°; FMA, 39.9°; U1-SN, 111.0°; and L1-Mp, 72.2°. Based on the above findings, the patient was diagnosed as having a skeletal Class III malocclusion associated with severe periodontitis.

**TREATMENT OBJECTIVES**

The treatment plan involved an approach to manage both the periodontitis and the malocclusion. The following objectives were established: (1) correct the crossbites in the anterior segment and the left buccal segment, (2) correct the crowding of the teeth, (3) close the spaces, and (4) improve the collapsed occlusion.

**TREATMENT ALTERNATIVES**

Both the orthodontic and the prosthodontic treatment options were presented to the patient. The orthodontic treatment plan was to correct the crossbites and align the teeth after extraction of the mandibular right first

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*Fig 5. Pretreatment radiographs.*
molar to reconstruct an acceptable occlusion. Managing the spaces in both arches in patients with severe periodontitis is difficult, because excessive tooth movement must be avoided to prevent further loss of supporting tissue. In these cases, restorative or prosthodontic treatment might be necessary to fill the spaces and establish continuity of the arches. The prosthodontic option for treatment in our patient would have been extraction of the teeth with severe bone loss, such as the maxillary and mandibular anterior teeth, and restoration of the occlusion with partial dentures.

**Fig 6.** Progress intraoral photographs at initial stage of treatment.

**Fig 7.** Progress intraoral photographs at late stage.

**TREATMENT PLAN**

The patient selected the orthodontic treatment plan because he was unwilling to have more extractions. Orthodontic treatment was aimed at (1) correction of the anterior crossbite, labial movement of the maxillary incisors, and intrusion and retraction of the mandibular incisors; (2) correction of the crossbite on the left side, buccal movement of the maxillary left canine and first premolar, and intrusion and retraction of mandibular left first molar, using the space of the mandibular left canine; (3) correction of the crowding and alignment
Fig 8. Facial and intraoral photographs after restorative treatment.

Fig 9. Pocket depth charts at posttreatment and 11 years after treatment.
of the teeth after extraction of the mandibular right first molar with the periapical lesion; and (4) improvement of the collapsed occlusion and reconstruction of an acceptable occlusion.

**TREATMENT PROGRESS**

The orthodontic treatment started with alignment of the 3 mandibular incisors by using a partial multibracket system. Lingual arch appliances were placed in the maxillary and mandibular arches (Fig 6). The main wire of the mandibular lingual arch was located 2 mm from the lingual cusps of the mandibular incisors. The maxillary incisors were moved labially with light continuous forces from a double spring. The mandibular incisors were intruded and retracted with light continuous forces from elastic thread ligated to the lingual arch appliance to correct the crossbite without interference between the maxillary and mandibular incisors. Then orthodontic brackets were placed on the other teeth, and partial alignment and space closure were performed with segmented archwires. This would prevent interferences and overloading on the teeth during initial leveling, so that further loss of the supporting bone could be avoided. After partial alignment of the teeth, full alignment was initiated to correct the crowding to reconstruct an acceptable occlusion. The crowding in the mandibular right posterior segments was improved by using the mandibular first molar space, and the buccally inclined first premolar was aligned into the space of the mandibular canine (Fig 7).

Orthodontic treatment was completed at the age of 42 years 8 months, and fixed retainers were used in both arches. Restorative and prosthetic treatments were performed to manage the spaces between the maxillary right canine and first premolar, and also the mandibular second premolar and second molar (Fig 8). The duration of active orthodontic treatment was 1 year 8 months.

**TREATMENT RESULTS**

The posttreatment facial and intraoral photographs (Fig 8) show continuous dental arches. Overjet and overbite were normal, but the mandibular midline was deviated to the right to compensate for the extracted canine. The lateral view showed Class III molar relationships on both sides, and the intercuspation was slightly unstable on the left, compared with that on the right side.

The periodontal conditions of all teeth remained unchanged with pocket depths of 1 to 3 mm when measured by the same periodontist (Fig 9). The superimposition of the lateral cephalometric images showed labial inclination of the maxillary incisors (U1-SN, 118.0°).
and lingual inclination of the mandibular incisors (L1-Mp, 65.0°) with adequate overjet and overbite. The height of the alveolar bone seemed to be unchanged except for the maxillary lateral incisors, around which the bone level had improved with narrowing of the periodontal space, on the radiographic examination (Figs 10 and 11).

Eleven years had passed since completion of orthodontic treatment. The patient was under observation, with periodontal maintenance every 3 to 6 months during that time. The fixed retainers were still stable, and he had maintained good periodontal, dental arch, and occlusal conditions (Fig 12). No teeth had been lost during these 11 years. The pocket depths were maintained within 3 mm (Fig 9), and the periapical radiographs showed no progression of alveolar bone loss (Fig 13).

**DISCUSSION**

There are several concerns when treating patients with periodontitis. A few reports have suggested that orthodontic force can have negative effects such as loss of attachment and further bone destruction when there is periodontal inflammation. An experimental study also showed that orthodontic tooth movement caused noninfectious inflammation in the pressure zone of the periodontal ligament, including degradation of the degenerating tissues and repair of the periodontal ligaments. Regeneration of the periodontal ligament does not occur in inflamed tissues, and the degenerated tissues on the pressure side of tooth movement had little defense to bacterial infection. On the other hand, a force acting on the tooth causes no further breakdown in the absence of inflammation. Therefore, it is essential to
eliminate inflammation of the periodontal tissues before orthodontic treatment. In this patient, intensive care was
taken to maintain the periodontal health with no inflammation before the orthodontic treatment so that the tis-
se response could be the same as that in a normal periodontium free from infection.

Light orthodontic force was applied during the treat-
ment. Especially, a light intruding force was applied to the mandibular anterior teeth for correction of the cross-
bite to prevent interference and damage to the supporting bone. Consequently, further reduction of the tooth-
supporting tissues did not occur in this patient. Careful
consideration of the application of force to each tooth is
critical in the movement of teeth with severe bone loss.11

Patients with periodontitis require a stable dental arch and occlusion to enable function. Orthodontic

treatment of this patient with severe periodontitis helped in tooth retention and improved oral hygiene. Proper
alignment of crowded or malposed teeth and flattening of the occlusal plane would enable better cleaning of all
tooth surfaces and eliminate any interferences; this is es-

tential for controlling periodontal inflammation and would also improve esthetics.12

This approach made it possible to maintain the occlusal function for over 10 years by recovering the contin-

tuity of the arch and the occlusal balance, and by connecting the teeth with a fixed retainer, even though these teeth were to be extracted because of severe bone loss. This long-term stability is due not only to the im-
provement of periodontal health and occlusion, but also to the patient’s high motivation to maintain oral hy-
giene. The fixed retainers in both arches prevented re-
lapse and supported the teeth against the masticatory
forces; this might also explain the long-term stability.

Orthodontic treatment aiming for a sustainable oc-
clusion also contributed to the oral health in our patient. He was satisfied with the successful esthetic and func-
tional improvements, which motivated him to pay care-
ful attention to his oral hygiene. The patient’s high
motivation was a tremendous advantage in the mainte-
nance of good oral conditions, and it also enabled ortho-
dontic and periodontal posttreatment management at regular intervals. This helped to retain the same good
conditions during the long observation period. Ortho-
dontic treatment is a potential treatment option after

periodontal treatment instead of other modalities such as temporary or permanent fixed appliances and pros-
sthodontic treatment.

CONCLUSIONS

Orthodontic treatment with a systematic approach helps to prevent the recurrence of periodontitis not
only by obtaining a good oral environment, but also by motivating the patient to maintain good oral health
for a long time. It also improves the patient’s esthetics and quality of life.

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