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An orthopantomographic study of hypodontia in permanent teeth of Japanese pediatric patients

Harold Agurto Goya[1], Shigeo Tanaka[1], Takahide Maeda[2] and Yoshiaki Akimoto[1]

[1]Department of Dento-Maxillofacial Surgery, Nihon University School of Dentistry at Matsudo, Matsudo, Japan

[2]Department of Pediatric Dentistry, Nihon University School of Dentistry at Matsudo, Matsudo, Japan

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Abstract: Hypodontia of permanent teeth was evaluated from orthopantomograms of 2072 apparently healthy pediatric patients at The Hospital of Nihon University School of Dentistry at Matsudo. The prevalence of congenitally missing teeth (CMT) was 8.7% in boys and 10.8% in girls, and 9.4% for both sexes combined. Most cases (67.8%) involved either one or two missing teeth. There were in total 574 CMT, and on average 2.8 teeth were missing per child. The most commonly absent tooth was the mandibular second premolar. On the other hand, no first molars were missing in any case. A high frequency of CMT mandibular incisors (18.82%) was observed, and this seems to be a characteristic peculiar to individuals of Asian ethnicity. Oligodontia (6 or more CMT excluding the third molar) ranged from 6 to 14 teeth, with a prevalence of 1.4% in general: 1.8% for girls and 0.9% for boys. Symmetry of CMT was predominant: 214 pairs for bilateral symmetry and 107 pairs for symmetry between two antagonistic quadrants. The distribution of CMT between maxillary and mandibular hypodontia in the right and left quadrants for boys and girls no had significant association ($P < 0.05$). (J. Oral Sci. 50, 143-150, 2008)

Keywords: hypodontia; oligodontia; prevalence; Japanese.

Correspondence to Dr. Harold Agurto Goya, Department of Dento-Maxillofacial Surgery, Nihon University School of Dentistry at Matsudo, 2-870-1 Sakaecho-Nishi, Matsudo, Chiba 271-8587, Japan
Tel: +81-047-360-9406
Fax: +81-047-360-9405
E-mail: harold70g@hotmail.com

Introduction

Hypodontia is best defined as agenesis of one or more teeth (1), and is considered to be one of the most frequently encountered oral alterations (2) and the commonest dental anomaly (3). Hypodontia is an important condition in that both esthetics and function can be detrimentally affected (4,5).

Oligodontia, partial anodontia, and severe or advanced hypodontia are synonymously defined in general as the "congenital absence of many teeth". In dental studies, it is commonly described as a condition involving absence of six or more teeth excluding the third molar (6-13). Affected children tend to have delayed tooth development, a reduced mesio-distal crown diameter, and abnormal tooth morphology and positioning (10,13,14).

There is a considerable body of literature about the prevalence and distribution of hypodontia. Large differences in the prevalence of dental agenesis have been reported worldwide, varying from 0.3% in Jerusalem to 36.5% in a caucasoid population (7). The wide range of hypodontia prevalence can be attributed to differences in the methods of sampling and examination, age distribution, sex, and racial origin (9,15-17).

Most studies have found a higher prevalence in girls than in boys, and also that the most frequently encountered congenitally missing teeth (CMT) after the third molar are the mandibular second premolars followed by the maxillary second premolars or maxillary lateral incisors. However, there are some exceptions such as the maxillary lateral incisors (5,18,19), the mandibular incisors (15,20), and the mandibular lateral incisors (21,22), which were the most frequent CMT in their respective studies.

The purpose of this study was to establish the prevalence

and distribution of congenitally missing permanent teeth, excluding the third molar, in Japanese pediatric patients.

Materials and Methods

In this cross-sectional study, 2072 orthopantomograms (OPGs) of apparently healthy pediatric patients (1073 boys and 999 girls) were used for diagnosis of hypodontia, as this approach has been considered reliable for diagnosing anomalies in tooth number in several studies (9,13,16,20-24).

The children had visited the Hospital of Nihon University School of Dentistry at Matsudo between 1995 and 2007. They were aged between 3 and 17 years (average 9.4 ± 2.7 years) at the time the OPGs were taken. Since this study was retrospective and ethnic, only children of Japanese origin were chosen to ensure racial homogeneity.

All OPGs were analyzed by the principal investigator under normal room lighting using a magnifying glass on a light box if needed. Dental agenesis was reassessed entirely by the same investigator 4 months later to establish a definitive list.

By definition, CMT are those that fail to erupt in the oral cavity and remain invisible in radiographs (8). A tooth was diagnosed as congenitally (developmentally) missing when it could not be identified or discerned radiographically on the basis of calcification and there was no evidence of extraction (17,25). If an accurate diagnosis of hypodontia could not be made, the file was excluded.

Because premolars show great variability in the initiation of calcification (5,9,14,17,24,26), they were only considered as CMT from an age of 7 years to avoid any false-positive diagnosis. Third molars were not included in this investigation. Patients with any systemic anomaly, especially cleft lip/palate and Down's syndrome, were also excluded because in such conditions tooth development has been shown to be delayed (10).

A subset of 60 OPGs of agenesis cases examined by two different observers (HAG; ST) was chosen at random in order to calculate the inter-observer agreement. The percentage of absolute agreement and Cohen's Kappa coefficient were calculated. Cohen's Kappa is a measure of the agreement between two or more observers after exclusion of agreement due to chance (27).

The chi-squared test was performed to determine the significance of the differences between CMT for maxillary and mandibular hypodontia in the right and left quadrants for boys and girls, using the Windows XP-Excel Statistical Package. The level of significance was set at 5%.

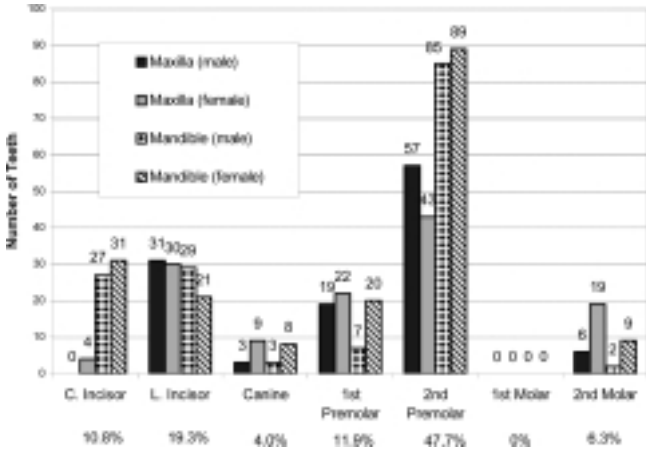

Fig 1. Distribution of hypodontia and its percentage by tooth type.

Results

The percentage of absolute agreement in the identification of hypodontia was 99.5%. Cohen's Kappa coefficient for inter-observer agreement was 0.96, which is interpreted as "substantially reliable" according to Landis and Koch (27).

Hypodontia of permanent teeth was found in 202 children (108 girls and 94 boys) as a result of examination of 2072 pediatric patients files. The prevalence of hypodontia was 8.7% in boys and 10.8% in girls, and for both sexes combined it was 9.4% (Table 1).

Table 1 CMT per child and % of affected cases (n = 202)

	Male	%	Female	%	Total	%
Hypodontia						
1	45	22.3	33	16.3	78	38.6
2	18	8.9	41	20.3	59	29.2
3	5	2.5	9	4.5	14	6.9
4	8	4	4	2	12	5.9
5	8	4	3	1.5	11	5.4
Sub-total	84	41.6	90	44.6	174	86.1
Prevalence	7.8%		9%		8.4%	
Oligodontia						
6	2	1	10	5	12	5.9
7	0	0	2	1	2	1
8	0	0	2	1	2	1
9	1	0.5	2	1	3	1.5
10	4	2	0	0	4	2
11	0	0	1	0.5	1	0.5
12	1	0.5	0	0	1	0.5
13	0	0	1	0.5	1	0.5
14	2	1	0	0	2	1
Sub-total	10	5	18	8.9	28	13.9
Prevalence	0.9%		1.8%		1.4%	
Total	94	46.6	108	53.5	202	100
Prevalence	8.7%		10.8%		9.4%	

A total of 574 permanent teeth were missing (269 in boys and 305 in girls) with an average of 2.8 teeth per child. The distribution of hypodontia is shown in Fig. 1.

The number of CMT per child ranged from 1 to 14 in this study. Hypodontia of 1 to 5 teeth had a prevalence of 8.4% and represented 86.1% of all cases. Most of the children (67.8%) had hypodontia of either one or two teeth.

Mandibular second premolars were most frequently missing, followed by maxillary lateral incisors and maxillary second premolars. On the other hand, maxillary and mandibular first molars were never absent (Fig. 1). Other teeth with low prevalence of CMT were the maxillary central incisor, followed in order by the mandibular second molar and canine, as has already been established in several studies (4,6-9,11,14,16,22,23,25,28,29).

Oligodontia ranged from 6 to 14 teeth and its prevalence was 1.4%, representing 13.9% of all agenesis cases. The most frequent oligodontia was of 6 CMT (5.9% of all agenesis cases), and girls were affected almost twice as often as boys (Table 1).

Although there were some differences in frequency, no significant association ($P < 0.05$) was found in the distribution of CMT over the maxilla and mandible and over the left and right sides for males and females (Table 2).

Hypodontia of single teeth accounted for 38.6% of all cases; its prevalence was 4.2% in boys and 3.3% in girls, and 3.8% for both sexes combined. The most frequently affected tooth was the second premolar, followed by the lateral incisor (Table 3).

Within the 574 CMT registered, symmetrical hypodontia was predominant, and as would be expected its prevalence increased with hypodontia severity. Bilateral or contralateral hypodontia (e.g., maxillary first premolar right and left) accounted for 214 pairs representing 74.6% of all CMT, and the remaining 146 CMT were located unilaterally. The most common tooth affected by contralateral hypodontia was the mandibular second premolar, followed by the maxillary second premolar, mandibular central incisor and maxillary lateral incisor. On the other hand, symmetrical hypodontia in antagonistic quadrants (e.g., maxillary central left incisor and mandibular central left incisor) accounted for 107 pairs, representing 37.3% of all CMT. The right and left sides were affected almost equally (55:52), and combinations between second premolars were the most frequent (Table 4).

Discussion

Because congenital lack of one or more permanent teeth is a common anomaly in man (2,3,8), many studies on the prevalence of hypodontia in permanent teeth have been published in the dental literature over the last 50 years. Of these, we have been able to find 12 reports in Japanese (19-23,25,29-34), and only 2 were published in English. For this reason, they have perhaps not been available worldwide in Internet Search Systems such as Medline (25).

Clinical examinations tend to yield underestimations in comparison with systematic and reliable roentgenographic registration (9,16,24,26,30,35). Clinical observations only obtain about a 70% coincidence with the true quantity of absent teeth (29). Moreover, by definition, CMT are those that fail to erupt in the oral cavity and remain invisible in radiographs (8), and the need for X-ray examination in studies of this nature is well recognized (22). Therefore, we considered it convenient to carry out this study based mainly on OPGs and dental history, rather than using clinical examination and plaster models.

Some discrepancies in the results of previous studies can

Table 3 Hypodontia of single tooth by tooth type and its percentage of the total of dental agenesis cases (n = 202)

	Female		Male		Total	
Teeth	Maxilla	Mandible	Maxilla	Mandible	Cases	%
C. Incisor	1	3	0	3	7	3.5
L. Incisor	1	7	9	7	24	11.8
Canine	0	0	0	1	1	0.5
1st Premolar	0	1	0	0	0	0
2nd Premolar	1	19	4	21	45	22.2
1st Molar	0	0	0	0	0	0
2nd Molar	0	1	0	0	1	0.5
Total	3	31	13	32	78	38.6
Prevalence	3.3%		4.2%		3.8%	

Table 2 Distribution of Hypodontia between sexes by cases and CMT localization

Cases	Male	Female	Total	%	Teeth	Male	Female	Total	%	Teeth	Male	Female	Total	%
Hypodontia	94	108	202	9.7	Right	130	158	288	50.2	Maxilla	116	127	243	42.3
No Hypodon.	979	891	1870	90.3	Left	139	147	286	49.8	Mandib.	153	178	331	57.7
Total	1073	999	2072	100	Total	269	305	574	100	Total	269	305	574	100
%	51.8	48.2	100		%	46.9	53.1	100		%	46.9	53.1	100	
$x^2 = 2.24$, d.f. = 1, $P < 0.05$					$x^2 = 0.56$, d.f. = 1, $P < 0.05$					$x^2 = 0.08$, d.f. = 1, $P < 0.05$				

be attributed to the method of case selection, the samples under investigation, and the fact that in some of the earlier studies radiographs were either not taken at all, or were taken only in cases where the examiners suspected a possibility of hypodontia (15). The prevalence of hypodontia in this study was high in comparison to other studies of pediatric patients (3,30,32,33), but very similar to that in studies of orthodontic patients (9,20,23,25,31,34). The prevalence of CMT in orthodontic patients was almost always higher than in other types of sample, except for a small sample examined in Hiroshima (20), as shown in Table 5. The fact that OPGs together with cephalometric radiographs are often indicated in children for a future orthodontic treatment could explain the similarity with our results.

Table 4 Distribution of symmetrical hypodontia

Bilaterally		Antagonistic quadrants	
Combinations	Pairs	Combinations	Pairs
1.1 - 2.1	1	1.1 - 4.1	0
1.2 - 2.2	23	1.2 - 4.2	5
1.3 - 2.3	5	1.3 - 4.3	1
1.4 - 2.4	16	1.4 - 4.4	6
1.5 - 2.5	43	1.5 - 4.5	39
1.6 - 2.6	0	1.6 - 4.6	0
1.7 - 2.7	12	1.7 - 4.7	4
3.1 - 4.1	25	2.1 - 3.1	0
3.2 - 4.2	15	2.2 - 3.2	6
3.1 - 4.3	5	2.3 - 3.3	0
3.4 - 4.4	9	2.4 - 3.4	6
3.5 - 4.5	58	2.5 - 3.5	38
3.6 - 4.6	0	2.6 - 3.6	0
3.7 - 4.7	3	2.7 - 3.7	2
Total	214	Total	107
% of CMT	74.6	% of CMT	37.3

FDI: Two-digit numbering system

The prevalence on CMT in this study was 9.4%, which is within the previously reported range in Japanese (15.9% (21), 10.9% (23) and 9.9% (34), 9.4% (31), 9.2% (20), 8.66% (29) and 8.5% (25)). Also there was a high average of 2.8 CMT per child. Both results confirm that hypodontia is not uncommon in Japanese.

The results of this study concur with other investigations (3-5,7-9,12,15,16,19,20,23,25,26,30,32,33) indicating that hypodontia involving one or two teeth represents a wide majority of cases, being 67.8% in this report. Therefore, most cases of hypodontia appear to be relatively mild.

Several previous investigations have also pointed out that symmetrical hypodontia is more prevalent. The frequency of contralateral or bilateral hypodontia in this study was 74.6% of CMT (Table 4), compared with figures of 75% in a Mexican study (18), 60% in a Norwegian study (26) and 89% in a Japanese study (25), suggesting a strong genetic pattern.

Table 5 Studies about hypodontia in Japan and others countries

Author (Reference)	Pub. Year	Population (Place)	Sample No.	Sample type (Age in years)	Prevalence Female	Prevalence Male	(%) Total	CMT per Child
Ma Chao-Mao (21)	1949	Japanese (Tokyo)	795	Dental students	Ns	Ns	15.9	Ns
Okamoto O (19)	1951	Japanese (Tokyo)	1001	Schoolchildren	7.27	4.6	5.59	1.65
Terasaki T (29)	1954	Japanese (Hiroshima)	1871	Schoolchildren (5-19)	8.66	8.66	8.66	1.59
Tsutsui H (32)	1955	Japanese (Tokushima)	1454	Oral Surg. Patients	1.89	0.97	1.44	1.43
Niswander JD (22)	1963	Japanese (Fukuoka)	4150	Schoolchildren (5-12)	9.2	5.8	6.6	1.57
Ergermark-Eriksson I (36)	1971	Sweden (Halmstad)	3327	Schoolchildren	7.77	4.85	Ns	Ns
Hanaoka H (20)	1972	Japanese (Hiroshima)	379	Schoolchildren (12-14)	9.5	8.8	9.2	1.65
Hanaoka H (20)	1972	Japanese (Hiroshima)	217	Orthodontic Patients	8.8	13	11	1.25
Wisth P J (9)	1974	Norway (Bergen)	813	Orthodontic Patients	8.1	5.6	6.6	2.2
Kurt Bergström (26)	1977	Sweden (Växjö)	2589	Schoolchildren (8-9)	9.3	5.6	7.4	1.81
Locht S (35)	1980	Danish (Århus)	704	Schoolchildren (9-10)	Ns	Ns	7.7	Ns
Davis J P (15)	1987	Chinese (Hong Kong)	1093	Schoolchildren (12)	7.7	6.1	6.9	1.5
Ishizuka K (34)	1988	Japanese (Tokyo)	1000	Orthodontic Patients	9.4	10.1	9.9	1.81
Nik-Hussein N N (5)	1989	Malaysian (Kuala Lumpur)	1583	Pediat.Ptts (6-15)	3.5	2.2	2.8	1.8
Lynham A (4)	1989	Australia (Holsworthy)	662	A.Def.Force (16-26)	5.7	8.6	6.3	2.2
Yanagida I (33)	1990	Japanese (Osaka)	4009	Pediatric Patients	Ns	Ns	7.83	1.8
Watanabe K (23)	1992	Japanese (Tokyo)	588	Orthodontic Patients	11.78	9.22	10.9	2.2
Aasheim B et al. (16)	1993	Norway (Oslo)	1953	Schoolchildren (7-10)	7.2	5.8	6.5	1.6
Ogita S (30)	1995	Japanese (Nagoya)	6299	Pediat.Ptts (up to 17)	2.96	2.7	2.81	1.87
Hirukawa K (31)	1999	Japanese (Nagoya)	3343	Orthod. Ptts (6-40)	9.65	8.94	9.42	2.27
Osuji O et al. (3)	2002	Saudi Arabia (Tabuk)	1870	Pediatric Patients	Ns	Ns	3.6	1.95
Silva Meza R (18)	2003	Mexico (Mexico D.F)	668	Orthod. Ptts (9-20)	Ns	Ns	2.7	Ns
Endo T (25)	2006	Japanese (Niigata)	3358	Orthod. Ptts (5-15)	9.3	7.5	8.5	2.4
Present study	2007	Japanese (Matsudo)	2072	Pediatric Ptts (3-17)	10.8	8.7	9.4	2.8

Ns = Not specified

In this and others studies (7,11,1416,18,25,32,33) there was no significant difference in total CMT between males and females, although as shown in Table 5 there was a higher prevalence in females than in males in several reports (15,19-23,25,26,29,30-32,35,36), except for a small sample of 217 orthodontic patients (20).

Coincident with other studies, although the frequency of CMT in the mandible was higher than in the maxilla (5-7,9,13,15,19,30-32), the difference was not significant. On the other hand, CMT affected the left quadrants almost equally, as was observed previously (7,9,15,19,25,29,32, 33). Only one study in Mexico (18) found a significant difference when analyzed symmetrical hypodontia between upper and lower arches in boys and girls in maxillary lateral incisor, maxillary second premolar and mandibular central incisors ($P < 0.01$).

The first molars are very probably the most stable teeth, because several reports (5,16,19,21,29,33-35) have indicated that these teeth are never absent. Moreover, maxillary and mandibular first molars together with maxillary central incisors and mandibular canines were very rarely missing (6-8,11,13,14,16,22,23,25,28,30).

Any study of hypodontia can suffer from three main shortcomings:

First, exclusion criteria based on age must be employed in this kind of study due to the important issue of age at diagnosis (7); that is to say, children should be analyzed at an age when mineralization of the permanent dentition can reliably be expected to have commenced (1,15). Also it is important to know that the visibility of tooth germs on radiographs depends on their mineralization stage, and major differences in mineralization stage and dental age can be evident among subjects of the same chronological age. Tooth buds showing late onset of mineralization (mandibular second premolars) could lead to a false-positive diagnosis of agenesis in radiographs (7, 24).

Hypodontia of the second premolars cannot be diagnosed as early with the same degree of certainty as in the incisors and canines because the second premolars can develop long after what it would ordinarily be expected to become evident. Therefore early registration may lead an incomplete or mistaken diagnosis (5,7,9,14,17,26).

In general, diagnosis of tooth agenesis in the permanent dentition should be made after the age of 6 years, excluding the third molar, and after 10 years of age if the third molar is also studied (24). Therefore, special attention should be paid to premolars in children before 7 years of age to avoid false-positive diagnosis, as in this study. On the basis of this criterion we eliminated 12 boys and 11 girls younger than 7 years in whom premolars were affected by CMT. Our definitive sample included only 13 children younger than 7 years, who were considered to have CMT affecting teeth other than the premolars. The assessment was always made by considering important publications about the chronology of development of permanent teeth (37,38), the chronology of human dentition (39), and standards of approximate age at which teeth can be expected to be visible on radiographs (1,40).

Second, it is frequently difficult to distinguish between absence of the mandibular central and mandibular lateral incisor, particularly when the remaining teeth have drifted or are unerupted (22). Therefore, there may be a slight amount of misclassification between those teeth, and perhaps for this reason some studies non-specifically grouped such teeth as mandibular incisors (15,19,20). Also in the present study, the principal problem was distinguishing among mandibular incisors due to anatomical ghost or artifact derived from superposition of cervical vertebrae on mental region. Most of the 38 errors found upon the re-examination were misclassification of these teeth rather than CMT not discovered. Thus, the definitive list was derived on the basis of the second revision. The analysis of inter-observer agreement also found common the confusion for identification among mandibular incisor.

Third, a further variable is the ethnicity of the subjects examined, which can affect the results. There is great variation in the literature as to which tooth types are commonly missing, due partly perhaps to ethnic variation. In African negroes and Australian aborigines the prevalence is 1%, but in Japanese it can be as high as 30%; in Swedish and Japanese, lower central incisors are more commonly missing than in other populations (6). Other studies have indicated that hypodontia is more frequent in Asians and Native Americans (17), and that the prevalence of dental agenesis in Europe (mainly Scandinavian countries) and Caucasian population in Australia is higher than in North American Caucasians (7).

Previous studies, conducted principally in Japan but also in other countries, are summarized in Table 5, which shows a wide range of prevalence from 1.44% to 15.9% among individual studies. The most frequent CMT excluding the third molar in most reports (4,23,26,33-35, etc.) was always the mandibular second premolars followed by maxillary lateral incisors or maxillary second premolars. However, Asian populations differed in this trend, the mandibular incisors (expressed as average prevalence) accounting for 60.2% of CMT in Chinese (15), the mandibular lateral incisor being most frequently affected in Japanese (21,22), and the maxillary lateral incisor being most frequently affected in Japanese (19), Malaysian (5), and Mexicans (18). Unification of the mandibular incisors in our series represented 18.82% of CMT, which is

comparable to the following results in other studies of Japanese: 30.9% reported by Hanaoka (20), 24.5% by Terasaki (29), 47% by Niswander (22), 30.5% by Ma (21), 29.2% by Yanagida (33) and 24.01% by Ogita (30).

The mandibular second premolar was most commonly affected by CMT, followed by maxillary second premolar, maxillary lateral incisors and "mandibular central incisor", which represented 10.1% of total of CMT and in turn ranked third after premolars for contralateral hypodontia. Although Asian populations can be considered a uniform race, it would be necessary to take into account environmental factors together with genetic factors in samples that are ethnically homogeneous.

Depending on the number and location of CMT, oligodontia may cause masticatory, speech, or esthetic problems (11,12). The literature contains no clear consensus concerning the definition of oligodontia (8,10). Some studies have described oligodontia (also called extensive, advanced or severe hypodontia) if the number of missing teeth is 4 or more (4,14), 5 or more (25), 6 or more (6-13), more than six teeth (18,24), and 10 or more (16), always excluding the third molar. In the present study oligodontia was considered to be a congenital lack of six or more teeth, a definition that has been widely used in the scientific literature. For oligodontia in this study, the second maxillary and mandibular premolar, maxillary lateral incisor and mandibular central incisor were most frequently affected by CMT.

Other studies (1,11,13) considered that oligodontia could occur alone (isolated oligodontia) or as part of a syndrome, for example, "Ectodermal Dysplasia", which has been related to a severe form of oligodontia occurring especially in males (2). Coincident with our results (18:10) frequency of CMT was higher in girls than boys in one study on oligodontia patients (11). However, for another study (13) difference between boys and girls with isolated oligodontia was not significant.

Several explanations have been forwarded for the etiology of hypodontia, from the many family case reports and studies of twins. Hypodontia appears to be an inherited characteristic, although the precise genetic mechanism responsible is not completely understood (5). One explanation has been considered that eventually congenital hypodontia, except for hereditary cases, has a greater chance of appearing when development of dental germs (I_2, P_2, M_3) is later than in surrounding areas and the space for the affected teeth is markedly deficient (34).

Jorgenson (1) mentioned that the frequency of hypodontia might have increased with the time as indicated by data for 1939 and those for 1976. In fact, I_2, P_2, M_3 have been found to be particularly affected by CMT in several papers included the present one. Moreover, tooth size reduction and tooth development delay has been observed in children with advanced hypodontia of the permanent dentition (10,13,14). Both findings agree with the changes proposed in the "Terminale Reduktion" theory by Bolk on most distal teeth in each tooth type (21).

Often the etiology of each anomaly is considered separately, but there may well be associations between some of them. Hypodontia and microdontia had a highly significant association, which increased with case severity. It is perhaps likely that genetic and environmental factors are not mutually exclusive, and that hypodontia arises as a result of combined effects, as proposed by Brook (41).

Since hypodontia preferably affects the permanent dentition rather than the deciduous dentition (1-3,5,8,28,30,33), and may result in functional disability and esthetic problems (4,5,12), it is important to recognize the disorder as early as possible because its treatment requires interdisciplinary management (6,11). Therefore, our findings could be of value to clinicians, especially orthodontists and pedodontists, bearing in mind that the number of CMT and its location will represent different diagnostics and treatment decisions (16)

In conclusion, the mandibular second premolar was unquestionably the most frequent CMT even without considering the third molar, and the first molars were the most stable teeth. There was a special predilection for CMT in mandibular incisors. Most cases involved agenesis of just one or two teeth, and therefore most individuals affected suffer only a mild form of hypodontia. Congenital absence of the mandibular second premolar and maxillary lateral incisor are closely related to hypodontia of a single tooth. On the other hand, absence of the first premolar, central incisor and second molars is closely related to oligodontia. The high prevalence and high average number of CMT per affected child indicate that hypodontia is not uncommon in the Japanese population. There were no significant differences in the distribution of congenitally missing teeth between sexes or in localization by arches and quadrant sides. Moreover, symmetrical hypodontia was predominant, being found in both the contralateral and antagonistic quadrant, possibly suggesting a strong genetic pattern.

The present study was conducted in an ethnically homogeneous community. The results may therefore be considered representative of the Japanese population. Moreover, establishment of the prevalence and distribution of hypodontia could provide a clinical phenotype for use in future investigations of the etiology of congenital numerical variation of teeth or anthropological studies in Japanese.

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