

Developmental Anomalies of Permanent Lateral Incisors in Young Patients

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Objective: To elucidate the prevalence of developmental anomalies of permanent lateral incisors among young patients in Japan. **Study design:** A total of 1375 patients were observed between 1990 and 2008 at the Department of Pediatric Dentistry in the Kyushu Dental College Hospital and four private pediatric dental clinics in Kitakyushu City. Panoramic and periapical radiographs were examined for all those patients aged 5 to 19 years. **Results:** The prevalence of agenesis of the lateral incisors was 7.3% (100 patients), with more girls than boys being affected. The prevalence rates of absent upper and lower lateral incisors were 2.7 and 4.8 % (34 and 63 patients), respectively. Nine (0.7 %) of the total patients had microdontia. Eruption disturbance was present in five patients (0.4 %). Two of five patients presented with a disturbed eruption owing to an odontoma or a supernumerary tooth. **Conclusion:** In our study, the prevalence of agenesis of the lateral incisors was higher in Japanese children than in other populations, and eruption disturbance occurred less frequently than agenesis and microdontia. Nevertheless, the early differential diagnosis of an eruption disturbance is important in order to begin appropriate treatment at the optimal time.

Keywords: lateral incisors/congenitally missing teeth/microdontia/eruption disturbance
J Clin Pediatr Dent 33(3): 211–216, 2009

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INTRODUCTION

Hypodontia is one of most common human dental developmental anomalies afflicting permanent dentition and can result in the agenesis of one or more teeth. In many studies, the most common missing tooth was the mandibular second premolar, excluding the third molars.¹⁻³ Stamatiou and Symons (1991)⁴ reported that upper lateral incisor agenesis was the most common form of hypodontia among Caucasian patients. Interestingly, several studies have reported that the prevalence of congenitally missing lateral incisors was higher in Asian populations than in other populations.^{3,5,6} Endo *et al* (2006)³ suggested that these findings may be attributable to the ethnic characteristics of Japanese or Mongoloid populations.

Pinho *et al* (2005)⁷ reported that the prevalence of upper lateral incisor agenesis was closely associated with upper lateral microdontic teeth. Dental anomalies such as tooth absence and lateral incisor malformations have an obvious impact on facial esthetics, and hypodontia patients may require subsequent orthodontic treatment or prosthetic tooth replacements.^{8,9} Japanese clinicians believe that systemic degeneration in human evolution during recent decades has caused the high prevalence of congenital agenesis and lateral incisor microdontia in Japanese children. However, to date, no evidence of this theory is documented. Furthermore, very few studies have reported on lateral incisor developmental anomalies in Japanese children and adolescents.

In the present study, we examined the prevalence of

developmental dental anomalies, including agenesis and malformation, as well as eruption disturbances of the permanent lateral incisors in Japanese children and adolescents.

MATERIALS AND METHODS

Sample and methods

This research was performed in the Department of Pediatric Dentistry of Kyushu Dental College and in four private pediatric dental clinics in Kitakyushu, Japan, using 1375 panoramic and periapical radiographs (652 boys, 723 girls) taken between 1997 and 2008. The patients were between five and 19 years of age. Patients with developmental anomalies such as ectodermal dysplasia, cleft lip or palate, or Down's syndrome and those who had undergone prior orthodontic treatment were excluded from the study.³

Cases of an eruption disturbance, impaction, microdontia, and congenitally missing teeth were documented. The radiographs were evaluated in terms of the location of the affected teeth and the eruption pattern, and similar teeth on the contralateral side and opposite jaw were analyzed. First, one examiner evaluated the radiographs in a standardized manner under good lighting conditions. Then, all of the radiographs showing evidence of agenesis and impaction were re-examined by another examiner. Inter-examiner conflicts were resolved by consensus.¹⁰

All materials were obtained with informed consent based on ethical principles incorporated in the World Medical Association's Declaration of Helsinki.

Statistical Methods

All of the data were analyzed using the chi-squared test or Fisher's exact test. The level of significance was set at $p < 0.05$.

RESULTS

Of the 1375 radiographs that were examined, 111 (8.1 %; 34 boys and 77 girls) showed probable developmental anomalies of the lateral incisors. The difference in prevalence between the boys and girls was significant ($p = 0.000$; Table 1).

Table 1. Distribution and prevalence of developmental dental anomalies of lateral incisors in 1375 patients

	Boys (n = 652)	Girls (n = 723)	Total (n = 1375)	%	<i>p</i> value
Dental anomalies	n = 34	n = 77	n = 111	8.1	0.000
Congenitally absence	27	73	100	7.3	0.000
Microdontia	3	6	9	0.7	0.152
Impaction	3	1	4	0.3	0.351
Ectopic eruption	1	0	1	0.1	0.474
Fusion	1	1	2	0.2	1.000
Total patients with dental anomalies	35	81	116*		

* Five patients had both congenitally absence and microdontia of lateral incisors.

Congenitally missing lateral incisors

Agenesis of one or more lateral incisors was determined in 100 patients, giving a prevalence of 7.3 % (Table 1). The 100 patients, comprising 27 boys (4.1 % of boys) and 73 girls (10.1 % of girls), were missing a total of 133 lateral incisors: 51 from the upper jaw and 82 from the lower jaw; 76 from the right side and 57 from the left side (Table 2). The incidence of missing teeth differed significantly between boys and girls ($p = 0.000$; Table 1). However, there was no significant difference in the number of missing teeth between the upper and lower jaws or between the right and left sides ($p = 1.000$).

The distribution of lateral incisor agenesis is shown in Table 3. Thirty-four (10 boys, 24 girls) of the 100 patients exhibited lateral incisor agenesis in the upper jaw (2.5 % of the total patients), and 63 patients (16 boys, 47 girls) presented with lower jaw lateral incisor agenesis (4.6 % of the total patients). Three patients (1 boy, 2 girls) had lateral incisor agenesis in both arches (0.3 %). There was no significant difference in the prevalence of lateral incisor agenesis between the upper and lower jaws ($p = 0.885$).

The distribution patterns of the missing teeth in lateral incisor agenesis are shown in Table 4. Among the 100 patients with congenitally missing lateral incisors, 71 patients (71.0 %; 14 boys, 57 girls) had agenesis of one tooth and 26 patients (26.0 %; 12 boys, 14 girls) had agenesis of

Table 2. Distribution of the number of congenitally lateral incisor absence

Distribution of missing teeth	Boys	Girls	Total	%
Maxilla				
Right	9	21	30	22.6
Left	8	13	21	15.8
Mandible				
Right	14	25	39	29.3
Left	10	33	43	32.3
Total No. of missing lateral incisor	41	92	133	100.0

Table 3. Distribution of congenitally missing lateral incisors

Congenitally missing lateral incisors	Boys (n = 652)	Girls (n = 723)	Total (n = 1375)	%
Maxilla	10	24	34	2.5
Mandible	16	47	63	4.6
Maxilla + Mandible	1	2	3	0.2
Total Prevalence	27	73	100	7.3

Table 4. The number of congenitally missing teeth of lateral incisors

No. of missing teeth	Boys (n = 652)	Girls (n = 723)	Total (n = 1375)	%
1	14	57	71	71.0
2	12	14	26	26.0
3	1	1	2	2.0
4	0	1	1	1.0
Total	27	73	100	100

two teeth. The absence of one tooth was significantly more prevalent than the absence of two teeth ($p = 0.018$), and all children missing two teeth showed bilaterally symmetrical tooth absences. Two patients (2.0 %; 1 boy, 1 girl) had three missing teeth, and one girl (1.0 %) had four missing teeth. Of the 71 subjects presenting with agenesis of one tooth, 46 children (10 boys, 36 girls) exhibited agenesis in the right jaw and 25 children (4 boys, 21 girls), in the left jaw. The difference between the right and left sides was significant ($p = 0.025$), but we noted no significant difference between the upper and lower jaws ($p = 1.000$).

Of the 26 patients with bilateral agenesis of the lateral incisors, 12 patients (6 boys, 6 girls) had maxillary lateral incisor agenesis, and 14 patients (6 boys, 8 girls) had mandibular lateral incisor agenesis. There was no significant difference in prevalence between the upper and lower jaws ($p = 1.000$).

Microdontia of the lateral incisors

The prevalence of microdontia of the lateral incisors and the combination diagnoses are shown in Table 5. Microdontia of the lateral incisors was found in nine patients (0.7 %; 3 boys, 6 girls) who presented with 13 microdontic upper lateral incisors: five patients had a unilateral microdontic tooth, and four patients had bilateral microdontic teeth. No significant difference in the prevalence of microdontia was evident between boys and girls ($p = 0.152$, Table 1). Of the nine patients with microdontia of the lateral incisors, six (66.7 %) were also missing teeth. Four (80.0 %) of the five patients presenting with unilateral microdontia also exhibited agenesis of the contralateral upper lateral incisor.

Other congenitally missing permanent teeth

Of the 100 patients whom we studied, 14 (14.0 %) were missing other teeth because of developmental dental agenesis. For these 14 subjects, the dental anomaly associated most frequently with the absent lateral incisors was an absence of the lower second premolars, followed by an absence of the upper second premolars (Table 6).

Impaction or eruption disturbance of the lateral incisors

The prevalence of impacted lateral incisors among the

total 1375 patients was 0.3 %. Three boys and one girl each had one impacted upper lateral incisor; the girl and one boy presented respectively with an odontoma and a supernumerary tooth, both associated with the impacted lateral incisors region. One boy (0.1 %) had an ectopic eruption in the mandibular right lateral incisor region.

Prevalence of fusion

Teeth fusion was identified in two (0.2 %) of the 1375 patients. In one boy, the lateral and central incisors in the right mandible were fused. In one girl, the lateral incisor and left mandibular canine were affected.

DISCUSSION

In the present study, we determined that the prevalence of developmental dental anomalies, including malformations and complete tooth absence, affecting the lateral incisors in the Japanese children studied here was 8.1 %, with a significantly greater prevalence in girls than in boys. The most common dental anomalies were congenitally missing teeth, followed by microdontia. The prevalence of congenitally missing teeth is one of most common developmental dental anomalies excluding the third molars, with a worldwide prevalence ranging from 2.6-8.5 %.^{3,5,7,11,12} In the present study, we determined that the prevalence of absent lateral incisors was 7.3 % and that more girls than boys were affected, consistent with other studies.^{3,5,11-13}

The types of missing teeth reportedly vary among different ethnic groups. In American and European children, the mandibular second premolars and maxillary lateral incisors are missing most often.^{1,2,4} In particular, in Caucasian patients who do not develop one or two of their adult teeth, the upper lateral incisor is the tooth most frequently involved.^{1,7} In Japanese children, however, the mandibular second premolars were found to be absent most frequently.³ Niswander and Sujaku (1963)⁵ and Davis (1987)⁶ showed that mandibular incisors were missing most often in Japan-

Table 5. The prevalence of microdontia and combination diagnosis

Microdontia of upper lateral incisors	Combination diagnosis
12	22, 35, 45 agenesis
12	22 agenesis
22	_____
22	12 agenesis, 13 microdontia
22	12 agenesis
1222	_____
1222	_____
1222	14, 15, 24, 25, 34, 35, 44, 45 agenesis
	11, 21 microdontia
1222	42 agenesis

Table 6. Associated developmental absence of other teeth found in the present study.

Congenital Absences of lateral incisors	Other associated congenital absences
12	35, 45
12	15, 25, 45
12	33, 43
12	14, 24, 25
12, 22	31, 41
12, 22	33, 35
22, 32, 42	15, 35, 45
12, 22, 32, 42	13, 27, 31, 33, 35, 37, 41, 43, 45, 47
32	14
32	35, 45
42	45
42	15, 25, 35, 45
42	15, 25, 35, 45
32, 42	23, 33, 43

ese and Chinese populations. In the present study, the most common missing teeth associated with an absence of the lateral incisors were the mandibular second premolars. Therefore, we believe that there is a close association between the developmental absence of the mandibular second premolars and an absence of the mandibular lateral incisors.

Furthermore, herein the prevalence of missing upper lateral incisors was 2.7 %, and that of missing lower lateral incisors was 4.8 %, suggesting that the mandible was more susceptible to congenital absence than the maxilla. These findings were contrary to the studies of Muller et al (1970)¹ and Altug-Atac and Erdem (2007),¹² which found a lower prevalence (1.7 %) for upper lateral incisor agenesis in other ethnic populations. Therefore, we believe that the prevalence of upper and lower lateral incisor agenesis is higher in the Japanese population than in other populations.

Additionally, in our study, unilateral agenesis was more common than bilateral agenesis, with the right lateral incisor tending to be absent more often than the left lateral incisor. These findings agree with those of other studies,^{7,14} suggesting that these trends occur regardless of ethnicity. Many studies on the prevalence of congenitally missing teeth have reported no significant preference for an affect on the right versus left side of the jaw.^{3,11,15} In the present study, a significant difference in prevalence between the right and left jaw sides was found for patients with single-tooth agenesis, but not for patients with lateral incisor agenesis. We suggest that the difference in the prevalence of lateral incisor absence between the jaw sides was masked by greater number of tooth absences.

Clayton (1956)¹⁶ reported that microdontia constitutes a small minority (0.3 %) of dental anomalies. However, Cho et al (2006)¹⁷ found that the prevalence of microdontic maxillary lateral incisors was 3.6 % in a Chinese population, and Altug-Atac and Erdem (2007)¹² reported a prevalence of 1.5 % for microdontia of the upper lateral incisors in Turkish populations. In our study, the prevalence of microdontia of the upper lateral incisors was lower than that reported in other populations. Nevertheless, our results showed that 80 % of patients with unilateral microdontia had agenesis of the contralateral upper lateral incisors.

Therefore, we propose that the reduced prevalence of upper lateral incisor microdontia observed in our study compared with that in other studies may be attributable to the greater prevalence of missing upper lateral incisors in our population compared with other populations.

In the present study, the prevalence of impacted teeth and of ectopic eruption of lateral incisors was 0.3 % and 0.1 %, respectively, making the overall prevalence of eruption disturbance 0.4 %. The disturbance of permanent incisor eruption may result from a number of factors, including prolonged retention of deciduous teeth, abnormal positioning of tooth buds, odontomas, trauma of deciduous teeth, and supernumerary teeth.¹⁸⁻²¹ In the present study, two lateral incisors exhibited a disturbed eruption caused by an odontoma or a supernumerary tooth. In previous reports, the most

frequently impacted teeth were the maxillary canines, with a prevalence ranging from 0.9 to 8.0 %, excluding the third molars.²²⁻²⁴ There were few data on the prevalence of dental impaction and eruption disturbance in the Japanese population, making a direct comparison impossible. Therefore, we suggest that even with a low incidence of lateral incisor eruption disturbance, it is necessary to perform a differential diagnosis on patients with teeth that are missing via congenital anomaly, so that proper treatment can be initiated at an optimal time.

In the present study, we determined the prevalence of fusion to be 0.2 %, which is consistent with the results of Altug-Atac and Erdem (2007).¹² Cho et al (2006)¹⁷ reported a fusion prevalence of 0.7 %. In the present study, all tooth fusions involved the mandibular lateral incisors. They also reported that the mandibular lateral incisors were most affected in tooth fusions and that the most common missing teeth were the mandibular lateral incisors.¹⁷ However, Altug-Atac and Erdem (2007)¹² reported that the maxillary lateral incisors were most often affected and that most common missing teeth were maxillary lateral incisors. Therefore, we propose that the distribution of the prevalence of fusion is similar to the prevalence distribution of congenitally missing teeth.

CONCLUSIONS

Our findings showed that 7.3 % of the individual patients cases in this study were missing permanent lateral incisors due to a developmental aberration and tooth agenesis more frequently affected girls than boys. The prevalence of lateral incisor agenesis in maxilla and mandibles was higher in our Japanese study group than in other ethnic populations. The prevalence of microdontia was lower than that reported in other populations and in a previous Japanese study. Although the prevalence of an eruption disturbance was lower than that of other tooth anomalies, it is important to provide an early diagnosis and appropriate treatment at an optimal time, as impacted teeth may be accompanied by odontomas or supernumerary teeth.

ACKNOWLEDGEMENTS

This work was supported by Grants-in-Aid 19390532 from the Ministry of Education, Culture, Sports, Science and Technology, Japan.

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