Patient with nonsyndromic bilateral and multiple impacted teeth and dentigerous cysts

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This article reports the successful treatment of a patient with the unusual occurrence of bilateral and multiple dentigerous cysts of the premolars. One impacted mandibular premolar was moved by traction orthodontically. On the opposite side, the impacted premolar was autotransplanted after space was created through mesial movement and hemi-sectioning of the neighboring molars. The impacted maxillary premolar was extracted. Miniscrews were additionally used for anchorage reinforcement to prevent unintended counteractions and solve the problem of space management after autotransplantation. We also reviewed the clinical implications of the diagnosis, planning, and treatment of cyst-associated impacted teeth in young adult patients. (Am J Orthod Dentofacial Orthop 2012;141:228-41)

Dentigerous cysts are major pathologic entities found in dentistry, accounting for approximately 24% of all true cysts in the jaws. 1,2 The cyst involves the odontogenic epithelia of impacted permanent teeth, supernumerary teeth, odontomas, and, rarely, deciduous teeth. 3-5 The mandibular third molars are the most frequently involved, although there is a marked incidence among mandibular second molars and premolars. 6 Even though the development of cysts can be responsible for structural changes in the bone, 7 root resorption, 8 and abnormal dentition development, there is usually no pain or discomfort associated with a cyst. Therefore, dentigerous cysts are frequently discovered when radiographs are taken to investigate delayed tooth eruption, a missing tooth, or malignment. Most dentigerous cysts are single lesions. Meanwhile, bilateral and multiple cysts are rare and occur typically in association with syndromes such as cleidocranial dysplasia, Maroteaux-Lamy syndrome, and basal cell nevus syndrome. 9-11 In the absence of these syndromes, bilateral dentigerous cysts located in the mandible are uncommon, with few reports. 10

Regarding orthodontic treatment for an impacted tooth with a dentigerous cyst, conventional treatment techniques have some limitations, including the age of the patient, tooth depth, tooth inclination, and eruption space. In some cases, extraction of the impacted tooth might be required, especially in adult patients. The autotransplantation of teeth has been widely used in orthodontics to provide a treatment alternative in many situations, mainly in patients with a severe impaction, early loss of permanent teeth, or congenital aplasia. 12 Recently, the orthodontic miniscrew has provided rigid anchorage, made treatment more efficient, and also made biologically permissible movements possible. 13-15

As a consequence, miniscrew use could change the treatment paradigm and extend the scope of orthodontic mechanotherapy.

In this article, we report the successful treatment of a patient with the unusual occurrence of nonsyndromic bilateral and multiple dentigerous cysts, in which the mandibular left first molar was severely damaged. Combined treatments, including extraction, marsupialization, orthodontic traction, and tooth autotransplantation, were performed for the impacted premolars. Additionally, miniscrews were used to bring the transplanted premolar to a suitable position in the mandibular arch for favorable occlusion. Our treatment included
a consideration of the guidelines for multiple dentigerous cysts associated with mandibular premolars and molars in young adults.

**DIAGNOSIS AND ETIOLOGY**

A boy, aged 13 years and 8 months, was examined in the outpatient clinic of Okayama University Hospital in Japan. A general dentist pointed out the impacted premolars and introduced him to us at Okayama University Hospital in Okayama, Japan. He had a symmetrical face, a straight profile, and an obtuse nasolabial angle. The patient’s medical history showed nothing unusual. There were no associated syndromes. Intraoral examination showed the remaining mandibular second deciduous molars, missing second premolars, a diastema, a deep overbite, and a unilateral scissors-bite involving the left second molar (Figs 1-3). The pretreatment panoramic radiograph and computed tomography scan (Fig 3, C-E) showed a well-defined radiolucent area surrounding the crown of the unerupted mandibular second premolars, the mandibular left third molar, and the maxillary right second premolar. The distal root of the mandibular left first molar was reabsorbed due to a dentigerous cyst associated

![Fig 1. Pretreatment facial and intraoral photographs.](image-url)
with the mandibular left second premolar (Fig 3, C). The maxillary left second premolar was congenitally absent.

When compared with Japanese norms, the cephalometric analysis showed a tendency toward a skeletal Class III relationship (ANB, 1.2°; Ar-Go, 64.6 mm; Go-Me, 82.2 mm) (Table I), a low mandibular plane angle (Mp-FH, 12.7°), and an acute gonial angle (106.9°). The mandibular incisors were proclined relative to the mandibular plane (L1-Mp, 106.0°). The molar relationships were Class II on both sides. The maxillary dental midline was almost coincident with the facial midline, but the mandibular midline was shifted 2.0 mm toward the left. The maxillary anterior teeth were spaced. The patient showed no significant symptoms of a temporomandibular disorder. The incisal path was unstable during opening-and-closing jaw movements with a 6 degrees-of-freedom jaw movement recording system (Gnathohexagraph system, version 1.31; Ono Sokki, Kanagawa, Japan). The interincisal distance on maximal opening without pain was 37 mm. An occlusal force of 776 N and an occlusal contact area of 16.6 mm² (Table II) were calculated on an occlusal-force recording system (Dental Prescale & Occluzer; Fuji Film, Tokyo, Japan).

**TREATMENT OBJECTIVES**

The patient was diagnosed with an Angle Class II malocclusion, a skeletal Class III jaw-base relationship, and multiple dentigerous cysts associated with the second premolars and the mandibular left third molar. The principal objectives were to create spaces for the unerupted mandibular second premolars, then bring them into the arch by using appropriate surgical techniques, and achieve acceptable occlusion with ideal overjet and overbite. The outline of the initial treatment plan is shown in Figure 3, F. The distal root of the mandibular left first molar, which was reabsorbed by the dentigerous cyst, underwent hemi-sectioning. Concerning the mandibular right second premolar, we selected orthodontic traction after marsupialization of the cyst. In contrast, the mandibular left second premolar was brought into the arch by autotransplantation. A miniscrew was implanted to move the hemi-sectioned mandibular left first molar mesially, isolate it from the impacted teeth, and produce adequate space for autotransplantation of the impacted mandibular left second premolar.
Fig 3. A, Pretreatment cephalometric radiograph; B, pretreatment cephalometric tracing (solid line) superimposed on a mean profilogram (dotted line); C, pretreatment panoramic radiograph; D, pretreatment computed tomography image of the maxilla; E, pretreatment computed tomography image of the mandible (the images represent consecutive slices taken from the level of impacted premolars); F, schematic outline of the initial treatment plan.
TREATMENT ALTERNATIVES

One therapeutic method proposed for the treatment of an impacted mandibular left second premolar is orthodontic traction after marsupialization of the cyst. However, the mandibular left second premolar was deeply and closely positioned next to the mesial root of the mandibular left first molar. Another alternative was surgical removal of the impacted teeth and replacement with implants or conventional prosthodontics after growth completion. This alternative is considered mostly for extremely malpositioned impacted teeth in uncooperative patients. The patient had a desire to preserve his own teeth as much as possible. After a thorough discussion, he decided to undergo autotransplantation.

TREATMENT PROGRESS

Initially, the mandibular second deciduous molars and impacted maxillary second premolar were extracted. A removable plate was used to correct the deep overbite and scissors-bite of the maxillary left second molar (Fig 4).

Then a marsupialization procedure was performed for the cyst-associated mandibular right second premolar. Five months after marsupialization of the cyst, orthodontic traction of the impacted tooth was initiated. A force was applied from the mandibular lingual arch with an elastic chain. Eight months after orthodontic traction, a 0.018 × 0.025-in preadjusted edgewise appliance was placed sectionally on both mandibular molars (Fig 4). After leveling and alignment with 0.016-in nickel-titanium archwires, a miniscrew was implanted between the mandibular left canine and the first premolar (Fig 4). After placement of the miniscrew, a ligature wire was used to connect the miniscrew to the mandibular first premolar to reinforce anterior anchorage. Lingual buttons were bonded on the lingual side of the mandibular left first premolar and the hemi-sectioned left first molar. Elastic chains were tied both labially and lingually from the mandibular left first premolar to the hemi-sectioned left first molar for mesial movement of the hemi-sectioned tooth (Figs 4 and 5).

Six months after mesial movement, adequate space was obtained for autotransplantation (Fig 5), and the impacted mandibular left second premolar was transplanted into the space. The autotransplanted tooth was fixed for 3 months by placing a 0.0175-in nickel-titanium archwire (Ormco, Glendora, Calif) between adjacent teeth. Occlusal adjustment was performed to prevent traumatic occlusion. By the end of the fixation period, endodontic treatment was started for the autotransplanted teeth. The pre-edgewise stage of cephalometric evaluation and superimposed cephalometric tracings showed a decrease in the ANB angle with mandibular growth (Table I).

The second phase of treatment began at age 16 years 6 months (Figs 6-9). An 0.018 × 0.025-in preadjusted edgewise appliance was placed for all brackets and bands. Initial alignment was achieved with 0.016-in nickel-titanium archwires. The leveling phase was completed with 0.016 × 0.022-in nickel-titanium archwires. The leveling stage took 4 months. Then stainless steel wires were positioned to coordinate both arch forms. Stainless steel 0.017 × 0.025-in archwires were placed for detailing. The total second phase of the treatment period was 19 months. After removing the edgewise appliance, the maxillary and mandibular teeth were stabilized by using bonded and Begg-type retainers. Fixed prosthetic restoration was performed for the hemi-sectioned and autotransplanted teeth to resolve tooth-size discrepancies.

TREATMENT RESULTS

After removing the fixed appliance, the impacted mandibular left second premolar was successfully aligned in
the mandibular arch after autotransplantation (Figs 10-12). The unilateral scissors-bite involving the left second molar was improved. The posttreatment panoramic radiograph showed good root parallelism and no marked apical root resorption or marginal or vertical bone loss of the periodontal tissues (Fig 12). Simultaneously, a Class II molar relationship was established on the right side with ideal overjet and overbite (Figs 10 and 11).

The posttreatment cephalometric evaluation and a superimposed cephalometric tracing showed that the mandibular incisors were slightly inclined labially (L1-Mp, 110.7°) and intruded by 1.9 mm (Fig 13, Table I). The dental midlines were almost coincident with the facial midline.

When we evaluated jaw movements after treatment, we found that the interincisal distance on maximal opening without pain had increased to 49 mm. Both the occlusal force and the occlusal contact area also increased (Table II). With a 6 degrees-of-freedom jaw movement recording system, a smooth and stable mouth open-and-close incisal path was achieved during
maximum open-and-close jaw movements (Fig 14, B). Additionally, increases in the condylar movement on both sides during maximum mouth opening and closing were observed.

Acceptable occlusion and a satisfactory facial profile were maintained during the 2-year retention phase, although a minor dental midline deviation occurred (Fig 15). The patient and his parents were satisfied with the results of the treatment.

DISCUSSION

Various surgical approaches and orthodontic techniques have been suggested for the treatment of impacted teeth. A dentigerous cyst can cause displacement or resorption of adjacent teeth, infection, and pathologic jaw fracture. Regarding the treatment of an impacted tooth with a dentigerous cyst in preadolescent children, removal of the entire cyst or marsupialization is the main treatment to preserve the cyst-associated tooth and promote its eruption. Orthodontic traction of the impacted tooth has often been performed after marsupialization if needed. Meanwhile, surgical removal of the tooth (extraction) is the usual treatment for cyst-associated impacted teeth in adult patients. This case report describes the management of a cyst-associated impacted tooth in a young adult.
Orthodontic treatment for the impacted tooth usually includes opening an adequate space with a fixed appliance to provide a more favorable alignment. Miniscrews have shown considerable potential as a straightforward alternative to simplify complicated cases for orthodontists. Miniscrews have gained wider acceptance for absolute anchorage during various types of tooth movement. We also used a miniscrew for orthodontic anchorage to solve the problem of space management and prevent some unintended counteractions, such as lingual tipping of the incisors and aggravation of the dental midline deviation. Without miniscrews, it might have been difficult to correct the interincisal relationship and the dental midline in this patient. Therefore, our report also demonstrates the usefulness of miniscrews in the treatment of cyst-associated impacted teeth.

Regarding both functional and esthetic aspects, fixed prosthodontic restoration such as a conventional bridge, a resin-bonded bridge, or a solitary implant is the treatment of choice when a single tooth is lost. Furthermore, tooth autotransplantation has become another method of treating certain orthodontic complaints. Autotransplantation is one of the treatment alternatives for replacing a missing tooth when a donor tooth is available. An advantage of this option is that it is a natural tooth rather than a prosthesis or an implant. Additionally, tooth transplantation allows dentofacial development and maintains the alveolar bone volume. The success rate has been reported to be excellent if the donor teeth are transplanted before root formation is complete. In addition, some studies have reported that autotransplantation is a reliable method leading to a favorable prognosis for donor teeth with closed apices if the teeth are endodontically treated. However, the long-term prognosis is questionable, with a potential for root resorption. In this patient, a cyst-associated tooth with completed root formation was autotransplanted and orthodontically moved after the initial healing period. As for the impacted mandibular left second premolar, orthodontic traction after marsupialization is another recommended treatment to preserve the cyst-associated tooth and promote its eruption. The successful eruption of dentigerous cyst-associated premolars is associated with many factors, including the age of the patient, tooth position, dental root formation, and mesiodistal angulation. Hyomoto et al mentioned that the angulation and the position of the impacted mandibular premolar in the alveolar bone were significant factors for eruption. The teeth showed less than an 80° tooth axis angulation.
Fig 8. A, pre-edgewise cephalometric radiograph; B, pre-edgewise cephalometric tracing (solid line) superimposed on a mean profilogram (dotted line); C, pre-edgewise panoramic radiograph.

Fig 9. Superimposed cephalometric tracings show changes from pretreatment to pre-edgewise stages: A, sella-nasion plane at sella; B, palatal plane at ANS; and C, mandibular plane at menton.
or were less than 9 mm deep in bone. Based on the results of their study, it might be appropriate to consider the autotransplantation of an impacted mandibular left second premolar by using the same criteria.

The autotransplanted tooth functioned over the 2 years of retention. Jonsson and Sigurdsson26 stated that 35 of 40 (87.5%) autotransplanted teeth reacted normally to orthodontic treatment, and the transplantation did not affect the long-term prognosis. However, further observation of the autotransplanted tooth is required because the long-term stability after treatment is unknown.

CONCLUSIONS

We treated a young adult patient with nonsyndromic bilateral and multiple dentigerous cysts. This report demonstrates several combined treatment approaches for a cyst-associated impacted tooth including the use of miniscrews, extractions, marsupialization, orthodontic traction, and tooth autotransplantation.

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REFERENCES


Fig 12. A, Posttreatment cephalometric radiograph; B, posttreatment cephalometric tracing (*solid line*) superimposed on a mean profilogram (*dotted line*); C, posttreatment panoramic radiograph.

Fig 13. Superimposed cephalometric tracings show changes from pre-edgewise to posttreatment stages: A, sella-nasion plane at sella; B, palatal plane at ANS; and C, mandibular plane at menton.
Fig 14. Condylar and jaw movements with a 6 degrees-of-freedom jaw movement recording system: A, pretreatment; B, posttreatment. C, Condyle; M, molar; I, incisor; R, right side; L, left side.
Fig 15. Postretention facial and intraoral photographs.