Case report

Severe dislocation of mandibular second premolar associated with deep ankylosis of primary molar

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Running title: Dislocation of permanent premolar by ankylosed primary molar

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Abstract

Background

Severe ankylosis is rare and any affected teeth are unlikely to exfoliate spontaneously. If left untreated, subsequent complications can develop.

Case Presentation

We treated a boy aged 10 years with a tooth affected by ankylosis for a long period, which caused dislocation of the mandibular second premolar. Because adjacent teeth were inclined, there was insufficient space for extraction and space regaining therapy was required.

Conclusion

It is important to properly determine the severity of the ankylosed tooth when it is detected and provide treatment with appropriate timing.

1. Introduction

Adhesion of alveolar bone to cementum is termed tooth ankylosis [1, 2]. The rate of prevalence of primary dentition ankylosis has been reported to range from 7-9% [2-4], with mandibular primary molars most commonly affected [5, 6]. The etiology of ankylosis is unclear, though genetic predisposition, excessive masticatory pressure, local metabolism disturbance, and trauma are considered to be possible causes [7]. Ankylosis is generally diagnosed in a clinical setting based on radiography findings. Tooth submergence or infraocclusion is generally the first indication, for which percussion and mobility tests are performed. An ankylosed tooth has a characteristic metallic sound and demonstrates lack of physiologic mobility due to fusion of alveolar bone with cementum [8]. Radiographic findings may show loss of the periodontal ligament and osteoid tissue between the tooth and alveolar bone [6, 9]. When a primary tooth is affected by early ankylosis, the subsequent permanent tooth can show ectopic eruption [10, 11].

Conservative follow-up examinations for patients with mild ankylosis is recommended. However, if the eruption path of the permanent successor is altered, or if an ankylosed molar is severely malpositioned and adjacent teeth are tilted to prevent eruption of the successor, extraction should be considered [7]. Nevertheless, some difficulties can be encountered depending on the position of the tooth to be extracted.

When extraction is difficult, it may be possible to remove the tooth after widening the area with space regain therapy, obtaining a clear view with use of an endoscope, or performance of a buccal corticotomy with a piezosurgery method [12-15].

Here, we present a case of severe dislocation of the mandibular second premolar caused by preceding deep ankylosis of the primary molar. Informed consent was obtained from the parents of the patient for publication of this case report and accompanying images.

2. Case report

A Japanese boy aged 10 years 6 months was referred to the Department of Pediatric Dentistry at Osaka University Dental Hospital with the chief complaint of impaired eruption of a primary tooth. Intraoral examinations revealed that the left mandibular first premolar and first permanent molar had erupted (Fig. 1A), while the mandibular left second premolar and second primary molar could not be confirmed. In addition, the alveolar bone height of the mandibular jaw was asymmetrical and the left side molar was not occluded (Fig. 1B, C). According to a medical interview with his mother, the mandibular left second primary molar had not yet emerged into the oral cavity. In addition, the mandibular left permanent molars had been found to be inclining towards the vacant space as they erupted, thus metal brackets and an open coil spring were applied from the age of 7 by another dentist. Thereafter, the patient came to our hospital for prevention of further space loss and to secure an adequate space until eruption of the mandibular left second primary molar.

Orthopantomography and cone-beam computerized tomography (CBCT) findings showed that the mandibular left second premolar and second primary molar were impacted (Fig. 2A-D). No space for the periodontal ligament of the mandibular left second primary molar was seen and there appeared to be no factor to prevent eruption of

the mandibular left second primary molar (Fig. 2A, B). Additionally, the mandibular left second premolar was shown to be located lingual from the mandibular left second primary molar (Fig. 2E-F). Because of ankylosis, extraction of the mandibular left second primary molar was needed while paying close attention not to damage the permanent successor. However, the space between the mandibular left first premolar and first permanent molar was determined to be only 3.5 mm, and not adequate for extraction, thus orthodontic therapy was performed to regain space to allow for extraction. Specifically, after applying new brackets to the mandibular left canine, and first premolar and first permanent molar an open coil spring was positioned between the mandibular left first premolar and first permanent molar, then adjusted once a month. Over a period of six months, the space had expanded to 7.5 mm (Fig. 3, 4A). In addition, space between the completely impacted mandibular left second primary molar and root of the mandibular left first premolar was obtained (Fig. 4B, C), which was considered to be adequate for extraction of the mandibular left second primary molar. It was decided to attempt to preserve the permanent successor and periodically observe its movement after extraction of the primary molar. 3D-CT image findings also indicated the need to pay attention to the mental foramen (Fig. 4D), while other imaging findings showed no change in the positional relationship of the mandibular left second premolar with the mandibular left

second primary molar (Fig. 4E-G).

Under local anesthesia, the lesion was approached with a submarginal incision from the mandibular left first premolar tooth to first permanent molar tooth (Fig. 5A), with attention given to the inferior alveolar nerve (Fig. 5B). After splitting the tooth, it was extracted (Fig. 5C, D). Orthopantomography findings confirmed that the mandibular left second primary molar had been fully extracted and the mandibular left second premolar remained undamaged (Fig. 5E). Following the extraction, the patient noted a change in sensation, considered to be paresthesia, though one month later that had nearly returned to normal.

At the time of writing, the course of the patient has been good. For maintaining space for the mandibular left second premolar and in anticipation of alveolar bone recovery in the mandibular left bicuspids area, the appliance will later be changed to a lingual arch. In addition, observations by orthopantomography to note movement of the premolar will be performed every six months. Should the premolar not erupt spontaneously, fenestration and traction approaches will be considered.

3. Discussion

The majority of ankylosed primary molar cases appear to be mild to moderate progressive infraocclusion [7] and conservative follow-up is typically performed, since most of the affected teeth undergo spontaneous exfoliation caused by eruption of the successor [8, 16]. Severe ankylosis, as seen in the present case, is rare and any affected teeth are unlikely to exfoliate spontaneously. If left untreated, subsequent complications can develop, such as inhibited eruption of the successor tooth, tipping of an adjacent tooth over an ankylosed tooth, decreased dental arch length, or supraeruption of an opposing tooth resulting in malocclusion [6]. As for the present patient, while the unerupted mandibular left second primary molar and erupted adjacent teeth were confirmed at around the age of 7 years, he had been under observation for the subsequent four years hoping to gain space in anticipation of eruption of the mandibular left second primary molar.

Ankylosis remained for a long period, thus the mandibular left second primary molar was completely impacted in a deep position and eruption of its successor was prevented, while vertical growth of the alveolar bone was inhibited and the alveolar bone height of the mandibular jaw became asymmetrical. When an impacted primary tooth is detected, it is important to confirm its position in relation to the succeeding permanent

tooth. Should eruption of the permanent successor be disturbed, extraction of the impacted tooth as soon as possible must be considered, with attention given to not to harm the tooth germ of the permanent successor. If there is a risk of damaging the permanent successor by extraction, a course of follow-up observations may be done. Disappearance of the periodontal ligament, shown by X-ray findings, is important to evaluate whether ankylosis is present [6, 9]. It is also important to note any movement of impacted teeth. In cases of ankylosis, the jaw appears to move to a relatively low position with jawbone growth [16].

When extraction is considered to be difficult, various measures may be necessary. In recent years, endoscopy and piezosurgery have been used to secure the field of vision, and deal with nerve damage and bleeding, depending on tooth position [13-15]. In addition, if space is needed for tooth extraction, space regain therapy can be effective [12]. Extraction space in the present case was of greater concern than dealing with visibility and nerves. Furthermore, the mandibular left first premolar and first permanent molar were inclined toward the vacant space, and their roots were shown to be in contact with the completely impacted mandibular left second primary molar. There was considered to be a high risk for damage to the roots of either adjacent tooth with extraction of the impacted tooth, thus orthodontic treatment was performed to facilitate extraction and

lower the risk of causing damage to the roots of adjacent teeth.

The reduction in alveolar bone level caused by ankylosis has been reported to normalize with eruption of the permanent successor, and no difference in marginal bone level between infra-occluded and normal sides was found in that study [17]. In the present case, the mandibular left alveolar bone height was lower than that on the right side and no occlusion was noted in the left bicuspid area. Therefore, with eruption of the mandibular left second premolar, it was anticipated that alveolar bone height might recover. However, the mandibular left second premolar was completely impacted by the distal tilting and its crown was found to be in contact with the mesial root of the mandibular left first permanent molar. Hence, careful monitoring of erupting direction was needed, and then fenestration and traction procedures would be considered if no ideal movements were observed.

In summary, we treated a juvenile with a tooth affected by ankylosis for a long period, which caused dislocation of the mandibular second premolar and required treatment prior to extraction. In order to minimize the burden on such affected patients, it is important to properly determine the severity of the ankylosed tooth when it is detected and provide treatment with appropriate timing.

Conflicts of interest

The authors hereby confirm that there are no known conflicts of interest associated with publication of this study as well as no significant financial support for this work that could have influenced the findings presented.

Figure legends

Fig. 1. Intraoral photograph taken at initial visit (10Y9M). **(A)** Affected region. **(B)** Right lateral view. **(C)** Left lateral view.

Fig. 2. X-ray images obtained at initial visit (10Y9M) (black arrows: mandibular left second primary molar, white arrows: mandibular left second molar). **(A)** Orthopantomography. **(B)** Sagittal view of CBCT. **(C, D)** 3D construction of affected region. **(E)** Coronal view of CBCT. **(F)** Axial view of CBCT. **(G)** 3D construction of affected region.

Fig. 3. Intraoral photograph obtained prior to extraction (11Y7M).

Fig. 4. X-ray images obtained prior to extraction (11Y4M) (black arrows: mandibular left second primary molar, white arrows: mandibular left second molar). **(A)** Orthopantomography. **(B)** Sagittal view of CBCT. **(C, D)** 3D construction of affected region. **(E)** Coronal view of CBCT. **(F)** Axial view of CBCT. **(G)** 3D construction of affected region.

Fig. 5. Intraoperative appearance (11Y7M). **(A)** Mental nerve (black arrow). **(B)** Impacted mandibular left second primary molar (white arrow). **(C)** After extraction. **(D)** Extracted tooth. **(E)** Post-operative orthopantomography after extraction.

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