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Case Report

Orthodontic Management of the Edentulous Space Caused by Surgical Removal of a Large Dentigerous Cyst

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Main Points

- This case report presents the orthodontic management of the growing patient who had a large dentigerous cyst, spaced arch and bone loss.
- Age and alveolar bone status should be considered when determining treatment for such cases of excessive bone loss.
- The second premolar was slowly mesialized into the the edentulous region. As a result, a wide bony ridge was obtained, which allowed us to autotransplant the maxillary lateral incisor.

ABSTRACT

Herein, we report the orthodontic management of a patient with excessive bone and permanent tooth loss after surgical cyst removal. The patient was a 13-year-old Japanese boy who was referred to our department by an oral surgeon. He had an edentulous space with alveolar bone loss and loss of 2 permanent molars in the left mandibular region, following surgical removal of a large dentigerous cyst. We decided to close this space orthodontically. First, we moved the left mandibular second premolar into the edentulous region and autotransplanted the left maxillary lateral incisor in the adjacent distal space. We then performed comprehensive orthodontic treatment to establish stable occlusion. Following treatment, functional and stable occlusion of all permanent teeth was achieved without any spaces. The findings from this case suggest that orthodontic treatment is effective in growing patients with edentulous spaces and alveolar bone loss.

Key words: Alveolar bone loss, autotransplantation, dentigerous cyst, orthodontics

INTRODUCTION

Dentigerous cysts comprise approximately 20% of all jaw cysts.[1,2] Large dentigerous cysts require surgical intervention that can lead to alveolar bone loss in the edentulous space.[3] Clinicians should ideally plan treatment that allows reconstruction of occlusion after surgery, especially in growing patients. In this case report, we present the orthodontic management of an edentulous space in a patient with excessive bone loss and loss of 2 permanent teeth following the surgical removal of a dentigerous cyst.

CASE PRESENTATION

DIAGNOSIS

A 13-year-old boy, referred to the clinic of Oral and Maxillofacial Surgery, Tsurumi University Dental Hospital, was diagnosed with a dentigerous cyst in the region of an impacted left mandibular canine and first premolar

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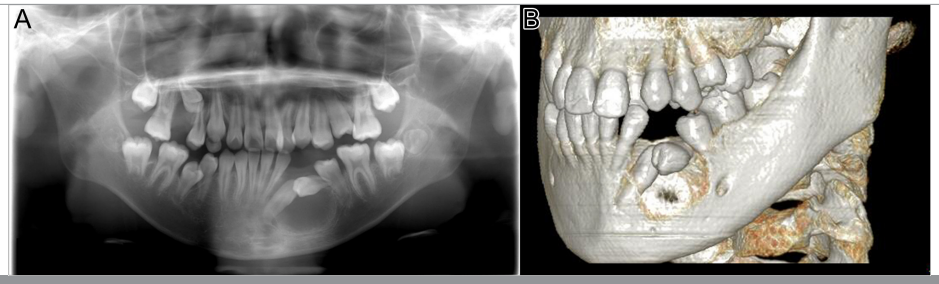

Figure 1. A, B. Pre-surgery radiographs. (A) Panoramic radiograph and (B) computed tomography

(Figure 1). Cystectomy was performed with extraction of the impacted teeth. At the 12-month follow-up, the cyst cavity had disappeared on the panoramic radiograph (Figure 2B); however, occlusal destruction was observed (Figures 2 and 3). Therefore, the patient was referred to the Department of Orthodontics. The patient had a straight facial profile with no asymmetry (Figure 3). Intraorally, the left mandibular canine and first premolar were missing with bone loss in the edentulous space. The overbite and overjet were +3.5 mm and +3.0 mm, respectively. The molar relationship was Class III on both sides, and the mandibular right first molar had a scissor-bite (Figure 3). the panoramic radiograph showed bilateral third molars in the maxilla and mandible (Figure 2B), and computed tomography (CT) images showed buccal bone loss in the edentulous region of the mandible (Figure 2C). Lateral cepharometric analysis showed that the patient had a skeletal Class I malocclusion (ANB = 1.2°), slightly high angle (Frankfort mandibular plane angle [FMA] = 34.1°), average upper incisors (upper incisor to SN plane [U1-SN] = 109.2°) and extreme lingual inclination of lower incisors (Incisor mandibular plane angle [IMPA] = 71.1°) (Table 1, Figure 2). The patient was diagnosed with an Angle Class III malocclusion associated with loss of the lower left canine and first premolar.

Table 1. Cephalometric measurements

Variables	Norm (SD)	Pretreatment	Posttreatment
Maxillomandibular relationships			
SNA (°)	81.4 (3.6)	83.8	84.9
SNB (°)	79.6 (3.9)	82.6	83.6
ANB (°)	1.8 (1.6)	1.2	1.3
Vertical skeletal relationships			
FMA (°)	25.6 (5.6)	34.1	32.2
Gonial angle (°)	112.4 (6.0)	135.7	133.3
Dental relationships			
U1 to SN (°)	105.0 (6.1)	109.2	110.5
U1 to FH (°)	111.2 (5.2)	116.3	117.1
FMIA (°)	58.0 (6.0)	74.8	66.3
IMPA (°)	94.7 (6.9)	71.1	81.5
Interincisal angle (°)	128.3 (8.8)	138.5	129.1
Soft tissues			
Upper lip to E-line (mm)	−1.0 (0.86)	−2.8	−3.2
Lower lip to E-line (mm)	0.0 (0.56)	2.3	0.0

FMIA, Frankfort mandibular incisor angle; IMPA, Incisor mandibular plane angle.

Treatment Objectives and Treatment Plan

The following treatment objectives were established: (1) closure of space in the edentulous region, (2) correction of maxillary crowding, and (3) establishment of functional occlusion.

We considered moving the lower left second premolar mesially and transplanting the extracted upper left lateral incisor or first premolar. Written informed consent was obtained from the patient's parents.

Treatment Progress

We bonded a button to the lower left second premolar lingual surface and placed a lingual arch with a hook. The premolar gradually moved mesially from the lingual button to the hook by an elastic chain. After 5 months, we removed the lingual arch and attached standard edgewise appliances with 0.018-inch slots. The lower left second premolar was again subjected to mesial bodily movement using a 0.016 × 0.016-inch stainless steel wire with a NiTi open-coil (100 gf) spring. We radiographically checked for root paralleling and observed bone formation (Figure 4). Dental

Figure 2. A-C. Pretreatment radiographs. (A) Lateral cephalogram, (B) panoramic radiograph, and (C) axial slice of computed tomography

Figure 3. Pretreatment facial and intraoral photographs

CT showed sufficient space and bone formation not only at the transplanted site but also at the edentulous site (Figure 5). We decided to autotransplant the upper left lateral incisor because its root width was almost coincident with the labiolingual bone width. We confirmed the position of the buccal cortical bone surrounding the second premolar that was moved (Figure 6). Two months after autotransplantation, we performed a root canal of the transplanted upper left lateral incisor (Figure 7). We instructed the patient to wear a Begg retainer for retention.

CASE RESULTS

Posttreatment facial and intraoral photographs showed a normal overbite and overjet (Figure 8). Panoramic radiographs showed a recognizable periodontal space surrounding the root of the autotransplanted lateral incisor (Figure 9B). Lateral cephalometric analysis and superimposition of the pre- and posttreatment lateral cephalograms showed facial growth during the treatment period. (Table 1, Figure 10). Since treatment completion 1 year 7 months ago, the transplanted tooth and occlusion have been stable (Figure 11).

DISCUSSION

In this patient, surgical dentigerous cyst removal caused destruction of occlusion and extensive bone loss. Autotransplantation is known to enhance the alveolar height and tooth eruption process,[4,5] which makes this procedure possible in growing patients rather than

Figure 4. A-C. Dental radiographs during mesial movement of the left mandibular second premolar. (A) 4 months, (B) 10 months, and (C) 14 months

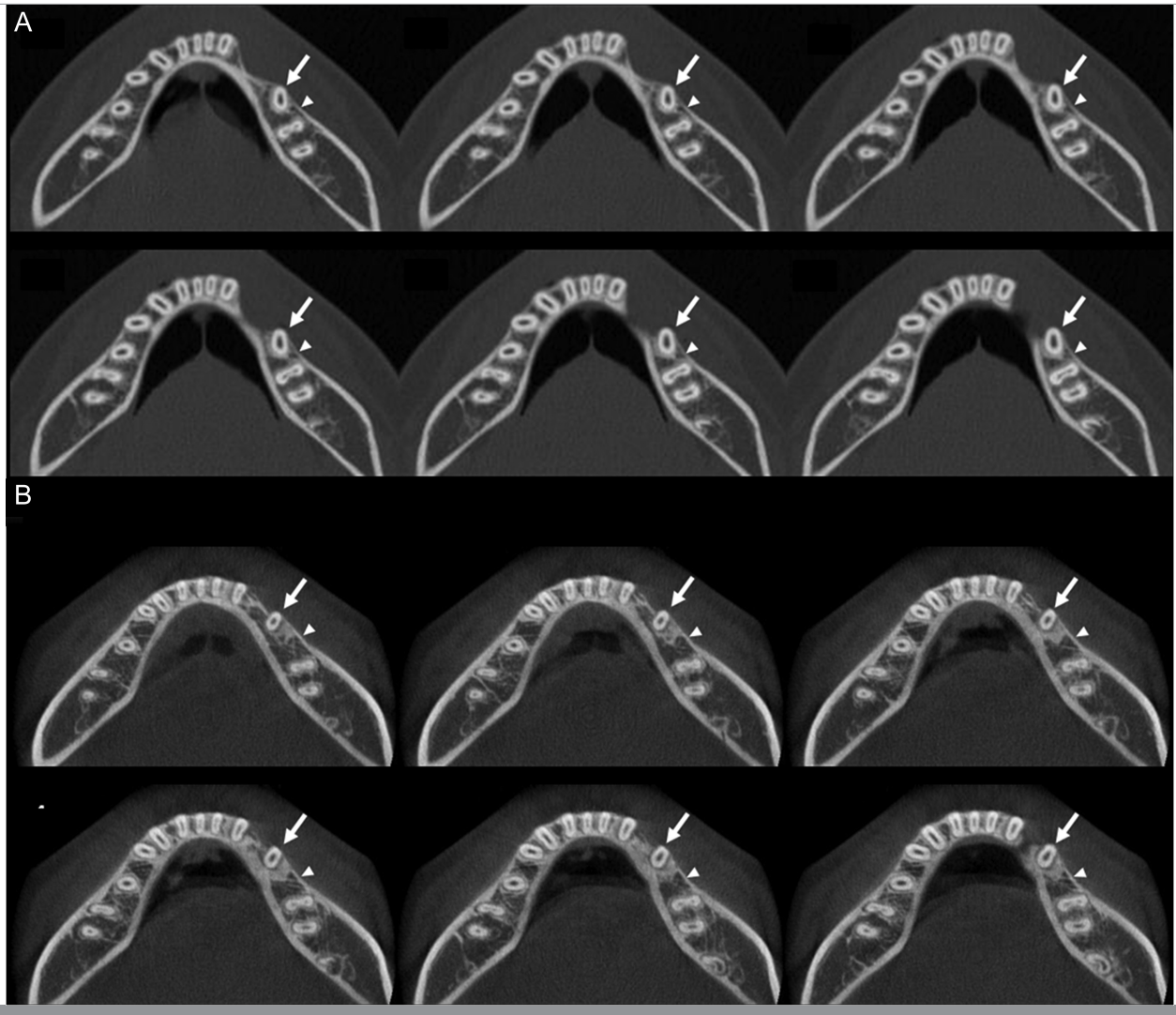

Figure 5. A, B. Axial slice of serial dental computed tomography images (A) before tooth movement and (B) before autotransplantation. Arrow: left mandibular second premolar; arrowhead: autotransplantation site

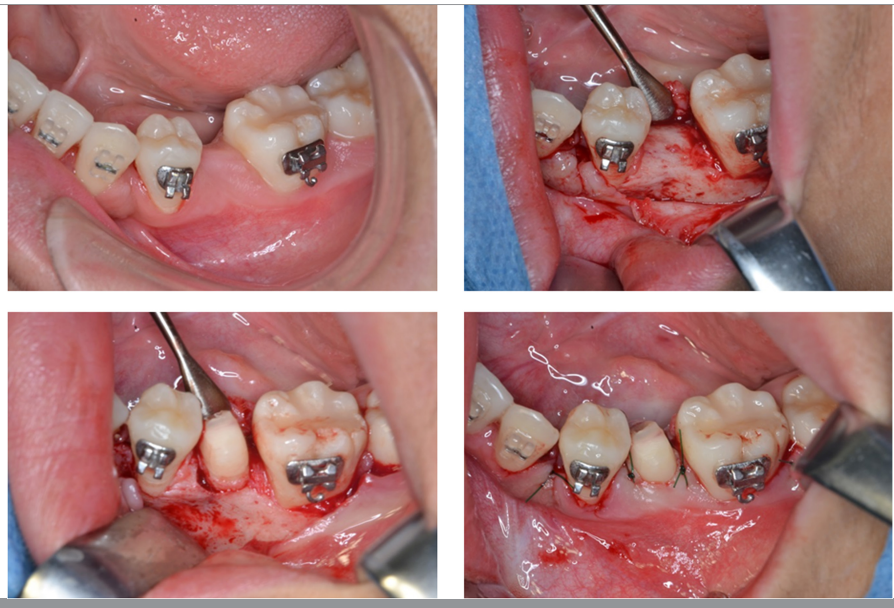

Figure 6. Photographs during autotransplantation

Figure 7. A-C. Dental radiographs after autotransplantation at (A) 2 weeks, (B) 3 months, and (C) 21 months

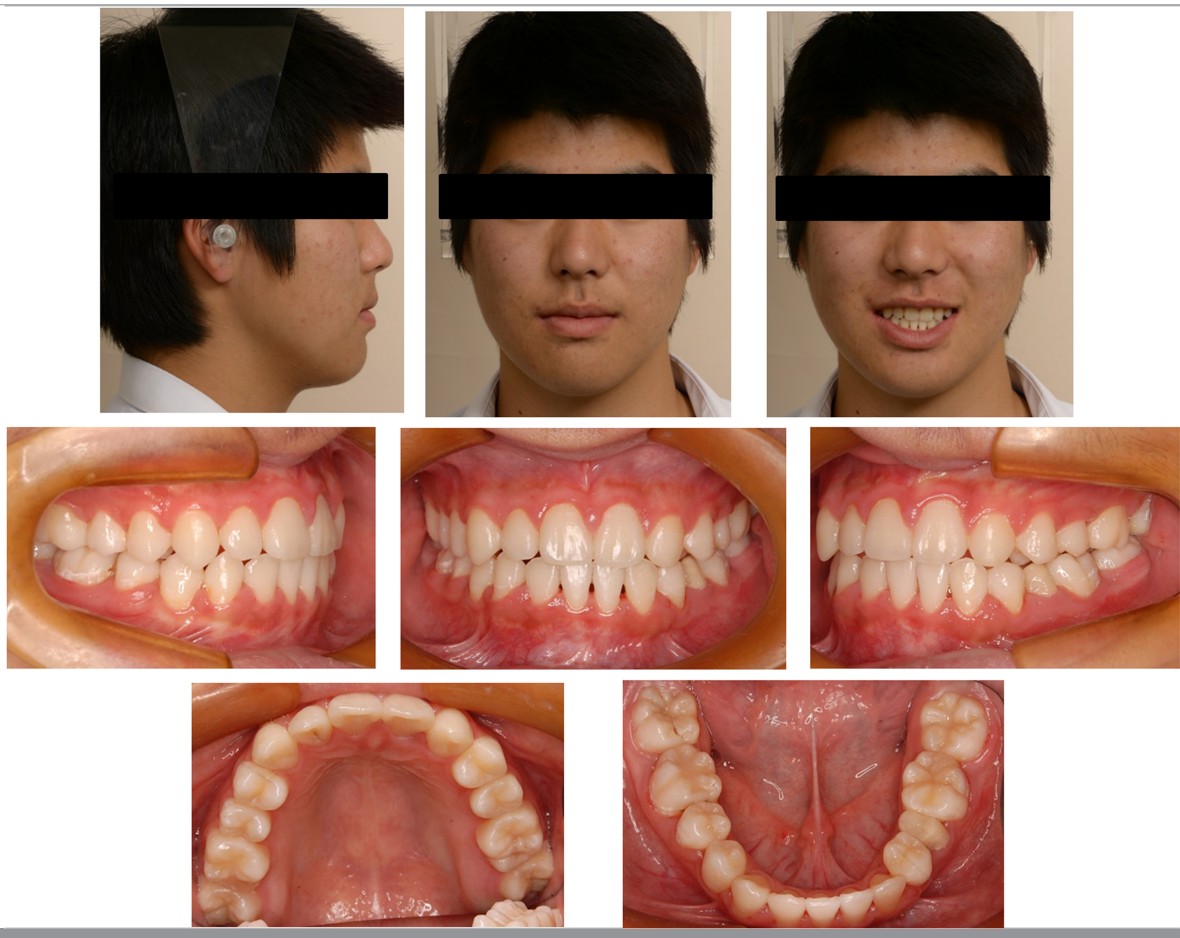

Figure 8. Posttreatment facial and intraoral photographs

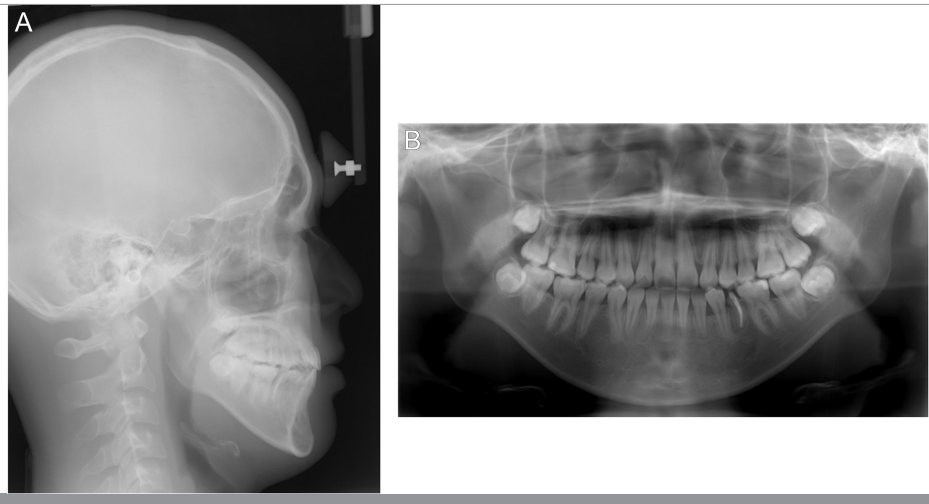

Figure 9. A, B. Posttreatment radiographs. (A) lateral cephalogram and (B) panoramic radiograph

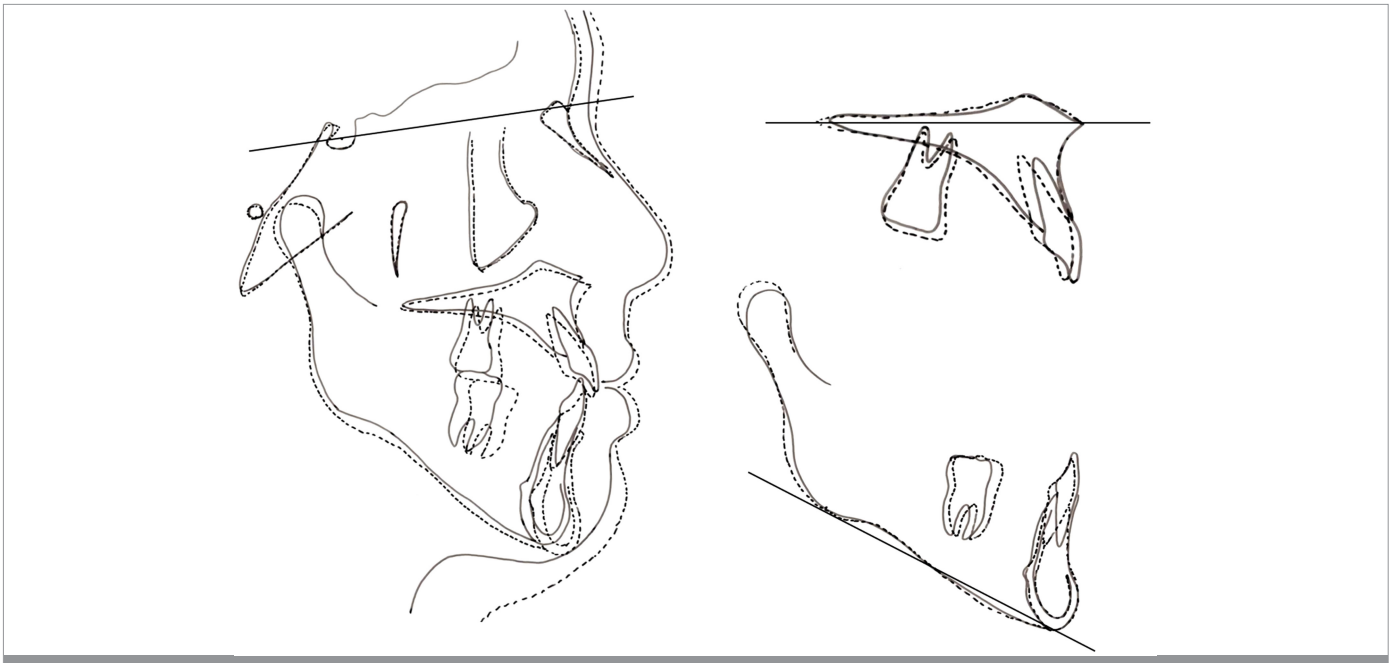

Figure 10. Cephalometric superimpositions. Solid line: pretreatment; dotted line: posttreatment

Figure 11. Postretention intraoral photographs at 1 year 7 months after treatment

dental implants and bridges. However, in our patient, the alveolar ridge was very thin labiolingually. According to Zachrisson,[6] tooth movement can be considered as an alternative to bone grafting. Based on this study, we attempted to move the second premolar to the edentulous region (Figure 4). As a result, we obtained a wide bony ridge on the tension side of the second premolar, which allowed us to autotransplant the maxillary lateral incisor (Figure 6).

However, this method of continuous force using superelastic coil springs has the risk of lateral root resorption.[6] Our patient showed a slight degree of lateral root resorption of the second premolar; we speculated that this was because of the difference in patient age and method of tooth movement.

The survival rate of an autotransplanted tooth ranges from 75.3% to 91%.[7] However, most studies used transplanted teeth with incomplete root formation.[8-11] It is necessary for clinicians to carefully consider whether autotransplantation should be performed or not. Andreasen et al.[8] reported that the healing rate of the pulp in transplanted teeth with complete root formation was only 15%. In our patient, the root of the autotransplanted upper left lateral incisor had formed completely. To prevent tooth loss due to pulp inflammation, pulp extirpation was performed on the incisor 2 months after autotransplantation.

Currently, at 2.5 years after the autotransplantation, the transplanted tooth is stable (Figure 7). It was important to consider the

aesthetics and functionality because the canine was moved to the position of the lateral incisor. We reduced the cusp tip and lingual surface of the canine and also lingually torqued the canine root.[12,13] While moving the first premolar to the position of the canine, we reduced the lingual cusp of the premolar and torqued it buccally.[12,13] Using these steps, a functional occlusion was obtained.

CONCLUSION

This case report suggests that orthodontic treatment is effective and safe for growing patients with edentulous spaces and alveolar bone loss. Preserving stable occlusion ultimately improves the masticatory function, aesthetics, and long-term quality of life in patients.

Informed Consent: Written informed consent was obtained from the patient's parents.

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