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Isolated Vertical Infrabony Defects Treated by Orthodontic Tooth Extrusion

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ABSTRACT

It has been reported that periodontal disease and traumatic occlusion may cause an isolated vertical infrabony defect. In such cases, the improvement of both inflammation and the occlusion are necessary to ameliorate the defect. We discuss the successful orthodontic treatment of an adult patient with isolated vertical infrabony defects of the maxillary right lateral incisor, left canine, and mandibular left incisor regions. The patient showed an anterior crossbite and one- and two-wall wide isolated vertical infrabony defects. The inflammation was improved by a periodontist; however, the vertical infrabony defects remained. In order to improve the defects, the pulps of the maxillary right lateral incisor, left canine, and mandibular left incisor were extirpated, and temporary crowns were put on those teeth. Next, an edgewise appliance was applied to the maxillary and mandibular teeth. After the anterior crossbite was improved, the incisor edge regions of the temporary crowns were ground, and the maxillary right lateral incisor, left canine, and mandibular left incisor were extruded until they touched antagonistic teeth. The patient's anterior crossbite, traumatic occlusion and gingival esthetics were improved by this treatment. Panoramic and dental radiographs after treatment also showed improvement of the vertical infrabony defects. Thus, tooth extrusion might be effective to improve one- and two-wall wide isolated vertical infrabony defects.

KEY WORDS: Traumatic occlusion, Extrusion, Vertical infrabony defect, Orthodontic treatment.

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INTRODUCTION Return to TOC

Periodontal considerations are important in the orthodontic treatment of adult patients because many patients who are 35 or more years of age have periodontal problems that may affect orthodontic treatment.[1] Infrabony defects following periodontal disease lead to numerous problems such as an increase in the periodontal pocket, gingival recession, tooth hypermobility, and/or deterioration of the clinical crown-root ratio. Isolated vertical infrabony defects of the anterior tooth region often cause both functional and esthetic problems.[2]

It has been reported that isolated vertical infrabony defects may arise due to traumatic occlusion[3] and infection of the periodontal tissue of the associated tooth.[4] If the patient has active periodontitis, the traumatic occlusion may prevent bone apposition by periodontal treatment.[5] Therefore, it is necessary to improve both inflammation and occlusion to treat such patients.

It is known that vertical infrabony defects can be improved through the use of periodontal techniques such as guided tissue regeneration (GTR).[6] However, it has been reported that a one-wall vertical infrabony defect is a contraindication to GTR and that the prognosis after GTR is poor in the case of wide defects.[5] On the other hand, orthodontic tooth movement is known to increase connective tissue attachment and alveolar bone height.[7–11] Therefore, in such cases, orthodontic treatment is recommended to improve both occlusion and the infrabony defect.

The present article discusses the successful orthodontic-periodontal treatment of a 50-year-old Japanese woman with anterior crossbite and isolated vertical infrabony defects.

CASE REPORT Return to TOC

Case Summary

The patient was a 50-year-old woman with a chief complaint of esthetic problems of the anterior teeth. Her medical history showed no allergies or medical problems. No signs or symptoms of temporomandibular disorders were noted. Before her first visit to our orthodontic clinic at University Hospital, the patient had been under the care of a periodontist for 2 years and 7 months to control inflammation and improve oral hygiene.

Pretreatment facial photographs show a retrogressive upper lip with competent lips and facial symmetry (Figure 1). The patient had an Angle Class I malocclusion with −2 mm of overjet and 2 mm of overbite (Figure 2A). Wide gingival recessions, deep periodontal pockets and tooth hypermobility were observed at the maxillary right lateral incisor, left canine, and mandibular left central incisor regions. Furthermore, gingival esthetic problems following gingival recession were also observed.

The maxillary and mandibular arches were irregularly aligned, with a 3.5-mm maxillary and 3.0-mm mandibular arch length discrepancy. The maxillary and mandibular left second molars were missing, and the patient had a full cast crown of the maxillary left first premolar. Additionally, there were occlusal interferences between the maxillary and mandibular central incisors on both sides and between the maxillary and mandibular right lateral incisor edges because the mandible was shifted anteriorly when the jaw was closed.

Lateral cephalometric analysis indicated a skeletal Class III relationship with an ANB angle of 1.3° and a McNamara line to point B of −0.5 mm, a low mandibular plane angle of

21.6°, and upright maxillary incisors with a maxillary central incisor to a Frankfort plane angle (FH-U1) of 107° (Table 1). Panoramic and dental radiographs before treatment showed isolated one- and two-wall vertical infrabony defects and the deterioration of the crown-root ratio at the maxillary right lateral incisor, left canine, and mandibular left incisor regions (Figures 3 and 4). Maxillary third molars were present on both sides.

The depth of the infrabony defects was measured on dental radiographs[12] before treatment, and the measurement values of the maxillary right lateral incisor, left canine, and mandibular left incisor regions were 3 mm, 5 mm, and 4 mm, respectively. These values were used as the amount of extrusion of the teeth.

Diagnosis

The patient was diagnosed with an Angle Class I malocclusion with a skeletal Class III, slightly low mandibular plane angle, isolated vertical infrabony defects, and occlusal interferences.

Treatment Objectives

The treatment objectives were to improve the anterior crossbite, the retrogressive upper lip, the vertical infrabony defects, the crown-root ratios, and the gingival esthetics of the maxillary right lateral incisor, left canine, and mandibular left incisor regions by the extrusion of these teeth.

Treatment Alternatives

Possible treatment alternatives included the correction of the traumatic occlusion by prosthetic treatment and occlusal adjustment, and the improvement of the vertical infrabony defects by regenerative periodontal techniques such as GTR.[6] However, because of the presence of one- and two-wall wide vertical alveolar bone defects, orthodontic treatment was required to improve all of the patient's problems.

Furthermore, it has been reported that both tooth intrusion and extrusion increase connective tissue attachment and alveolar bone height.[7–11] In the present case, inflammation was controlled and oral hygiene was improved by the 2-year periodontal treatment before orthodontic treatment. However, the alveolar bone form and the gingival esthetics of the maxillary right lateral incisor, left canine, and mandibular left incisor regions were not sufficiently improved. Therefore, the extrusion of those teeth was performed to solve those problems.

Treatment Progress

The patient was treated by a periodontist for 2 years and 7 months until her inflammation was controlled and her oral hygiene improved. Next, the pulps of the maxillary right lateral incisor, left canine, and mandibular left incisor were extirpated, and temporary crowns were put on those teeth. When the temporary crowns were produced, they were labeled with red acrylic resin to identify them as landmarks to extrude the teeth (Figure 5).

After setting the temporary crowns, we began to level and align the teeth with a preadjusted edgewise appliance (0.018 × 0.025 inch). After the anterior crossbite was improved (Figure 2B), the incisor edge regions of the temporary crowns were ground to the height of the labels. The maxillary right lateral incisor, left canine, and mandibular left incisor were extruded until they touched antagonistic teeth. The preadjusted edgewise appliance was then removed. The total active treatment period was 19 months. Hawley-type retainers were applied full-time to the maxillary and mandibular arches. During all treatment, the patient was examined monthly by the periodontist to prevent plaque formation and gingival inflammation.

At 19 months after the removal of the edgewise appliance, resin-veneered crowns were placed on the maxillary right lateral incisor, left canine, and mandibular left incisor. Although we recommended extraction of the maxillary third molars, the patient declined this treatment.

RESULTS Return to TOC

The patient showed acceptably good occlusion and a good facial profile, ie, balanced lip line, owing to the successful flaring of the maxillary anterior teeth and slightly mandibular clockwise rotation (Figure 1). The anterior shift of the mandible and the traumatic occlusion were corrected through the improvement of the anterior crossbite. Good occlusion was achieved by flaring the maxillary incisors and obtaining an upright position of the mandibular molars (Figure 6). In the maxillary right lateral incisor, left canine, and mandibular left incisor regions, panoramic and dental radiographs after orthodontic treatment showed improvement of the alveolar bone form and crown-root ratio (Figure 4). Furthermore, the consecutiveness of the gingival margins (Figure 2C), the periodontal pockets, and tooth hypermobility were also improved (Table 1). Intraoral photographs taken at 19 months after the removal of the edgewise appliance showed stable occlusion (Figure 2D).

DISCUSSION Return to TOC

Orthodontic tooth movement is contraindicated if major marginal bone loss is observed due to periodontal disease.[13] Orthodontic forces can cause alveolar bone defects and attachment loss due to the presence of plaque.[14] However, it is possible to move teeth into the periodontal bone loss orthodontically and to gain connective tissue attachment if the gingival condition is healthy or controlled.[8]

In the present patient, inflammation was controlled and oral hygiene was improved before orthodontic treatment began. Furthermore, light orthodontic forces were to improve the extrusion of the maxillary right lateral incisor, left canine, and mandibular left incisor. As a result, the alveolar bone forms were also improved. The present study thus confirms that vertical infrabony defects can be improved by orthodontic tooth extrusion.

Tooth extrusion has been reported to decrease probing depths in isolated vertical infrabony defects.[7,8,15] It has been reported that alveolar bone does not increase if circumferential supracrestal fiberotomy is used during tooth extrusion.[16,17] A new attachment is reported to be formed only by periodontal ligament cells.[18] The turnover rate of periodontal ligament cells increases due to orthodontic tooth displacement resulting in a stretching of the periodontal ligament.[8] Therefore, we believe that the alveolar bone of the vertical infrabony defect regions increased successfully in this patient because fiberotomy was not performed.

Gingival esthetic problems are created by gingival recession after alveolar bone loss.[1] Gingival levels are known to be related to sulcus depth, the location of the cementoenamel junction relative to the bone level, and the crown-root ratio.[19] Gingival recession can be improved by means of gingival/osseous surgery and/ or orthodontic treatment.[2] In this patient, both the gingival recession and the crown-root ratio of the maxillary right lateral incisor, left canine, and mandibular left incisor regions were improved by orthodontic treatment. We believe that the patient's gingival esthetic problems improved because the location of the cementoenamel junction was moved in the direction of the crowns by the tooth extrusion.

Traumatic occlusion is frequently associated with jiggling forces[20] leading to tooth mobility, an increase in the width of the periodontal ligament space, and leukocytes in the periodontal ligament.[21] Therefore, an improvement in the interference of the anterior teeth due to orthodontic treatment might lead to an improvement in tooth hypermobility and stable occlusion, as in this patient.

At the end of orthodontic treatment the crown-root ratios of the maxillary right lateral incisor and mandibular left central incisor were slightly poor. The use of fixed-type retainers was desirable for the stability of those teeth. However, Hawley-type retainers were applied to the maxillary and mandibular arches after the orthodontic treatment on consideration of the oral hygiene and the desire of patient. As a result, the occlusion and the periodontal tissue were stable in this patient.

CONCLUSION Return to TOC

- Tooth extrusion and periodontal treatment can be effective for improving alveolar bone defects, gingival esthetics, and the crown-root ratio in patients with one- or two-wall isolated vertical infrabony defects.

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TABLES Return to TOC

Table 1. Cephalometric Measurements, Periodontal Pocket Depth, Tooth Mobility, and Crown-Root Ratio Before and After Treatment

Variables	Pretreatment	Posttreatment	Norm
Cephalometric measurements			
SNA, degree	82.9	82.9	82.3
McNamara line to point A, mm	1.5	1.5	1.0
SNB, degree	81.6	80.4	78.9
McNamara line to point B, mm	−0.5	−1.2	−6.0
Facial axis, degree	87.4	88.0	86.0
Mandibular plane angle, degree	21.6	22.4	30.2
FH-U1, degree	107.0	112.0	110.0
U1 to APo, mm	3.5	6.8	6.2
FMIA, degree	65.8	65.3	54.6
IMPA, degree	92.6	92.6	96.3
L1 to APo, mm	6.3	5.1	3.9
Periodontal pocket depth, mm			
Maxillary right lateral incisor	3–4	2–3	1–2
Maxillary left canine	4–8	3	1–2
Mandibular left incisor	2–4	2–3	1–2
Tooth mobility, grade			
Maxillary right lateral incisor	1.5	1.0	0–1
Maxillary left canine	1.0	0.5	0–1
Mandibular left incisor	2.0	1.0	0–1
Crown-root ratio			
Maxillary right lateral incisor	1 : 0.4	1 : 0.7	1 : 1–1.5
Maxillary left canine	1 : 0.5	1 : 1.2	1 : 1–1.5
Mandibular left incisor	1 : 0.3	1 : 0.7	1 : 1–1.5

FIGURES Return to TOC

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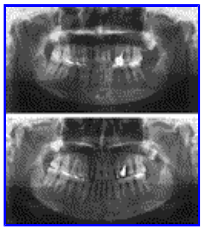
Figure 1. Facial photographs before and after treatment. Top, pretreatment; bottom, posttreatment

Click on thumbnail for full-sized image.

Figure 2. Intraoral photographs. (A) Before treatment. (B) Immediately after improvement of the anterior crossbite. (C) At the removal of the edgewise appliance. (D) At 19 months after the removal of the edgewise appliance



Click on thumbnail for full-sized image.

Figure 3. Panoramic radiographs before and after treatment. Top, pretreatment; bottom, posttreatment

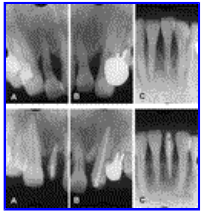


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Figure 4. Dental radiographs before and after treatment. (A) Maxillary right lateral incisor. (B) Maxillary left canine. (C) Mandibular left incisor. Top, pretreatment; bottom, posttreatment

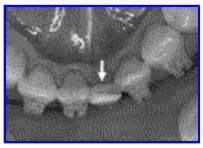

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Figure 5. Temporary crown labeled with red acrylic resin to indicate the same height as the amount of extrusion

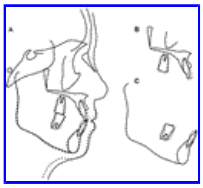

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Figure 6. Superimposition of cephalometric tracings before (solid line) and after (dotted line) treatment. (A) A best-fit on the anterior wall of the sella turcica, the greater wings of the sphenoid, the cribriform plate, the orbital roofs and the surface of the frontal bone. (B) A best-fit on the zygomatic process of the maxilla (key ridge) and the curvature of the palate. (C) A best-fit on the symphysis and the mandibular plane

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