

An Angle Class I malocclusion with a paradental cyst

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According to the WHO, a paradental cyst is classified as an odontogenic inflammatory lesion, showing a relative frequency of 0.9–4.7% in the world population. There are no identifiable reports of orthodontic treatment of patients who also present with a paradental cyst. The presenting patient was a Japanese female, aged 16 years and 10 months. The chief complaint was crowding and protrusion of the incisors. The magnitude of the overjet was +4.0 mm, overbite was +3.8 mm, and the intermolar relationship was Angle Class I. Pretreatment computed tomography identified a radiolucency extending from the root furcation to the apex of the mandibular left first molar, which was diagnosed as a paradental cyst. Orthodontic treatment was performed using lingual multi-bracket appliances and miniscrews following the extraction of the affected mandibular first molar, mandibular right first premolar and both maxillary first premolars. The paradental cyst was enucleated, and occlusal cusp-fossa relationships were maintained with complete space closure. This case is the first report of orthodontic treatment in association with the management of a paradental cyst.
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Introduction

According to the World Health Organisation (WHO), a paradental cyst is classified as an odontogenic inflammatory cyst.¹ Although first described in 1930, a paradental cyst remains unrecognised by many clinicians.^{2,3} This type of cyst has a relative frequency of 0.9–4.7% in the world population, and it most often occurs in association with the mandibular molars.^{4,5} The mean age of patients presenting with a mandibular paradental cyst is 8.7 years.⁶ The lesion appears radiologically as a well-defined, semilunar, unilocular radiolucency.⁷ The reduced enamel epithelium, cell rests of Malassez and the remnants of the dental lamina stimulated by inflammation are related to the pathogenesis of the cyst.^{4,8} The lesion requires a considered differential diagnosis to distinguish it from other possibilities such as a radicular cyst, severe localised periostitis, an odontogenic keratocyst, or an ameloblastoma.⁹

Vitality testing is helpful in the differential diagnosis⁶ as the involved tooth is characterised by a vital pulp. The treatment of a paradental cyst of the mandibular first or second molar at an early stage is usually by enucleation without extraction of the involved tooth.⁷ When allowed to advance to a later stage, the affected tooth must be extracted along with enucleation, which creates a large space in the dentition. It is critically important to restore the occlusion with prosthodontic and/or dental implant management of the edentulous space.^{10,11} However, prosthetic options often have a limited survival period^{12,13} and long-term stability may not be obtained. The restoration of the occlusion in the edentulous area using the patient's own teeth is a desirable option. Closing the edentulous space by orthodontic tooth movement contributes to the restoration of a sustainable occlusion,¹⁴ and consequently improves the patient's long-term quality of life.¹⁵



Figure 1. Pretreatment facial and intraoral photographs.

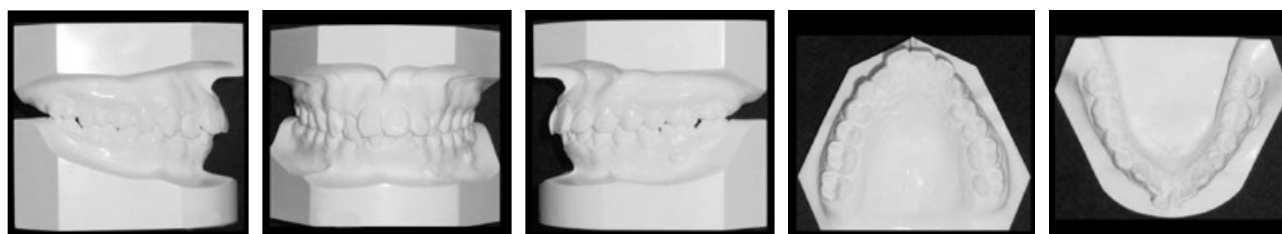


Figure 2. Pretreatment dental casts.

In the present case presentation, an Angle Class I patient with accompanying crowding and protrusion of the maxillary and mandibular incisors along with a paradental cyst involving the mandibular left first molar was treated by lingual orthodontic treatment. The occlusion in the edentulous area caused by enucleation of the paradental cyst and extraction of the mandibular left first molar was managed by careful space closure.

Diagnosis and etiology

The patient, a Japanese female, was 16 years and 10 months old on presentation. The chief complaint was protrusion of the maxillary incisors and crowding of

the lower arch. She had an unremarkable medical history.

The upper and lower lips were slightly protrusive (Figure 1). On dental examination, a fistula was noted on the buccal side of the mandibular left first molar. However, there were no symptoms and the involved tooth was determined to be vital following pulp testing. The magnitude of the overjet was +4.0 mm, the overbite was +3.8 mm, and the intermolar relationship was Angle Class I. Arch length discrepancies were -1.5 mm in the upper and -5.0 mm in the lower arch, respectively (Figure 2).

A panoramic radiograph revealed a radiolucency of approximately 10 mm in diameter extending from

Table 1. Cephalometric measurements.

Angular measurement (°)	Mean	S.D.	Pretreatment	Post-treatment
SNA	81.3	3.0	85.3	85.4
SNB	79.2	3.0	81.5	81.2
ANB	2.1	2.1	3.8	4.2
FMA	27.1	5.2	20.1	20.2
Gonial angle	121.6	6.0	114.4	114.7
U1-FH	111.0	5.5	117.7	106.5
L1-Mandibular plane	93.0	6.2	107.4	96.0
FMIA	58.0	6.0	52.5	63.8

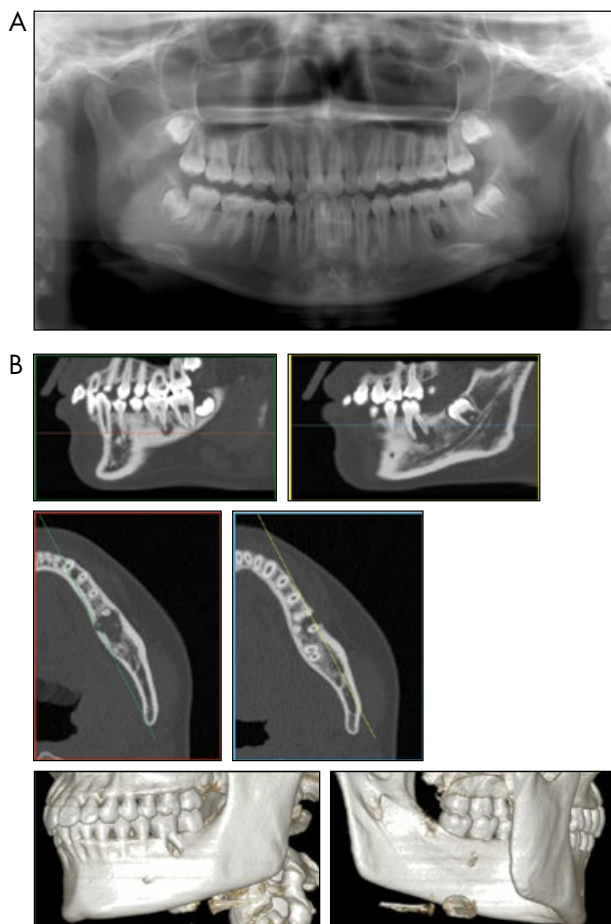


Figure 3. Pretreatment radiographs. a: Panoramic radiograph. b: Computed tomography. The colour lines and frames show the image of the corresponding cross section.

the root furcation to the apex of the mandibular left first molar (Figure 3a). In a computed tomography scan, the radiolucency was observed around the distal, mesial and accessory root apices. The alveolar bone on the buccal side was considerably resorbed from the alveolar crest to the root apex, and there was a fenestration defect around the distal accessory root apex (Figure 3b).



Figure 4. Pretreatment lateral cephalogram.

Based on these clinical and radiographic findings, a benign tumor or cystic lesion was suspected. In consultation with the Department of Oral and Maxillofacial Surgery at the university, it was considered prudent to extract the mandibular left first molar to allow complete removal of the accompanying lesion.

A lateral cephalometric analysis showed a skeletal Class I relationship. The maxillary and mandibular incisors were labially inclined (Figure 4, Table I). Based on the above findings, the patient was diagnosed with an Angle Class I malocclusion with crowding and protrusion of maxillary and mandibular incisors accompanied by a benign tumor or cystic lesion associated with the mandibular left first molar.

Treatment objectives

The following treatment objectives were established: (1) the extraction of the mandibular left first molar concomitant with the removal of the lesion to facilitate a histopathological diagnosis, (2) closure of the large extraction space and restoration of the occlusion, (3) retraction of the maxillary and mandibular incisors, (4) correction of the crowding, (5) achieve proper overjet and overbite relationships and (6) maintenance of the occlusal cusp-fossa relationships for a sustainable occlusion.

Treatment alternatives

Two treatment options were presented to the patient. The first was the extraction of the mandibular left first molar and removal of the lesion, following which, prosthetic treatment requiring a dental implant would be performed to re-establish the occlusion. This option was convenient due to the shorter time frame but did not guarantee long-term stability nor address the other treatment objectives.

A second treatment option was an orthodontic approach involving the extraction of the maxillary first premolars, mandibular right first premolar, mandibular left first molar, and removal of the lesion. The extracted space would be closed by lingual movement of the incisors, distal movement of the mandibular left second premolar and mesial movement of the mandibular left second molar without later prosthetic requirement. Because this treatment option removed the need for prosthodontic involvement, it had a high probability of supporting the long-term oral health of the patient. However, root resorption and gingival recession of adjacent teeth due to the large alveolar bone defect at the mandibular left first molar site was considered a possibility.¹⁶

Discussions with the patient determined that she wanted to improve the protrusion of the maxillary incisors and correct the crowding of the lower arch without prosthetic treatment, and so the second treatment option was chosen. However, the patient desired an aesthetically acceptable orthodontic appliance. Therefore, orthodontic treatment was proposed using lingual multi-bracket appliances. Written informed consent was granted by the patient before treatment. Remodelling alveolar bone loss often occurs at the edentulous site if the area is left untreated for a long period after extraction and therefore early closure of the space was planned.

Treatment progress

Prior to orthodontic treatment, the mandibular left first molar was carefully extracted and the lesion was completely removed. Histopathological examination of the specimen revealed a cyst wall comprising non-keratinized squamous epithelium (Figure 5a). The cyst was surrounded by fibrous connective tissue, in which there was chronic inflammation and associated lymphocytes and plasma cells (Figure 5b). Based on the clinical, radiographic and histopathological findings, the lesion was diagnosed as a paradental cyst.

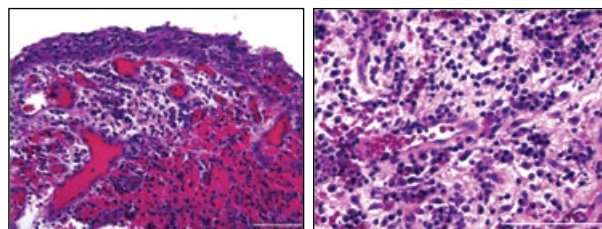


Figure 5. Histopathological examination findings (H&E staining). a: a cyst wall constituted by non-keratinized squamous epithelium surrounded by fibrous connective tissue (x100, scale: 50 μ m). b: chronic inflammation with lymphocytes and plasma cells was observed in fibrous connective tissue (x200, scale: 50 μ m).

It was imperative to close the edentulous space in the mandibular left first molar site early to prevent extensive resorption of the alveolar bone. Immediately after the molar extraction, the mandibular right first premolar was also removed and lingual multi-bracket appliances^{17,18} (central incisor: single standard bracket, TOMY International, Japan; lateral incisor-canine: Fujita lingual bracket, Ortho-Dentaurum, Japan; first premolar-second molar: CLIPPY-L, TOMY International, Japan) were applied to the lower arch using an indirect bonding method.¹⁹⁻²¹ A 0.012 inch nickel-titanium continuous arch wire was inserted, and a nickel-titanium closed coil spring (TOMY International, Japan) was applied between the mandibular left first premolar and the second molar to close the extraction space using a light continuous force (Figure 6). Secondly, both of the maxillary first premolars were extracted and a lingual multi-bracket appliance and a 0.012 inch nickel-titanium arch wire were placed (Incisor-canine: Fujita lingual bracket, Ortho-Dentaurum, Japan; first premolar-second molar: CLIPPY-L, TOMY International, Japan). The teeth were aligned and levelled using a sequence of continuous arch wires. After the unravelling of the crowding of the mandibular incisors, the single brackets on the central incisors were replaced by Fujita lingual brackets.

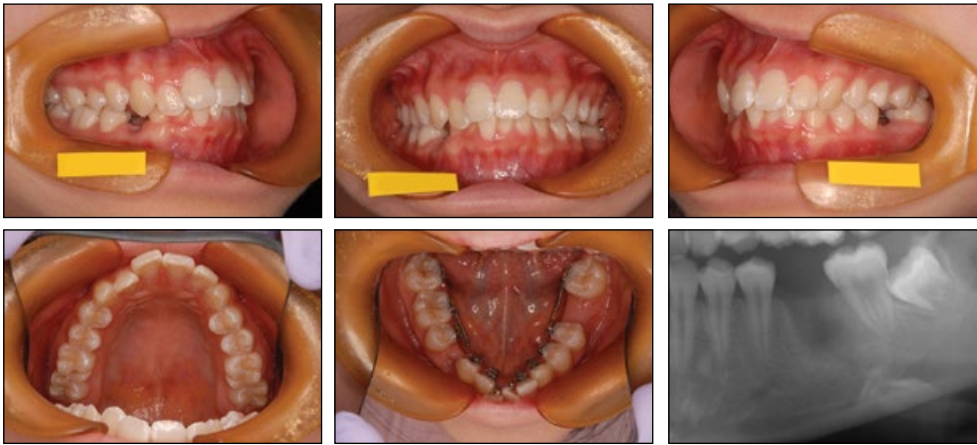


Figure 6. Initial phase of treatment progress. Extracted spaces of the mandible were beginning to close by closed coil spring applying extra light force. The panoramic radiograph after enucleation of the cyst.

After nine months, the mandibular left first molar space had closed considerably but not completely (Figure 7). Therefore, 0.017 × 0.025 inch stainless steel closing arch wires were placed in both arches to further retract the anterior teeth (Figure 8). To reinforce anchorage of the maxillary molars, miniscrews (Dual top auto screw III, Proseed, Japan) with a diameter of 1.6 mm and a length of 8 mm were placed between the palatal roots of the second premolar and the first molar. During space closure, the mandibular left third molar erupted.

Following complete space closure, detailing of the buccal segments was enhanced by the attachment of a multi-bracket appliance on the buccal side of the mandibular left second and third molars to correct a crossbite of the left third molar.

Orthodontic treatment was completed by the age of 19 years and 11 months. Fixed lingual retainers were placed in both arches for retention.

Treatment results

The intended treatment objectives were achieved. The paradental cyst was completely enucleated and, although the mandibular left first molar was extracted, the space was completely closed without the need for prosthetic involvement. The occlusal cusp-fossa relationship was maintained along with a Class I canine relationship. The crowding was relieved and the final overjet was +2.5 mm and overbite was +3.0 mm (Figure 9, 10).

A post-treatment panoramic radiograph revealed that root parallelism was achieved and minimal root



Figure 7. Panoramic radiograph nine months after enucleation. The space in the mandibular left first molar was almost closed, and no recurrence was observed.

resorption occurred (Figure 11a). In a post-treatment computed tomography scan, the paradental cyst was completely removed without sign of recurrence. The alveolar bone in this edentulous area remodelled efficiently and without subsequent defect (Figure 11b).

A cephalometric analysis showed that the maxillary and mandibular incisors were retracted and that their positions were well within the accepted and standard range (Table I, Figure 12). Cephalometric superimpositions revealed that the mandibular left second molar was moved 6.5 mm mesially (Figure 13, broken line), assisted by the anchorage support generated by the miniscrews. The maxillary incisors were moved 7.5 mm lingually, and the mandibular incisors were moved 7.0 mm lingually. The patient was satisfied with the treatment result of complete space closure to obviate the need for prosthodontic treatment. After one year of retention, the occlusion was stable without any signs of recurrence of the paradental cyst.



Figure 8. Closing phase of treatment progress.



Figure 9. Post-treatment facial and intraoral photographs.



Figure 10. Post-treatment dental casts.

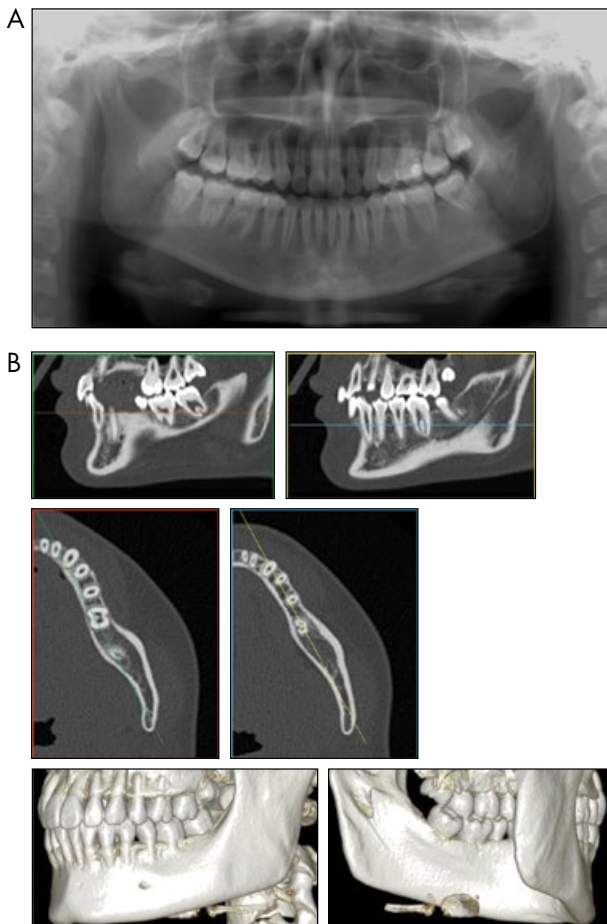


Figure 11. Post-treatment radiographs. a: Panoramic radiograph. b: Computed tomography.

Discussion

In the presented case, orthodontic closure of a large mandibular edentulous space contributed to the patient's long-term oral health.¹⁵ When space is created by pathological factors, such as odontogenic tumors or cysts, prosthodontic treatment is usually necessary to re-establish the occlusion. However, the present result strongly suggests that orthodontic treatment has a significant ability to reduce or completely close a large edentulous space²² and remodel the alveolar bone affected by pathology. Space was required to correct the crowding and protrusion of the maxillary and



Figure 12. Post-treatment lateral cephalogram.

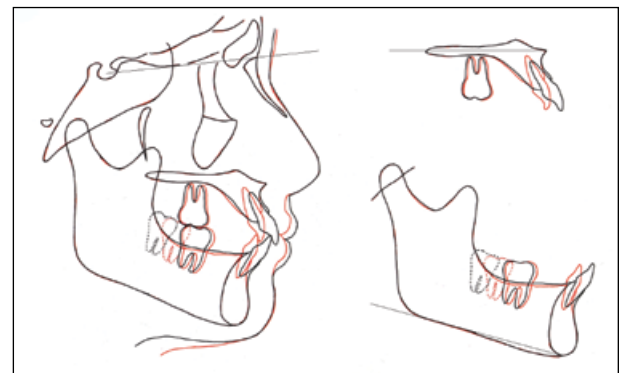


Figure 13. Superimpositions of pretreatment (black line) and post-treatment (red line) lateral cephalometric tracings. Broken line: pretreatment (black) and post-treatment (red) mandibular left second molar.

mandibular incisors^{23,24} and so the treatment plan was chosen to utilise the edentulous space created by the lesion. As a result, the created space was completely closed, and the occlusion re-established. The deficient alveolar bone in the mandible was remodelled by the movement of the adjacent teeth (Figure 11). This case

suggests that orthodontic closure of a sizable space caused by the treatment of a large lesion is a possible and viable option.

In the selection of the orthodontic appliance, aesthetic lingual multi-bracket appliances were placed, which creates a tendency for excessive lingual tipping of the incisors.^{17,25} This was managed by the incorporation of incisor overcorrection by using a customised composite resin base of the lingual brackets.^{19,26} Secondly, a tandem arch wire technique was used to control the torque of the incisors.²⁷ In addition, a closing loop method of space closure was implemented by ligating a ligature wire from the molar brackets or miniscrews to the central portion of the closing loops; the loops can be activated with distal tipping (Figure 8). When the loops were distally tipped, a crown-labial torquing moment was applied to the incisors. As a result, excessive lingual inclination of the incisors was avoided, which made it further possible to move the mandibular second molar mesially.

In summary, this is the first case report of orthodontic treatment of a patient who presented with a paradental cyst. The large space created by cyst removal was closed completely and safely, while maintaining occlusal cusp-fossa relationships and removing the need for prosthetic treatment. The alveolar bone at the edentulous area remodelled during treatment as a result of early movement of the adjacent teeth. Root resorption was minimal and the occlusion and the alveolar bone at the edentulous site were stably maintained.

Conclusions

In the presented case, a paradental cyst in the mandibular left first molar was enucleated and the involved tooth extracted. Acceptable results were achieved without loss of mandibular alveolar bone or root resorption of the adjacent teeth. This case suggests that the considered extraction of a tooth involved with a paradental cyst is a viable orthodontic option.

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