Retarded eruption of maxillary second premolars associated with late development of the germs

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This study focused on five unusual cases with anomalous eruptions of the maxillary second premolars that related to late development of the germs. In four cases, the affected premolars erupted between the ages of 12y3m and 14y6m. In one case, which was suspected to include bilateral anomalies, the eruption of the premolar was excessively late, continuing up to 17y8m old. It was surmised that the degree of tooth formation in the contralateral side might help to predict approximately at what age the late premolars will erupt.
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INTRODUCTION

Not only pediatric dentists, but also general dentists, frequently encounter eruption disturbances of permanent teeth during mixed dentition in children. Although there have been many reports on eruption disturbances of the maxillary permanent central incisor,[1-5] canine[6-9] or first molar,[10-12] there have been few on maxillary premolars.[13] In our previous report, 14 eruption disturbances were detected on 12 maxillary first premolars (2.4%) and 17 second premolars (3.5%) of 470 permanent teeth that had been noticed or treated in patients aged 4 to 16 years at the Pediatric Dental Clinic of Niigata University Dental Hospital between 1979 and 1996. Besides space loss due to early exfoliation of the predecessor teeth, eruption disorders of maxillary premolars were often caused by aberrant eruptive direction or anomalous tooth germ positions. Among the 17 cases of anomalies in the eruption of the second premolars, five were associated with late development of the germs. The present study focused on those cases and the prognoses.

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MATERIALS AND METHODS

Between 1979 and 2000, 30 patients with eruption disturbances of 36 maxillary permanent premolars were diagnosed and/or treated at the Pediatric Dental Clinic of Niigata University Dental Hospital. Out of all affected premolars, 11 were maxillary first premolars and 25 were second premolars. The causal factors that were surmised to have induced the eruption disturbances of the second premolars were classified into four categories in decreasing order as follows. Cases caused only by space deficiency due to early loss of primary molars were not involved because this cause was considered only secondary.

1. Aberrant eruptive direction (too-far palatal or mesio-distal direction, 14 premolars),
2. Anomalous tooth germ position (too-far mesio-distal positioning, five premolars),
3. Late development of the tooth germ (five premolars),
4. Transposition of the canine (one premolar).

The present materials comprised five, second premolars associated with late development of the germs in two males and three females aged 8y6m to 11y9m (Table 1). The deciduous predecessors, except for Case 1, remained at the detection of the anomaly in the tooth formation. The deciduous predecessor in Case 1 was extracted to accelerate eruption of a proximal huge first molar fused with a supernumerary tooth a half year before detection of the premolar germ.

RESULTS

As shown in Table 2, the tooth formation of all affected second premolars was retarded, compared to those in the contralateral side, according to the classification of Moorees.[15] Except for Case 1, although four retarded premolars were in crown calcification, the contralateral

Table 1. Distribution of the patients

Case No.	Sex	Affected side	Age at detection
1	F	L*	10y 5 m
2	M	R	8y 6 m
3	F	L	9y 6 m
4	F	L	8y 10 m
5	M	L	11y 9 m

*This case was suspected to include bilateral anomalies

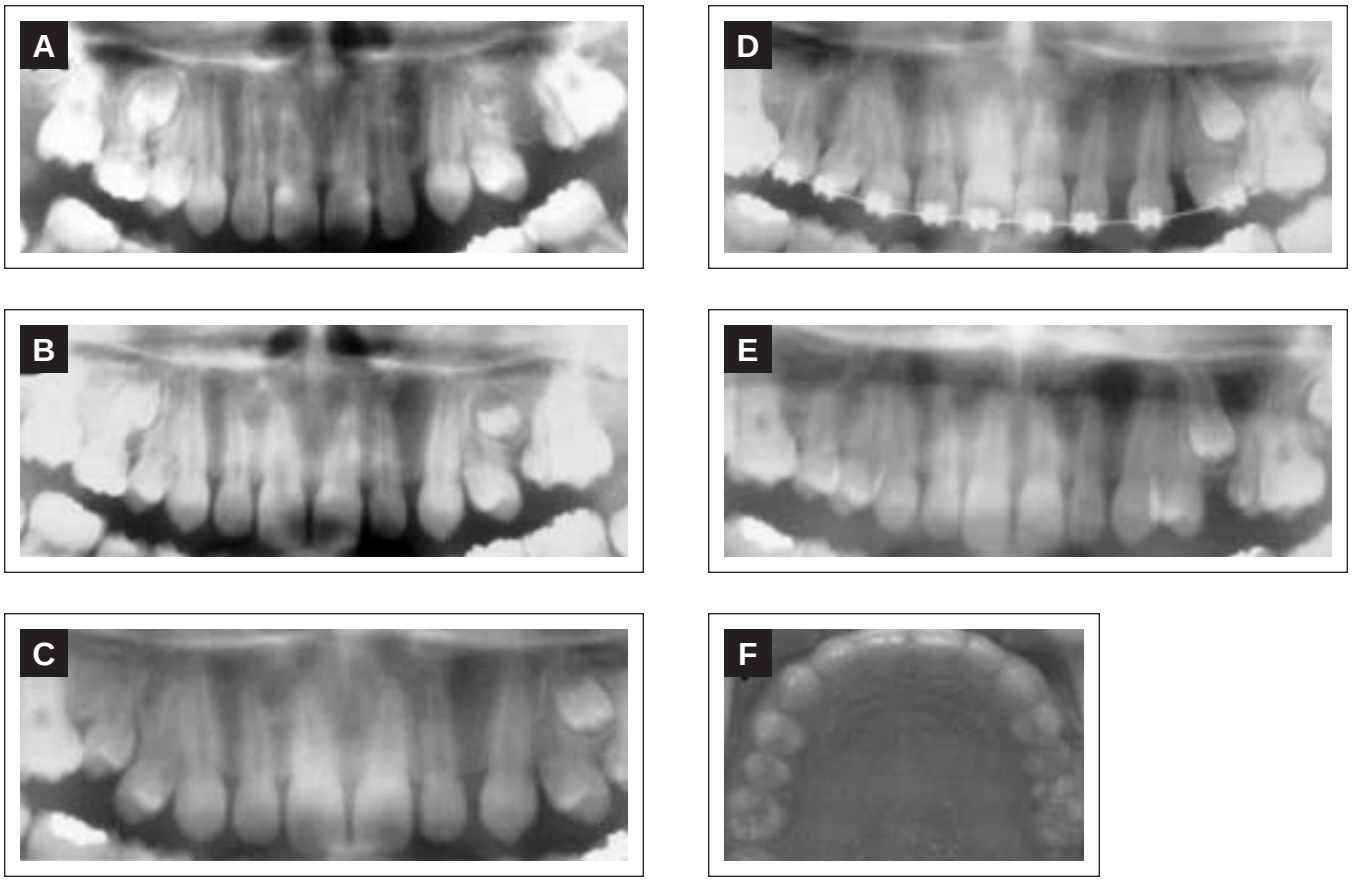

Figure 1. CASE 1. The tooth germ of the left second premolar was noticed at the age of 10y5m **(A)**. It slowly developed during about 7 years between **B and E:** B at 11y10m, C at 13y5m, D at 15y6m, and E at 17y3m, respectively. Eruption space for it was started to reform at D. After surgical exposure at the time of E, the premolar began to erupt. At the age of 17y8m, eruption was completed **(F)**. Note the development of the antimere tooth germ of the opposite side is also retarded.

corresponding premolars had started the root formation (Figures 1-4).

In Case 1, the left first molar proximate to the affected premolar fused with a supernumerary tooth (Figure 1). The tooth germ of the left second premolar was detected at the age of 10y5m. The calcification of the right second premolar was also suspected to be retarded, since the adjacent first premolar fully erupted and the root was more than half-length. The left second premolar erupted after the eruption space was reformed, and subsequent exposure was performed.

In Case 3, the deciduous predecessor of the retarded second premolar was submerged too deeply to succeed in traction, so it was extracted (Figure 3). The affected

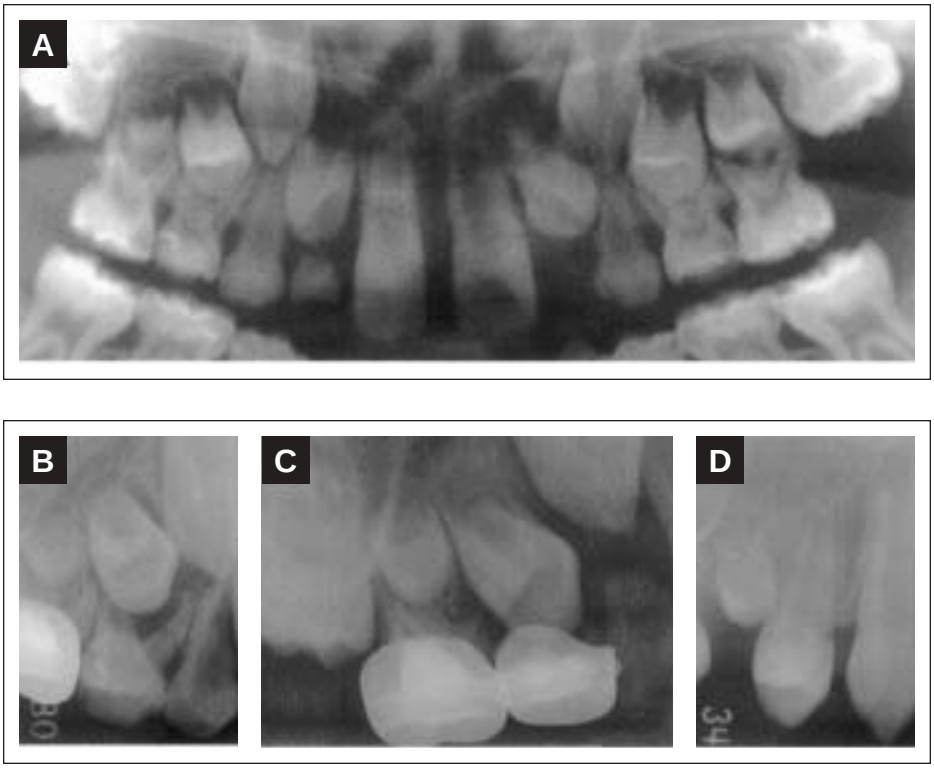

Figure 2. CASE 2. The calcification of the right second premolar was noticed at the age of 8y6m **(A)**. The tooth germ developed gradually **(B-D):** B at 9y1m, C at 9y10m, and D at 11y11m, respectively. The predecessor was extracted at the age of 11y6m. The premolar erupted at 12y3m and the crown showed microdontia at that time.

premolars in Cases 3 and 4 were positioned mesially upon the tooth germ of the adjacent first premolar (Figures 3 and 4). Although space control was needed in Cases 1, 3 and 4, the other affected premolars erupted spontaneously after extraction of the predecessors.

Periods until oral emergence of the retarded premolars showed a wide distribution, ranging between 9m and 7y4m after detection (Table 2). Microdontia was confirmed in three affected premolars after eruption.

DISCUSSION

Calcification of the second premolar usually begins at the age of two to two-and-a-half years, and crown formation is usually completed at 6 to 7 years old.[16] It has also been reported that wide ranges exist for premolar calcification time, and that it is not rare for a mandibular second premolar to start calcifying after the age of five years.[17,18] However, it seems infrequent for calcification in a maxillary second premolar to be delayed as much as it is in the present cases. As shown in Cases 1 and 5, we should note the possibility that the maxillary premolar started mineralization when the patient was around 10 to 11 years old. Unfortunately, in Case 1, our treatment plan erred in not involving a space maintainer after extraction of the deciduous predecessor. We made this error because the successor appeared as agenesis at that time.

In Japanese children, eruptive movements of the second premolars within the bone start at the age of 9 to 10 years when root formation is initiated and oral emergence takes place at the mean age±standard deviation of 10.6±1.3 years in females and 11.0±1.3 years in males.[19] In the present cases, except the male in Case 2, four premolars were delayed in eruption beyond the mean value plus a standard deviation according to the chronological age. As shown in Table 2, the degree of tooth formation in the contralateral comparison side may help to predict approximately at what age the late premolars will erupt. In Cases 2, 3 and 4, the tooth formation stage of the comparison side was $R_{1/4}$ at detection, and the late premolars erupted after 3y7m to 5y0m. In Case 3, the prolongation of the period before eruption of the affected premolar may be attributed to excessive malpositioning of the tooth germ. In Case 5, the retarded premolar, of which only the crown was completed, erupted relatively early, at 9 months after detection, and the formation stage of the antimere was $R_{3/4}$. On the other hand, the affected premolar in Case 1 needed the longest period, 7y4m, until eruption among the present cases, and the contralateral premolar was in C_{co} at detection in this case.

It is also interesting that the second premolar in the contralateral side of Case 1 was delayed in eruption at the age of 13.5 years. Additionally, since the

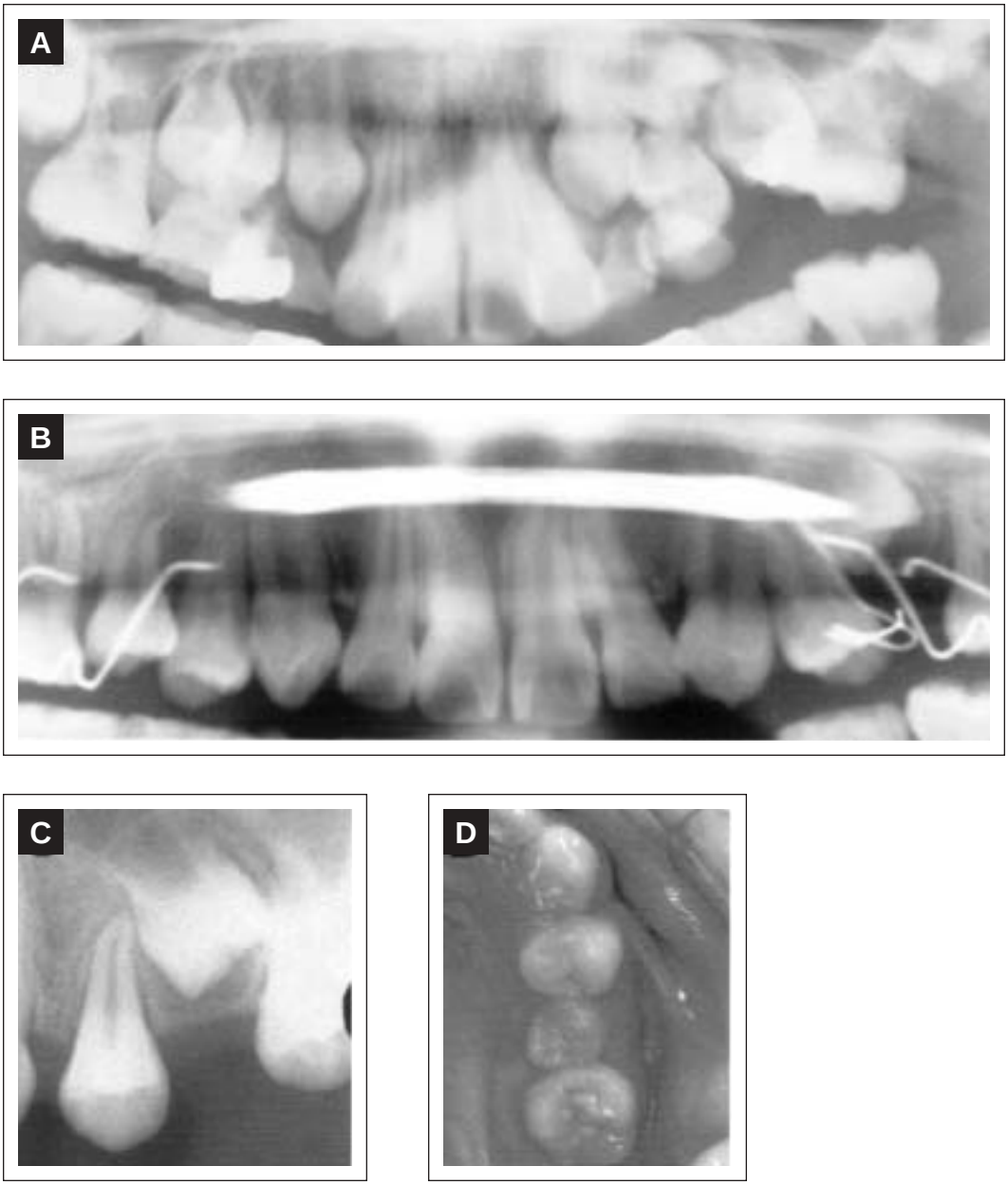

Figure 3. CASE 3. The left second premolar positioned high with late development of the germ at the age of 9y6m **(A)**. Its predecessor showed severe infraocclusion and was extracted at that time. Space control for eruption was performed from 11y1m **(B)**, and the affected premolar moved toward eruption within the bone **(C)**, 11y11m old). The premolar with microdontia erupted at the age of 14y6m **(D)**.

calcification of the germ seems to be late in comparison with the adjacent first premolars, Case 1 may have bilateral late development of the second premolar. After eruption of the affected premolars, microdontia could be confirmed in three of the five cases. The prevalence rates of bilateral occurrence and microdontia would be clarified by further investigation dealing with large samples.

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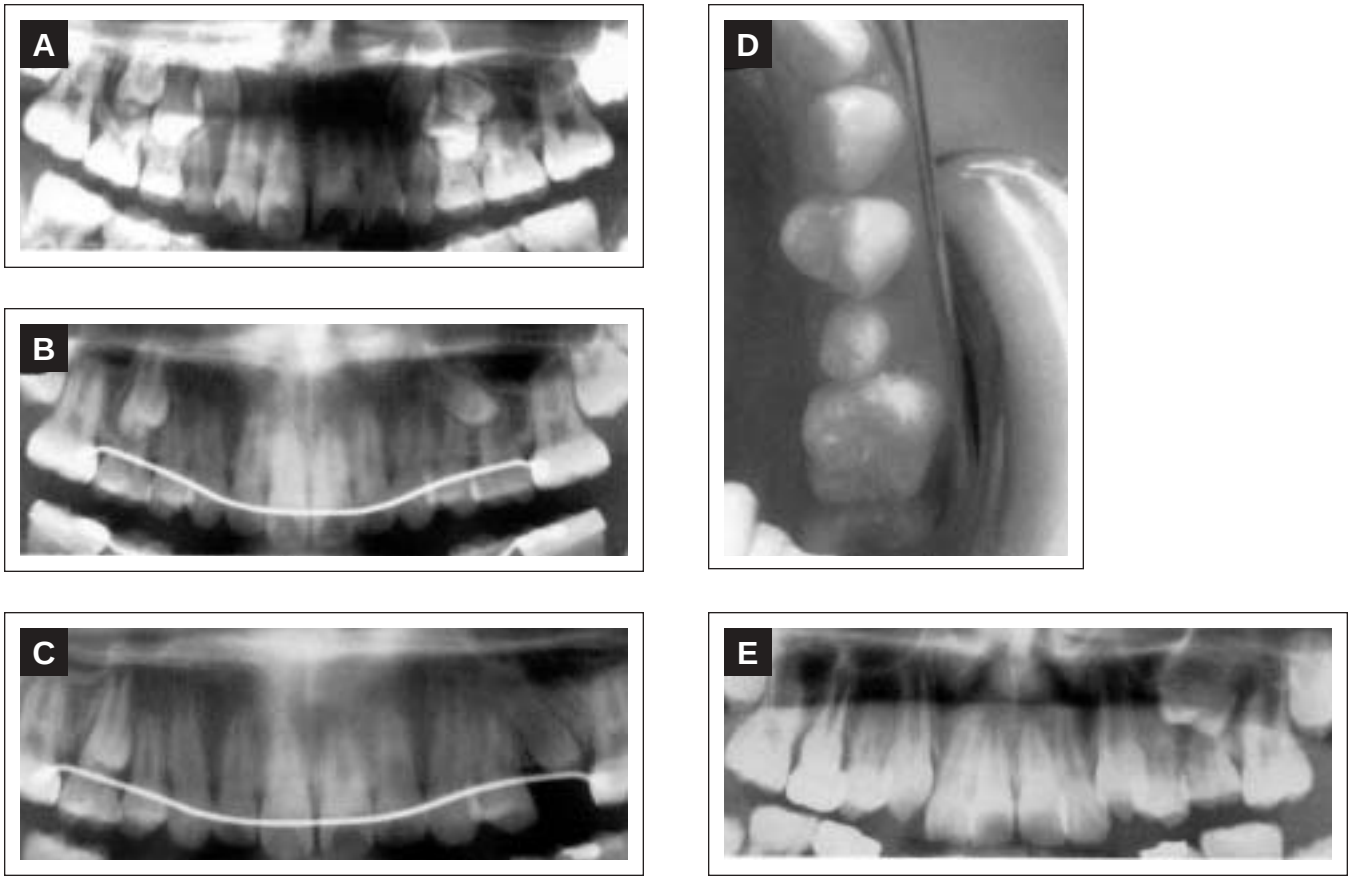

Figure 4. CASES 4 (A-D) and 5 (E). In Case 4, the tooth germ of the left second premolar developed late at the age of 8y10m, positioning itself mesially high **(A)**. Its predecessor was extracted at the age of 11y1m **(B)**, and oral emergence of the late premolar was noticed at 12y1m **(C)**. The premolar showed microdontia after eruption at 12y5m old **(D**). In Case 5, the left second premolar showed late development at the age of 11y9m **(E)**, and the predecessor was extracted at this time. It erupted after 9 months.

Table 2. Conditions at detection and periods until oral emergence of the affected premolars

Case No.	Stage of tooth formation* at detection		Microdontia	Period until oral emergence after detection (Age at oral emergence)
	Affected side	Contralateral side		
1	C_{co}	Cr_{c}	–	7y 4m (17y 8m)
2	C_{co}	$R_{1/4}$	+	3y 9m (12y 3m)
3	$Cr_{1/2}$	$R_{1/4}$	+**	5y 0m (14y 6m)
4	Cr_{c}	$R_{1/4}$	+**	3y 7m (12y 5m)
5	Cr_{c}	$R_{3/4}$	–	9m (12y 6m)

*The classification is in accordance with Moorees et al.[15]
C: cusp, Cr: crown, R: root"
co: coalescence, c: complete"
**Mesial positioning of the germ

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