<Original Article>

Consideration of Clinically Related Dental Anomalies: Prevalence and Association

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• Abstract

Objective : To investigate the prevalence of dental anomalies and to determine the associations between dental anomalies in permanent teeth

Materials and methods : The samples were 1,240 patients (760 females and 480 males, mean age=15.1 years) who visited the Samsung Medical Center. Dental anomalies were diagnosed using pre-treatment dental casts, radiographs, clinical examinations, and medical/dental histories. Prevalence and association were investigated according to gender and sidedness. The Chi-square test was performed for statistical analysis.

Results : The most common missing tooth was the lower lateral incisor, followed by the lower and upper second premolars. This particular dental anomaly is characteristic of the East Asian population (prevalence of congenital missing tooth=12.3%). The upper anterior area was the most frequently affected area (prevalence of supernumerary tooth was 1.5%). The presence of a supernumerary tooth was more prevalent in males than in females ($p<.05$, odds ratio=3.2). The most frequently affected tooth was the upper canine (prevalence of impacted tooth=4.3%). Unilateral impaction of the upper canine occurred significantly more often compared to bilateral impaction ($p<.001$). The prevalence of peg lateralis was 2.7%. The presence of congenital missing tooth was closely associated with peg lateralis ($p<.01$). If children aged 7~8 years have peg lateralis, the rest of the teeth should be checked for congenital absences.

Conclusion : The early detection of dental anomalies and understanding of their associations help clinicians determine the appropriate treatment timing and methods of dealing with these anomalies.

• Key word : dental anomaly, prevalence, association

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Introduction

If dental anomalies such as congenital missing tooth, supernumerary tooth, impacted tooth, and peg lateralis occur, orthodontic and prosthodontic treatments are needed to repair function and aesthetics[1].

In particular, the prevalence of dental anomalies and the associations between them should be examined to determine the appropriate treatment timing and methods.

With regard to the prevalence of dental anomalies, a congenital missing tooth has recorded various occurrence values ranging from 0.3% to 14.69% except for the third molar[2,3]. The most frequently reported congenital missing tooth is the lower second premolar in the Caucasian population and the lower incisor in the Asian population (Figures 1 and 2)[4,5]. The prevalence of a supernumerary tooth has been reported to be 0.36% ~ 3.9%[6,7], it frequently occurs in the upper anterior area (Figure 3)[8]. In terms of the impactions of permanent teeth, the upper canine (Figure 4) shows prevalence of 1% ~ 3%[9,10], and the peg lateralis (Figure 5), a 0.66% ~ 4% prevalence[11,12].

Considering the associations between dental anomalies, Brook[13] reported that an association between a congenital missing tooth and the anomalies in tooth size could exist. According to Baccetti[7], there was an association between the missing second premolars, a decrease in the mesiodistal width of the upper lateral incisors, and the palatal displacement of the upper canines. Therefore, in cases with single dental anomaly, special attention should be paid to the diagnosis and treatment planning because the patients have increased risk of experiencing other dental anomalies.

Although epidemiological studies regarding dental anomalies have been conducted extensively throughout the world, the expression of dental anomalies varies depending on race and genetic and environmental factors. This study sought to investigate the prevalences of congenital missing teeth, supernumerary teeth, impacted teeth, and peg lateralis and to assess the associations among these dental anomalies in Koreans.

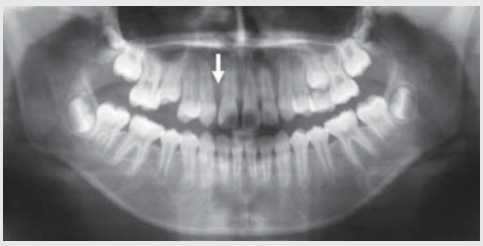

Figure 1. Panoramic view of a congenitally missing upper right lateral incisor.

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Patients and methods

The subjects were 1,240 patients who visited the Institute of Oral Health Science, Samsung Medical Center from 2001 to 2006 (480 males and 760 females, mean age=15.1 years). Patients with oral clefts and other systemic diseases were excluded from this study. Inclusion criteria for this study included age range of 9 ~ 30 years and after the stage of mineralization of the lower second premolar crown[14].

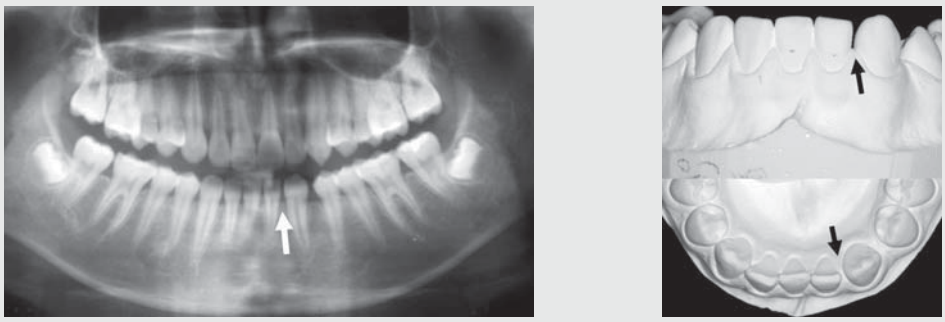

Figure 2. Congenitally missing lower left lateral incisor. A. Panoramic view, B. Dental cast.

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Figure 3. Panoramic view of a supernumerary tooth occurring in the upper anterior area.

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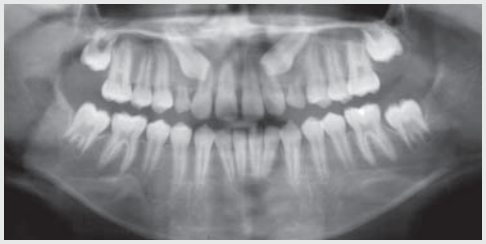

Figure 4. Panoramic view of upper canines that were bilaterally impacted.

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To determine whether or not a patient had congenital missing tooth, supernumerary tooth, impacted tooth, or peg lateralis, clinical examination, patient's medical and dental histories, dental casts, panoramic and intraoral radiographs, and intraoral photographs taken during the initial examination were used. A reassessment of 10% of randomly selected samples was performed one month later. Since there were no significant differences in the presence of dental anomalies and locations (kappa value>0.95) between the first and second assessments, the data from the first assessments were used.

The prevalence of dental anomalies according to gender and sidedness, number of dental anomalies per affected person, frequency of dental anomalies per tooth, and associations between dental anomalies were examined. The Chi-square test was performed for statistical analysis. A p-value of less than 0.05 was considered statistically significant.

Results

Congenital missing tooth (hypodontia)

The prevalence of a congenital missing tooth was 12.3% (152/1,240); no significant gender difference was noted (Table 1). Most of the patients showed one or two missing teeth (85.5%, Table 2). The most commonly missing tooth was the lower lateral incisor (22.5%), followed by the lower second premolar (20.3%), upper second premolar (18.5%), lower central incisor (11.4%), and upper lateral incisor (11.1%) (Figure 6).

Supernumerary tooth (hyperdontia)

The prevalence of supernumerary tooth was approximately 1.5% (18/1,240). Unlike the congenital missing tooth condition, males showed higher prevalence of supernumerary tooth compared to females ($p<0.05$, odds ratio=3.2, Table 1). Almost all the patients had one supernumerary tooth (94.4%, Table 2). The upper anterior

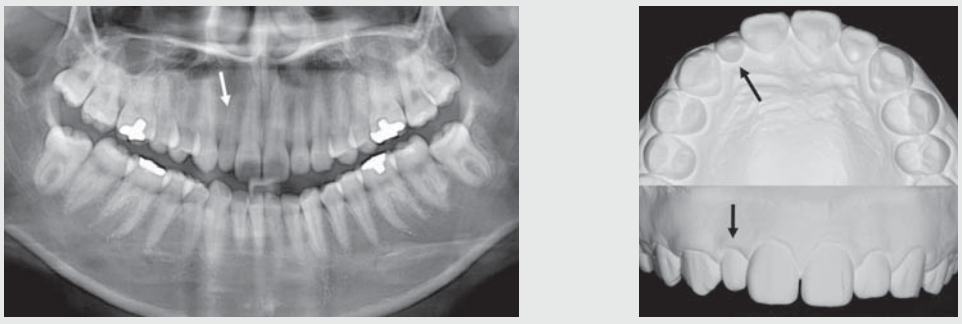

Figure 5. Peg lateralis of the upper right lateral incisor. A. Panoramic view, B. Dental cast.

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Table 1. Comparison of the prevalence of dental anomalies according to gender

Type of anomaly	Male (n=480)	Female (n=760)	Total (n=1,240)	p-value	Odds ratio
Hypodontia	50 (10.42%)	102 (13.42%)	152 (12.26%)	0.1161	0.7501
Hyperdontia	12 (2.50%)	6 (0.79%)	18 (1.45%)	0.0142*	3.2222
Impacted tooth	26 (5.42%)	27 (3.55%)	53 (4.27%)	0.1140	1.5547
Peg lateralis	11 (2.29%)	22 (2.89%)	33 (2.66%)	0.5204	0.7868

Chi-square test was performed. * indicates $p < 0.05$.

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Table 2. Number of dental anomalies per affected person

Type of anomaly	Number of dental anomalies per affected person					≥6	Total
	1	2	3	4	5		
Hypodontia	71 (46.71%)	59 (38.82%)	13 (8.55%)	3 (1.97%)	5 (3.29%)	1 (0.66%)	152 (100%)
Hyperdontia	17 (94.44%)	1 (5.56%)	-	-	-	-	18 (100%)
Impacted tooth	43 (81.13%)	10 (18.87%)	-	-	-	-	53 (100%)
Peg lateralis	20 (60.61%)	13 (39.39%)	-	-	-	-	33 (100%)

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area was the most frequent area of occurrence (73.7%), and the lower anterior area, the least frequent (Figure 7).

Impacted tooth

The prevalence of an impacted tooth excluding the third molar was approximately 4.3% (53/1,240). Similar to the congenital missing tooth condition, there was no significant gender difference (Table 1). Most of the patients had one impacted tooth (81.1%, Table 2). The most frequently impacted tooth was the upper canine (57.1%), followed by the upper second premolar (9.8%), lower canine (9.5%), and upper first premolar (8.0%) (Figure 8).

Most of the impacted upper canines were unilaterally impacted (90.9%, $p<0.001$, Table 3). Note, however, that there was no significant gender difference in the frequency of impaction (males: 2.5%; females: 2.8%).

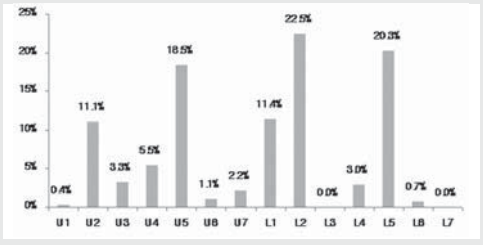

Figure 6. Frequency of hypodontia according to tooth. The total number of missing teeth was 271. U: upper jaw; L: lower jaw; 1: central incisor; 2: lateral incisor; 3: canine; 4: first premolar; 5: second premolar; 6: first molar; 7: second molar.

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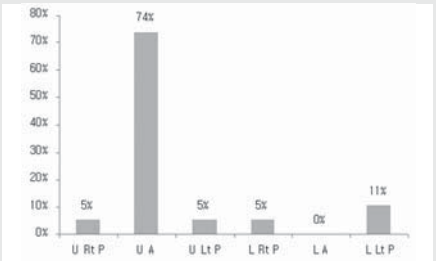

Figure 7. Frequency of hyperdontia according to tooth in 19 total supernumerary teeth. U: upper jaw; L: lower jaw; Rt: right; Lt: left; A: anterior teeth (canine~canine); P: posterior teeth (premolar~molar).

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Table 3. Comparison of the prevalences of an impacted canine and peg lateralis according to sidedness

Type of anomaly	Unilateral	Bilateral	Total	p-value
Impacted upper canine	30 (2.42%)	3 (0.24%)	33 (2.66%)	⟨0.0001***
Peg lateralis	20 (1.61%)	13 (1.05%)	33 (2.66%)	0.2230

One-sample binomial test was performed. *** indicates p ⟨0.001.

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Table 4. Associations of the dental anomalies

Type of dental anomaly (number)	Accompanied dental anomaly (number/p-value)			
	Hypodontia	Hyperdontia	Impacted tooth	Peg lateralis
Hypodontia (152)	·	4 (0.2630)	6 (0.8316)	11 (0.0011)**
Hyperdontia (18)	4 (0.2630)	·	2 (0.1776)	0 (1.0000)
Impacted tooth (53)	6 (0.8316)	2 (0.1776)	·	3 (0.1637)
Peg lateralis (33)	11 (0.0011)	0 (1.0000)	3 (0.1637)	·

Chi-Square test was performed to investigate the associations. ** indicates p ⟨0.01.

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Peg lateralis

The prevalence of peg lateralis was approximately 2.7% (33/1,240). Similar to the congenital missing tooth and impacted tooth conditions, there was no significant gender difference (Table 1). Although there was no statistically significant difference, there was a tendency for unilateral peg lateralis to occur more often than bilateral peg lateralis (60.6%, Table 3).

Associations between dental anomalies

Among the four types of dental anomalies, congenital missing tooth was closely associated with peg lateralis ($p<0.01$, Table 4). Note, however, that there were no significant associations among the other dental anomalies (Table 4).

Discussion

Congenital missing tooth

Age is one of the key factors for the presence of congenital missing tooth. Although the mineralization of the lower second premolar usually begins at age 3 ~ 3.5 years, there are some cases showing a late onset of mineralization[5]. Wisth, et al[14] reported that the prevalence of a congenital missing tooth decreased from 7.1% in patients aged 7 years to 6.6% in patients aged 9 years. Since the lower second premolars had not yet erupted in patients aged 7 years or less, determining a congenitally missing lower second premolar could not be established. Following the initiation of mineralization, at around age nine, congenital missing lower second premolars could be determined. Therefore, patients aged 9 years or older were selected for this study.

Prevalence of congenital missing tooth is known to be higher among orthodontic or pediatric patients (14.7%)[3] than in the general population (3.4% ~ 10.1%)[5]. These results indicate that aesthetic and functional problems due to a congenital missing tooth can be easily recognized by patients and/or parents[15]. The results of this study showed a value approximating that in the previous studies with regard to the prevalence of congenital missing tooth (approximately 12.3%).

The prevalence result of 85.5% for subjects with one or two congenital missing teeth (Table 2) was within the range of 76.3%[15] ~ 97.4%[4] as described previously.

The result showing the order of missing teeth from most to least frequent - lower lateral incisor, lower second premolar, upper second premolar, lower central incisor, and upper lateral incisor (Figure 6) - was consistent with the general trend, i.e., a distal tooth has greater variability potential in each tooth group[14].

The result showing that the most frequently missing tooth was the lower incisor was consistent with reports from Hong Kong and Japan[4,16,17]. In the Caucasian population,

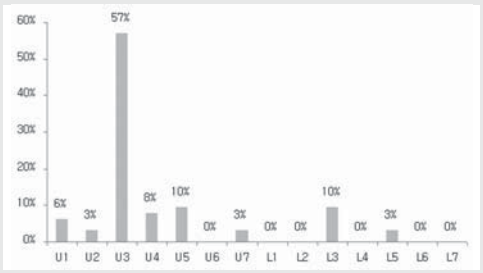

Figure 8. Frequency of impaction according to tooth in 63 impacted teeth. The same abbreviations in Figure 1 were used.

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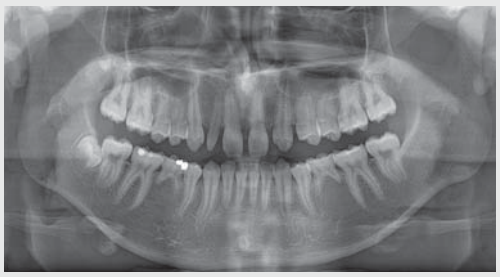

Figure 9. Example of association between peg lateralis and congenital missing teeth (upper lateral incisor and lower second premolars).

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however, the lower second premolar and the upper lateral incisor were reported to be more prevalent than congenital missing teeth[5]. Therefore, the higher prevalence of the lower lateral incisor as congenital missing tooth may be based on ethnic differences[15].

There has been controversy regarding the existence of gender difference in the prevalence of congenital missing tooth, since some studies showed females to have higher prevalence than males[4,5,18,19]. In contrast, other studies have shown no significant gender difference[3,15,20]. In this study, the prevalence of congenital missing tooth was higher in females than in males, but there was no significant difference (Table 1).

Supernumerary tooth

If the supernumerary tooth is not erupted, it can be easily neglected, and various problems can occur. Therefore, the supernumerary tooth is a type of dental anomaly that should be diagnosed and treated at the appropriate time. In this study, the prevalence of a supernumerary tooth was approximately 1.5% (Table 1); this finding was similar to other studies conducted on the general population[4,11,20] and those focusing on orthodontic patients[3].

The results showing that the most frequent area for the supernumerary tooth was in the upper anterior area and that the least frequent area was in the lower anterior area (Figure 7) were consistent with previous reports[4,6,17,21]; ditto for the result showing that the supernumerary tooth was more developed in males than females ($p<0.05$, odds ratio=3.2, Table 1)[3,4,13,17].

Impacted tooth

Except for the third molar, the prevalence of impacted tooth was approximately 4.3% (Table 1); this was similar to the prevalence among North American students (5.4%)[11].

The tooth showing the most prevalent impaction was the upper canine. In addition, impaction of the upper canine accounted for approximately 57% of the total cases and corresponded to the highest frequency (Figure 8). According to Thilander, et al[11], the order in terms of prevalence of impacted teeth was the upper canine, upper second premolar, lower second premolar, upper incisor, and lower canine. In this study, however, the order of prevalence for impacted teeth was the upper canine, upper second premolar, and lower canine (Figure 8).

Impaction of the upper canine showed prevalence of approximately 2.7%, which was within the range of 1%9 ~ 3% as reported previously[10]. This was consistent with the prevalence among orthodontic outpatients (2.75%)[22]. Bilateral impaction of the upper canine had significantly lower prevalence (approximately 10%) compared to unilateral impaction ($p<0.001$, Table 3), which was different from the results of Leifert, et al (24%)[22].

With regard to gender difference in the prevalence of upper canine impaction, several studies showed females to have relatively higher frequency compared to males[10,23]. In this study, however, there was no significant gender difference; this finding was consistent with that of Leifert, et al[22].

Peg lateralis

Morphological variations of the tooth were manifested most prevalently in the upper lateral incisor. In this study, the

prevalence of peg lateralis was approximately 2.7% (Table 1), similar to other studies considering the general population[12,20,24] and those focusing on dental patients[6,25].

There was no significant gender difference in the prevalence of peg lateralis (Table 1), which was also well documented in previous studies[6,25].

Albashaireh, et al[25] stated that unilateral cases had a similar profile of prevalence to the bilateral cases; this was consistent with the results of this study (Table 3).

Associations among dental anomalies

In this study, associations between missing teeth, supernumerary teeth, impacted teeth, and peg lateralis were examined. An association between missing tooth and peg lateralis was found ($p<0.01$, Table 4, Figure 9). Therefore, significant associations between peg lateralis and congenital missing teeth were recognized. The possibility of other congenital missing teeth should be checked among children aged 7~8 years with peg lateralis.

According to Niswander, et al[17], 4.7% of children with missing tooth had peg lateralis. In normal controls, however, only 1.5% had peg lateralis. Lai, et al[26] reported associations between missing teeth, peg lateralis, ankylosis of the primary molar, enamel hypoplasia, and taurodontism. Brook, et al[13] found an association between missing teeth and microdontia. According to Baccetti, et al[7], there were associations between the aplasia of the second premolars, small size of the upper lateral incisors, infraocclusion of the primary molar, enamel hypoplasia, and palatal displacement of the upper canines. The authors of the aforesaid studies reported that congenital missing teeth could be an autosomal recessive trait due to the homozygous state of the gene for small-pegged missing upper lateral incisors.

No association was found between missing teeth and impacted teeth. Lai, et al[26] reported that the frequency of canine or premolar impaction was relatively higher in the control group compared to that of the missing tooth group.

Similarly, there was lack of association between the presence of a supernumerary tooth and an impacted tooth. According to Baccetti, et al[7], there was no significant association between other types of dental anomalies and the presence of a supernumerary tooth. These results indicate that a supernumerary tooth is an independent dental anomaly.

Baccetti, et al[7] reported a significant association between the palatal displacement of the upper canine and decreased size of the upper lateral incisor. Leifert, et al[22] also found a significant association between the palatal displacement of the upper canine, hypoplasia of the upper lateral incisor, peg lateralis, and congenital missing teeth. In this study, however, an association between impacted tooth and peg lateralis was not demonstrated. This result may be due to the fact that this study examined all of the teeth for impaction instead of focusing on only on the upper canine. Therefore, further studies are necessary to examine the associations between the palatal displacement of the upper canine, peg lateralis, and congenital missing upper lateral incisor.

Although the patients in this study were not representative of the general population, they did not show significant differences from other studies that focused on the general population[4-5,11-13,17-20,24]. Therefore, the results from this study could have relevant clinical implications. Nonetheless, further studies will be necessary to examine the prevalence and associations of dental anomalies in the general population.

Conclusions

- The most frequent congenital missing tooth among Koreans was the lower lateral incisor, which is assumed to be characteristic of the East Asian population. A supernumerary tooth was mostly frequently observed in the upper anterior area, with a significantly higher prevalence in males than in females. Except for the third molar, the upper canine was the most prevalently impacted tooth. Unilateral cases of tooth impaction were more prevalent than bilateral cases.
- Among the dental anomalies, significant associations between peg lateralis and congenital missing teeth were recognized. If children aged 7~8 years have peg lateralis, they should be checked for other congenital missing teeth.
- Early detection of dental anomalies and understanding of their associations help clinicians determine the clinical implications and establish the appropriate treatment timing and methods.

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