

The Prevalence of Lateral Incisor Hypodontia and Canine Impaction in Croatian Population

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ABSTRACT

The study investigates the prevalence of second incisor hypodontia and canine impaction in Croatia. The study of incisor hypodontia encompassed 568 examinees (229 boys, 339 girls) aged 6–22 ($X = 11.2$, $SD = 2.8$) while for canine impaction, a subsample of 170 examinees older than 13 years was formed (68 boys and 102 girls). The participants were non-selected ambulatory patients of the Dental Clinic Zagreb and the School of Dental Medicine, University of Zagreb who voluntarily participated in the study. Investigated anomalies were registered from panoramic x-rays and dental records and a tooth was diagnosed as congenitally missing when no crown mineralization could be identified on dental panoramic tomogram and no evidence of extraction was found. For each examinee, the final dental panoramic tomogram evaluation was performed at the age of 13 years. Missing lateral incisors are found in 14 out of 568 participants, indicating the prevalence of 2.46%. With the M : F ratio 1 : 6, sex-specific prevalence are 0.87% and 3.54% for males and females respectively. The prevalence of missing lateral incisor is 1.76% in maxilla and 0.70% in mandible. The sex specific pattern as well as overall prevalence of lateral incisor hypodontia is within the range reported in other studies. On the other hand, the findings of bilaterally missing lateral incisor in six out of 14 examinees (or in 42.86% of hypodontia) is certainly the specificity of the here investigated population. The additional peculiarity is the finding of the bilateral aplasia of mandible canines registered in one child. Canine impaction is found in 8 participants of the present study (4.71%) and in all cases it was placed in maxilla. No sex specific differences in prevalence of impactions are found. In one case (or in 12.5%) a canine impaction is found bilaterally. Missing lateral incisors and canine impaction in the same examinee was not found in this study.

Key words: hypodontia, impaction, palatally displaced canine, tooth agenesis, tooth, abnormalities, epidemiology, Croatia

Introduction

Anthropological investigations of developmental dental variations have provided insights into the continuing evolutionary trend of the reduction in tooth number with the reduction in the size of the jaws in humans¹. It seems that phylogenetic changes in the dentition correlate with functional adaptation and that teeth and supporting bones evolve together². The absences of one or more teeth as well as impactions are common developmental anomalies in humans and studies of dental anomalies

showed significant association between palatal displacement of maxillary canines and small size or missing maxillary lateral incisor^{3,4}. The polygenic regulation of tooth development has been proposed implying that mutations in a number of genes could result in failure of teeth to develop^{5,6}. Using familiar tooth agenesis approach Vastardis presented a spectrum of theories and possible genetic factors in understanding human tooth agenesis⁷.

According to Symons et al. (1993)⁸ apart from the third molars, the most commonly congenitally absent tooth is the second premolar (3.4%) followed by the permanent lateral incisor (2.2%) and both are frequently associated with other dental anomalies⁸. In the paper by Pečina et al. (1996) dental hypodontia was found in 10% of scoliotic children and in only 0.8% of children without scoliosis of the spine⁹. The prevalence of upper lateral incisor hypodontia in different populations range from 0.8 percent in Iceland¹⁰ to 2 per cent in Norway¹¹. In different samples in USA the total prevalence of hypodontia ranges from 3.5 per cent¹² to 8.8 per cent¹³ and in Europe from 5 per cent in Denmark¹⁴ to 7.9 per cent in Iceland^{15,16}.

Canine is palatally impacted in 85% and buccally in 15% of cases¹⁷. Buccal impaction is mostly caused by inadequate arch space, while palatal displacement of the maxillary canine is a positional anomaly that generally occurs despite adequate arch space¹⁷. The etiology of palatally displaced canine (PDC) is probably multifactorial – with long eruptive pathway, atypical morphology or missing lateral incisors and heredity – presenting the most important risk factors¹⁸.

Since the ectopic maxillary canine and maxillary second incisor hypodontia are medical conditions requiring complex multidisciplinary treatment – surgery, restorative dentistry, periodontics and orthodontics – the early diagnosis as well as well defined curative protocol are equally important for successful outcome. The aim of this study is to provide the prevalence of second incisor hypodontia and canine impaction in Croatia and to explore for both traits the pattern of the sex specific prevalence and the frequencies of bilateral occurrence. It is expected that the information on population-specific and sex-specific prevalences will be valuable for public dental health as well as for incoming anthropological and genetic-epidemiological studies of dental variations in the population of Croatia.

Material and Methods

The presented epidemiological study encompassed 568 examinees (229 boys, 339 girls) aged 6–22 ($X = 11.2$, $SD = 2.8$). For canine impaction analyses, a subsample of 170 examinees older than 13 years was formed (68 boys and 102 girls). All participants were non-selected ambulatory patients of the Dental Clinic Zagreb and School of Dental Medicine, University of Zagreb who voluntarily participated in the study.

Investigated anomalies (hypodontia, canine impaction) were registered from panoramic x-rays and dental records. Subjects with poor quality of x rays or with incomplete records were excluded from the study. All patients with systemic conditions likely to predispose towards hypodontia or ectopic teeth were excluded from the sample. A tooth was diagnosed as congenitally missing when no crown mineralization could be identified on dental panoramic tomograms (DPT) and no evidence of extraction was found. In the lower dental arch the apla-

sia of central and lateral incisor was identified according to position on DPT. Impacted teeth and teeth lost as a consequence of extraction or trauma were recorded as present. To prevent the registration of late mineralized teeth as congenitally missing, final DPT evaluation was performed in the age of 13 years. This criterion was based on the finding by Aasheim and Ogaard (1993)¹¹ who reported that no tooth, excluding third molars, was found to mineralize in patients after the age of 12 years.

Results

Missing lateral incisors

Missing lateral incisors (12, 22, 32, or 42) are found in 14 out of 568 participants (Table 1), indicating the prevalence of 2.46% in Croatian population. It is by far more frequently found in females (12 cases or 85.71%) than in males (2 cases or 14.29%) with M : F ratio 1 : 6. The sex-specific prevalence of missing lateral incisors is 0.87% and 3.54% for males and females respectively. The significance of the observed higher prevalence of missing lateral incisors in females is confirmed by the results of the χ^2 -test ($\chi^2 = 4.042$, $df = 1$, $p = 0.044$) as presented in Table 1.

Missing lateral incisors are more frequently found in maxilla (10 cases, 71.43% of all cases) than in mandible (4 cases, 28.57%). The extrapolated prevalence of missing lateral incisor being 1.76% in maxilla and 0.70% in mandible.

In six (or 42.86%) out of 14 examinees a bilaterally missing lateral incisors are found (Table 2). From all

TABLE 1
NUMBER OF PERSONS HAVING MISSING LATERAL INCISORS IN HOSPITAL-BASED SAMPLE OF CROATIAN POPULATION. GENDER DIFFERENCE IN OCCURRENCE OF MISSING LATERAL INCISORS IS TESTED BY χ^2 -TEST

	Boys	Girls	Total
Missing lateral incisors	2	12	14
Normal lateral incisors	227	327	554
Total	229	339	568

$\chi^2 = 4.04218$, $df = 1$, $p = 0.044379$

TABLE 2
NUMBER OF EXAMINEES WITH UNILATERALLY AND BILATERALLY MISSING LATERAL INCISORS

Missing lateral incisors	Unilateral N (%)	Bilateral N (%)
12	3 (21.43%)	5 (35.71%)
22	2 (14.29%)	
32	–	1 (7.14%)
42	3 (21.43%)	
Total (unilateral, bilateral)	8 (57.14%)	6 (42.86%)
Total (unilateral + bilateral)	14 (100%)	

cases of bilaterally missing incisors, five are found in upper (i.e. 50% of all hypodontia in maxilla are bilateral) and one in lower jaw (i.e. 25% hypodontia in mandible are bilateral). Unilateral hypodontia in both jaws was not found in this sample.

Although all bilaterally missing lateral incisors are found exclusively in females, χ^2 -test, owing to low overall prevalence of hypodontia in males, the gender difference showed only borderline significance ($\chi^2 = 4.932$, $df = 2$, $p = 0.084$). It should be noted that in females the unilateral and bilateral hypodontia are equally frequent (50%:50%).

In the present study hypodontia of canines was also found in one examinee (placed bilaterally in mandible). The calculated prevalence of this anomaly (0.18%) should be interpreted with precaution since it was found only in one case per 568 examinees.

Canine impactions

Canine impaction is found in 8 participants of the present study (4.71%) and in all cases it was placed in maxilla. As presented on Table 3, the sex distribution of impacted teeth is almost exactly as expected – implying that the prevalence of canine impaction in women (4.90%) compared to that in men (4.41%) are statistically the same. In one out of 8 cases (12.5%) a canine impaction is found bilaterally (Table 4).

Table 5 shows the difference in occurrence of normal tooth and occurrence of missing lateral incisor or canine impaction in persons contralaterally having the same condition (the significance is presented as revealed by χ^2 -test). Bilateral canine impaction was significantly more frequently found than what would be expected by population frequency of canine impaction cases ($\chi^2 = 6.982$, $df = 1$, $p = 0.0082$).

TABLE 3
NUMBER OF PERSONS HAVING CANINE IMPACTION IN HOSPITAL-BASED SAMPLE OF CROATIAN POPULATION. GENDER DIFFERENCE IN OCCURRENCE OF CANINE IMPACTION IS TESTED BY χ^2 -TEST

	Boys	Girls	Total
Impacted canine	3	5	8
Normal canine	65	97	162
Total	68	102	170

$\chi^2 = 0.021$, $df = 1$, $p = 0.882$

TABLE 4
NUMBER OF EXAMINEES WITH UNILATERAL AND BILATERAL CANINE IMPACTION

Impacted canine	Unilateral	Bilateral
13	4 (50.0%)	1 (12.5%)
23	3 (37.5%)	
Total (unilateral + bilateral)	8 (100%)	

More significant result is found for missing lateral incisors, especially upper (Table 5). We can see that the bilateral hypodontia of lateral incisors was significantly more frequently found than expected in both upper ($\chi^2 = 250.235$, $p < 0.001$) and lower ($\chi^2 = 141.249$, $p < 0.001$) jaws. Expected frequency is a calculated probability (from the prevalence of hypodontia) for cases when one lateral incisor is missing that the other incisor will be missing by pure chance.

In this study missing lateral incisors and canine impaction in the same examinee was not found.

TABLE 5
OCCURRENCE OF NORMAL TOOTH VS. OCCURRENCE OF MISSING LATERAL INCISOR OR CANINE IMPACTION IN PERSONS CONTRALATERALLY HAVING THE RESPECTIVE CONDITION TESTED BY χ^2 -TEST

	N	χ^2	p ($df = 1$)
Missing upper lateral incisors (12, 22)	568	250.235	0.00000
Missing lower lateral incisors (32, 42)	568	141.249	0.00000
Impacted canines (12, 23)	170	6.982	0.0082

Discussion

The prevalence of missing lateral incisor in maxilla of 1.76% in this study is within the range from 0.8 % in Island¹⁰ and 2 % found in Nordic population¹¹. Similar prevalence of 1.7 % is found in Denmark¹⁹ and 1.7 % in the USA¹². The absence of lateral incisor in this investigation is found to be significantly more common among females than in males, which is in agreement with previous studies^{10,12,16,20}. On the other hand, the finding of bilateral upper lateral incisor hypodontia is rarely reported and the most studies report unilateral absence was more common than bilateral absence^{11,16,19}. In contrast, the results of the present study strongly suggest that a missing lateral incisor presents a high risk for contralaterally having the same condition.

As reported in papers by Becker et al. (1981)²¹ and Al-Nimiri and Gharaibeh (2005)⁴ lateral incisor hypodontia is relatively frequent finding among PDC cases. Miller²² noted 2.4 times more frequently missing lateral incisor in the group with PDC. Findings from this study with no missing lateral incisors in cases with PDC could be explained by the relatively modest link of these two anomalies in their heredity⁷ as suggested by Becker (1995)²³. The prevalence of canine impaction of 4.71% is slightly more than the 1% to 3% range established by other epidemiological studies^{22,24,25}. However, the difference could be attributed to random sampling variation since only 8 canine impactions are found in our sample.

Several authors have commented gender differences in the occurrence of PDC. Findings from earlier studies report that PDC is more than twice more common in girls than in boys²⁶. Although the same tendency was

found in this study (M 3:F 5), the gender difference could not be confirmed owing to the small sample size for detectable effect. Peck et al. (1994) stressed the gender bias as one of five categories²⁶ for supporting the hypothesis for genetic origins of PDC. Results in this study would support a hypothesis that both genetic mutations and environmental factors seem to play a role in defining PDC in affected individuals^{27,28}.

In this sample, 12% of the total number of palatally displaced canine (PDC) cases showed bilateral occurrence and this finding is slightly lower than data documented in earlier studies (from 17% to 45%)^{21,26}. The interesting finding in this investigation is bilateral aplasia of mandible canines registered in one child. Unilateral mandible canine hypodontia was not found in this study. The bilaterally missing mandible canines are extremely rare and we did not find similar cases in the literature.

In conclusion, the presented results displayed that the prevalence of missing lateral incisors and canine im-

pactions are comparable to what was previously reported for populations of European origin. Since the sample consisted of randomly selected dental hospital pediatric patients treated for conditions unrelated to hypodontia and impaction, we consider the reported prevalence as only slight overestimation of those present in general population of Croatia. However, the obtained results should be confirmed in future studies encompassing larger sample. Here detected cases (and their families) are also providing an excellent starting point to widen study goals towards investigation of the genetic basis of developmental dental anomalies.

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PREVALENCIJA HIPODONCIJE LATERALNOG SJEKUTIĆA I IMPAKCIJE OČNJAKA U HRVATSKOJ

SAŽETAK

U ovoj studiji provedeno je istraživanje prevalencije hipodoncije lateralnog sjekutića i impakcije očnjaka u populaciji Hrvatske. U istraživanje je bilo uključeno 568 ispitanika (229 dječaka, 339 djevojčica) dobnog raspona 6–22 godina ($X = 11,2$; $SD = 2,8$) pri čemu je za analizu impakcije očnjaka formiran poduzorak od 170 ispitanika koji su bili stariji od 13 godina (68 dječaka i 102 djevojčice). Svi su ispitanici neselektivno odabrani pacijenti Stomatološke poliklinike Zagreb i Stomatološkog fakulteta Sveučilišta u Zagrebu koji su dobrovoljno pristali sudjelovati u studiji. Ispitivane anomalije ustanovljene su iz panoramskih rendgenskih slika i zubnih kartona te je zub dijagnostičiran kao kongenitalno nedostajući kada se uz odsutnost ekstrakcije zuba nije mogla uočiti mineralizacija krune na ortopantomogramu. Za svakog ispitanika, konačna ortopantomografska evaluacija napravljena je u dobi od 13 godina. Nedostajući lateralni sjekutići pronađeni su kod 14 od 568 ispitanika, što čini prevalenciju od 2,46% za populaciju Hrvatske. Uz omjer spolova M : Ž od 1 : 6, spolno specifična prevalencija iznosi 0,87% za muškarce i 3,54% za žene. Populacijska prevalencija hipodoncije

lateralnih sjekutića prema čeljusti iznosi 1,76 za maksilu i 0,70% za mandibulu. Spolna učestalost kao i ukupna prevalencija hipodoncije unutar je raspona koji se nalazi u drugim populacijama. S druge strane, nalaz bilateralne hipodoncije lateralnih sjekutića kod 6 od 14 ispitanika (ili kod 42,86% svih hipodoncija) svakako je specifičnost ovdje istraživane populacije. Dodatna posebnost ove studije jest nalaz bilateralne aplazije očnjaka mandibule koja je pronađena kod jednog djeteta. Impakcija očnjaka pronađena je kod 8 ispitanika ove studije (tj. kod 4,71% osoba) i u svim slučajevima bila je smještena u maksili. Nije se mogla ustanoviti spolna razlika u učestalosti impakcije. Kod jednog ispitanika pronađena je bilateralna impakcija očnjaka (12,5% svih impakcija). U ovoj studiji nije bio niti jedan slučaj istodobnog javljanja hipodoncije lateralnih sjekutića i impakcije očnjaka.