

## Occlusal guidance for eruption disturbance of mandibular second premolar: a report of three cases

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*This study presents the treatment courses in three impacted cases of mandibular second premolars caused by distal inclination of the tooth germs. In all cases, the second premolars were surgically exposed, but the traction periods until oral emergence differed. The reasons for the differences may be the variation in the severity of the distal inclinations of the tooth germs and the calcified development of the affected germs at fenestration.*

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### INTRODUCTION

Eruption of mandibular premolars can be disturbed in several ways. The most frequent causes are space loss and ectopic position of the tooth germ.<sup>1,6</sup> Other etiologies are obstacles in the eruption path such as ankylosed primary molars,<sup>4,7</sup> odontogenic cysts<sup>1</sup> and the presence of supernumerary teeth or odontomas.<sup>1,8</sup> Finally, a genetic origin is sometimes found.<sup>9</sup>

Of 493 teeth (415 children) which had been treated for eruption disturbance at the Pediatric Dental Clinic of Niigata University Dental Hospital, 30 (6.1%) were mandibular second premolars that occupied 28.5% of all mandibular affected teeth.<sup>10</sup> The aims of this study are to present the treatment courses in three cases of impacted mandibular second premolars caused by distal inclination of the tooth germs, and to discuss the appropriate time to begin the treatment.

### REPORT OF CASES

In Cases 1 and 2, the patients first visited the Pediatric Dental Clinic of Niigata University Dental Hospital for caries treatment at the ages of 4 years 0 months and 2 years 0 months, respectively. In each of these cases, radiographs taken during our routine periodical examination revealed distal inclination of the mandibular permanent second premolar. In Case 3, the patient was referred to our clinic by a private dentist because of an impacted premolar. Details of the present cases at diagnosis are shown in Table 1. Classification of the root formation conformed to the method described by Moorrees *et al.*<sup>11</sup>

In a few textbooks<sup>9</sup>, the inclination of the ectopic premolar germ is described, but the precise method of measurement cannot be defined.

Figure 1 shows the present method for premolar inclination ( $\alpha$  degrees) that can be used even when the predecessor is absent. This measurement seems to be useful clinically, since the difficulty of the treatment depends on the degree of inclination against the first molar even if the molar is tilted.

The treatment courses of the affected premolars are shown in Figure 2.

### CASE 1

An 8-year-0-month-old female visited our clinic for a regular check-up. The tooth germ of her mandibular left second premolar, in an initial calcified stage of the crown (Moorrees's stage Coc), showed severe distal inclination on an orthopantomogram (Figure 3A). The crown formation of the affected left premolar was delayed in comparison to the antimere. Since the distal inclination was not improved after an observation period lasting for the next 3 years and 10 months, in spite of the root calcification (Moorrees's stage R<sub>1/4</sub>), the deciduous predecessor was extracted and traction was started (Figure 3B). The impacted premolar altered

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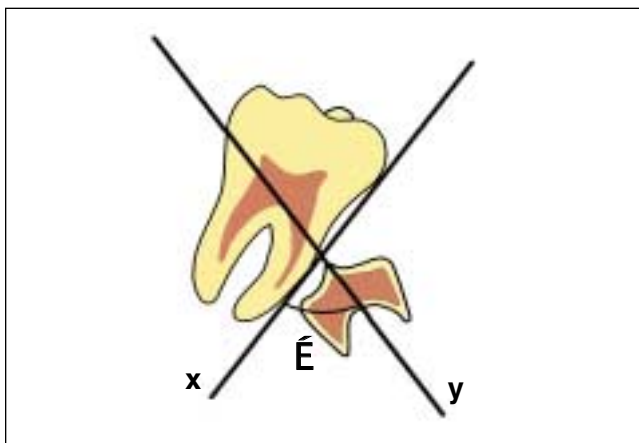
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**Table 1.** Present three cases

Case no.	Sex	Affected side	Age at diagnosis	Inclination of tooth germ ( $\alpha$ degrees)	Radiographic findings	
					Tooth development Affected side	Unaffected side
1	F	L	8y0m	138	Coc	Cr <sub>3/4</sub>
2	M	R	9y5m	60	Cr <sub>3/4</sub>	Agenesis
3	F	R	10y2m	88*	Crc*	R <sub>3/4</sub> *

\* Radiographic findings in Case 3 were obtained at the time of her first visit to our clinic.



**Figure 1.** Method for measurement of the premolar inclination on the orthopantomogram. The angle ( $\alpha$  degrees) between the axis of premolar and line on the medial surface of the permanent first molar indicates the distal inclination of the premolar.

the angulation gradually within the alveolar bone for 6 months and exhibited oral emergence soon after fenestration (Figure 3C). Thereafter, the tooth was aligned and retained within the dental arch for 2 years and 7 months (Figure 3D).

### CASE 2

Intraoral radiographs of a 9-year-5-month-old male revealed that his mandibular right second premolar (Moorrees's stage Cr<sub>3/4</sub>) showed mild distal inclination (Figure 4A). The contralateral premolar was of agenesis. At this time, his mandibular right second primary molar was extracted in order to improve the distal inclination of the permanent tooth germ. Two years after this extraction, the crown of the impacted second premolar (Moorrees's stage Ri) was exposed, since the distal inclination still remained (Figure 4B). The affected premolar received traction 4 months after fenestration and began to erupt into the oral cavity 3 months later (Figure 4C). Two years after the beginning of traction, occlusal guidance and retention of the premolar were finished (Figure 4D).

### CASE 3

A private dentist extracted the mandibular right second primary molar of a 10-year-2-month-old female to

improve the severe distal inclination of the successor (Figure 5A). Since the inclination improved slightly, but still remained after one year and 6 months, she was referred to our clinic and received fenestration of the premolar (Figure 5B). The tooth formation (Moorrees's stage Crc) of the affected premolar was delayed in comparison with the contralateral premolar. The angulation of the premolar improved gradually within the bone after fenestration (Figure 5C). One and a half years after fenestration, the premolar started to erupt without traction (Figure 5D). Occlusal guidance and wearing of a retainer were finished two years later (Figure 5E).

### DISCUSSION

The overall frequency of mandibular premolar impaction in all populations has been found to range from 0.1 to 0.3%.<sup>9,12,13</sup> Among impacted teeth of young subjects at our university hospital, premolars are third in frequency after maxillary central incisors and canines.<sup>10</sup> Many etiological factors can be associated with unerupted premolars, including space loss, ectopic position of tooth germs, obstacles in the eruption path and genetic origin.<sup>1-9</sup> The second premolar can develop with variable degrees of rotation and inclination. According to Rose,<sup>14</sup> there is more often a distal rather than a mesial inclination in the mandible. In the present three cases, the premolars were impacted in the bones with the crowns tipped distally.

Treatment plans for the ectopic inclined premolar should consider three factors: the development stage of the tooth, the severity of deviation from the normal eruption path, and the space condition. However, before we decided on any treatment, we should consider the possibility of self-correction of the inclination. In some young patients, spontaneous eruption may take place.<sup>15</sup> If after a short observation period spontaneous uprighting has not occurred, an active treatment, such as extraction of a predecessor, fenestration of the crown and/or traction, would be selected.

When the primary molar and the premolar are very close to each other, extraction of the primary molar is indicated to activate and guide the eruption process.<sup>9</sup>

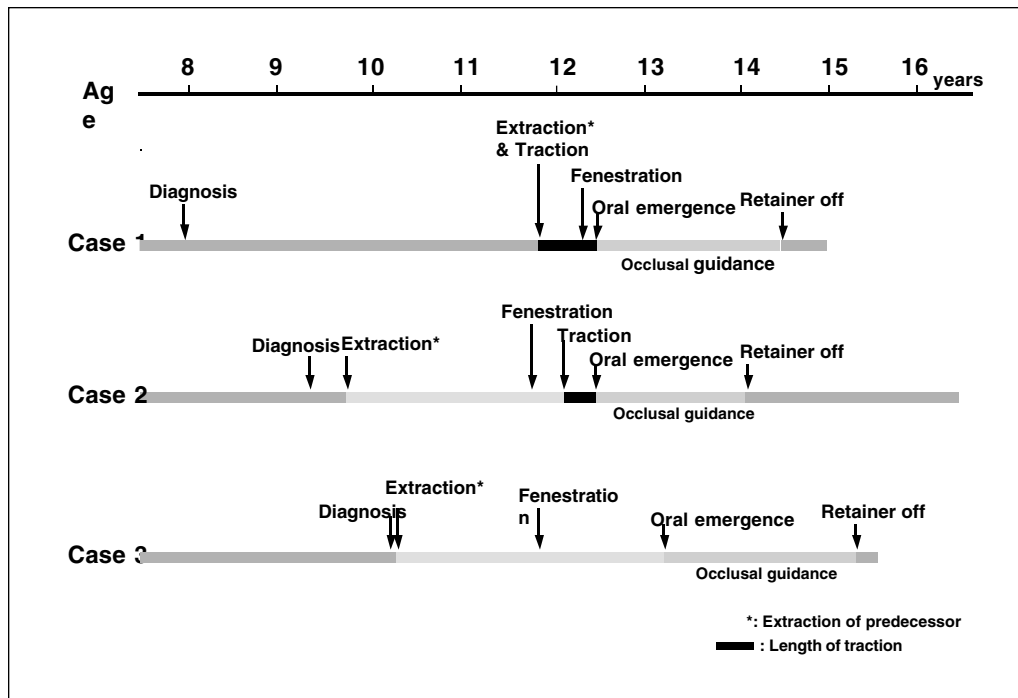


Figure 2. Treatment courses of the three cases.

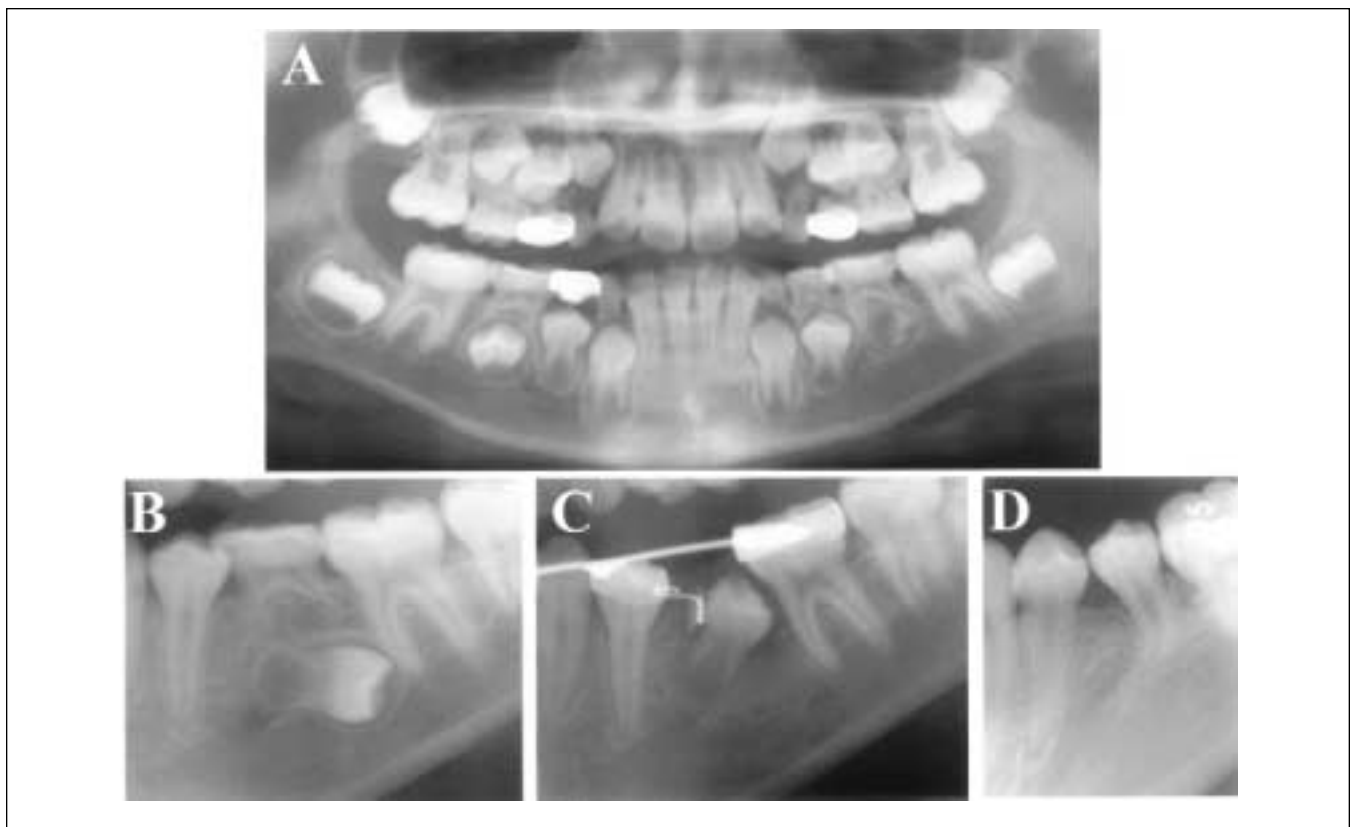
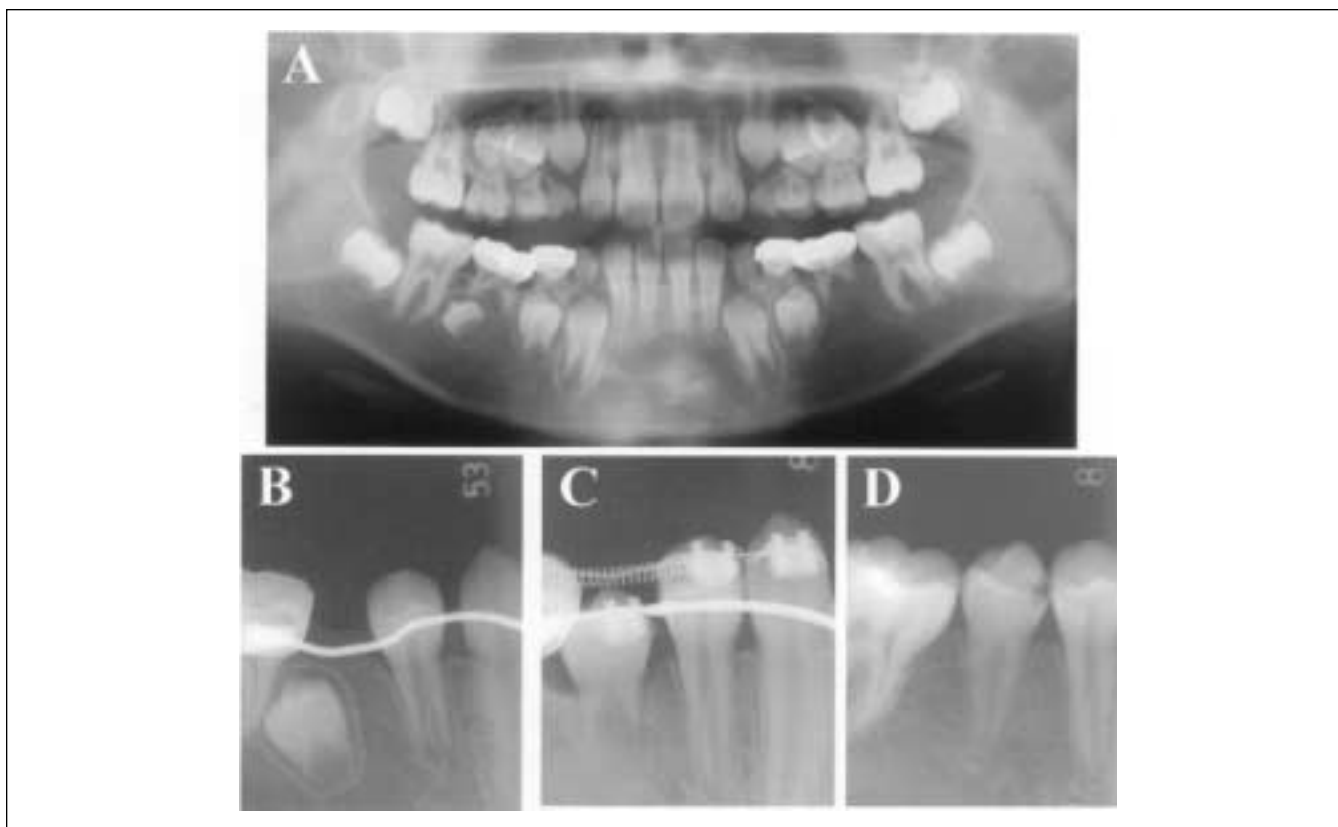


Figure 3 Case 1.

- (A) Panoramic radiograph of an 8-year-0-month-old female, showing severe distal inclination (138 degrees) of the tooth germ of the mandibular left second premolar.
- (B) At 11 years 9 months (at the time of extraction of the predecessor and traction).
- (C) At 12 years 4 months. Note the oral emergence of the second premolar.
- (D) At 14 years 5 months. Occlusal guidance is finished.



**Figure 4 Case 2.**

- (A) At 9 years 5 months. The mandibular right second premolar is distally oriented (60 degrees) and the crown is partly formed. Radiograph revealed congenital absence of the mandibular left second premolar.  
 (B) At 11 years 5 months (at the time of fenestration).  
 (C) At 12 years 6 months. Note the oral eruption of the second premolar.  
 (D) At 14 years 1 month. Treatment completed.

According to Collett,<sup>6</sup> however, even an unfavorably inclined and deeply located premolar within the alveolus could successfully erupt with the removal of a predecessor.

In Cases 2 and 3, the affected premolars improved the inclination after extraction of the predecessor. The calcified stage of both teeth at the extraction was Moorrees's stage  $Cr_{3/4}$ .

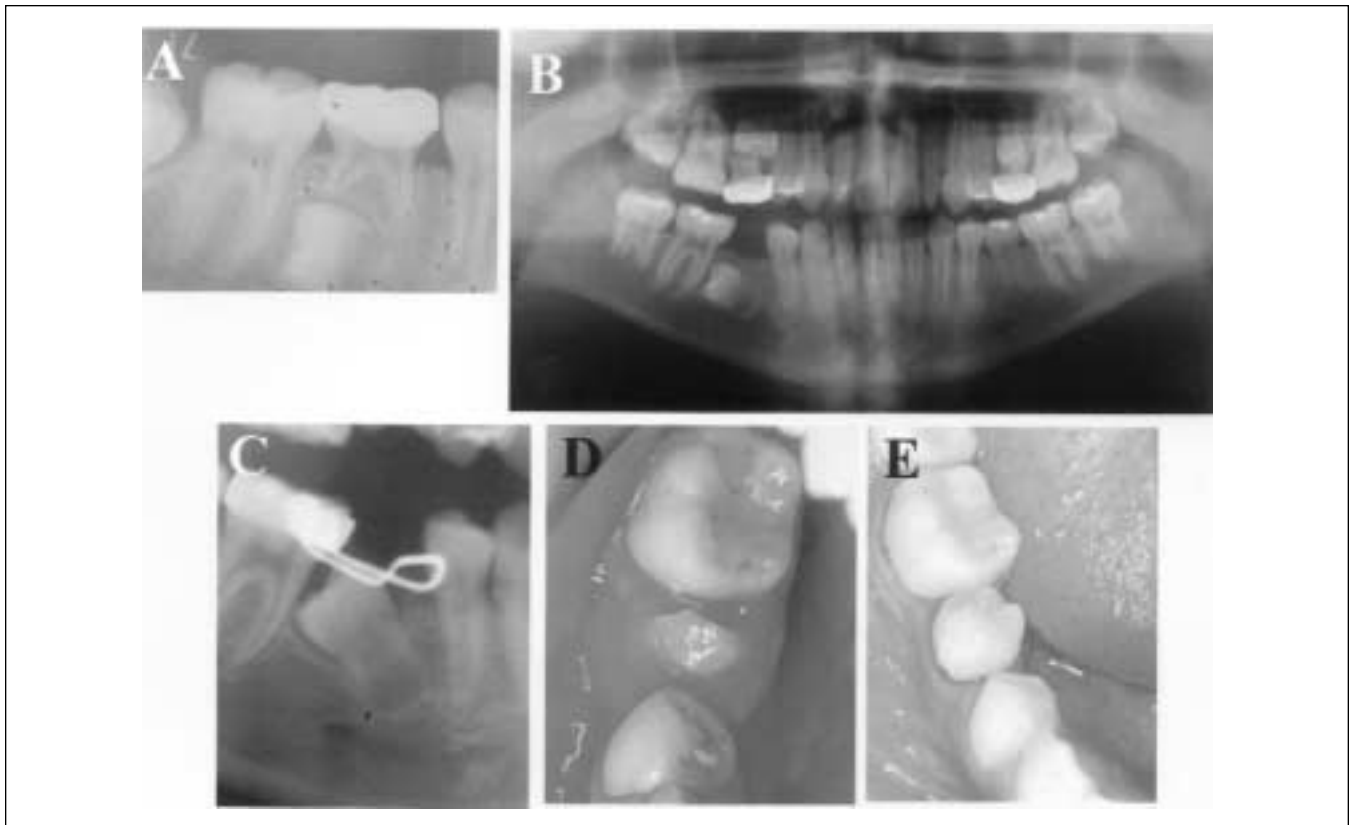
In Case 1, during the observation period until extraction of the primary molar after detection, the root calcification was advanced to Moorrees's stage  $R_{1/4}$ . Earlier extraction during crown formation might support the self-correction of the premolar within the alveolar bone and shorten the traction period.

According to Andreassen<sup>9</sup> when the distally inclined angle of the premolar is limited to 45 degrees, surgical exposure is usually successful. He also illustrated successful and unsuccessful cases after only exposure of horizontally inclined premolars. Traction is used to guide eruption if the premolar does not move toward eruption within the bone after the surgical exposure.<sup>4,6</sup>

In the present three cases, the traction periods until oral emergence varied: 7 months in Case 1, 3 months in

Case 2 and no need in Case 3. One of the reasons for this variation may be the severity of the distal inclination of the tooth germ. However, this has no relation with the conflict of treatment sequences between Cases 2 and 3. In spite of the mild inclination, the premolar in Case 2 needed traction. The difference in the calcified development of the germ after extraction of the predecessor may be related to the treatment sequence. Until fenestration was performed, the premolar germ in Case 2 developed into  $Ri$  from  $Cr_{3/4}$ , whereas the germ of Case 3 developed slowly into  $Crc$ . If earlier fenestration of the premolar in Case 2 had been done before the initiation of root formation, spontaneous eruption might be expected without traction.

Recently, autotransplantation of the ectopic tooth germ of a premolar has been shown to be effective when the position deviates 90 degrees or more from normal.<sup>9</sup> However, this procedure carries the risks of injury to the periodontal ligament, and the damage to the pulp that may induce root resorption and pulp necrosis.<sup>9,16</sup> Autotransplantation may be chosen if eruption fails to occur after an affected premolar has received fenestration and traction.



**Figure 5 Case 3.**

- (A) At 10 years 2 months (at the time of extraction of the second primary molar).  
 (B) At 11 years 9 months (at the time of her first visit to our clinic). The second premolar tooth germ is tilted distally (88 degrees).  
 (C) At 12 years 11 months (3 months after fenestration).  
 (D) At 13 years 7 months. Note the oral emergence.  
 (E) At 15 years 4 months. Occlusal guidance is complete.

In Cases 1 and 3, the affected premolar germs developed later than the corresponding teeth in the contralateral side. In Case 2, although the contralateral premolar was of agenesis, the affected premolar seemed to be slightly late in development. Johnsen<sup>1</sup> also pointed out the delayed root development of affected teeth. The present type of anomalies may be related to the late development of the tooth germ.

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