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THE PREVALENCE OF PEG-SHAPED AND MISSING LATERAL INCISORS WITH MAXILLARY IMPACTED CANINES

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THE PREVALENCE OF PEG-SHAPED AND MISSING LATERAL INCISORS WITH MAXILLARY IMPACTED CANINES

ABSTRACT

Introduction. /Aim. Many authors are finding that impacted maxillary canines is associated with missing and peg-shaped lateral incisor. The aim of this study is to examine the prevalence of peg-shaped and missing lateral incisor in subjects with impacted maxillary canines, then compare the size of maxillary lateral incisor on the side with palatal impacted canine and on the opposite side of the jaw where there is no impaction. Methods. The research included 64 patients with 80 impacted maxillary canines (23 males and 41 females, mean age 16.3). For each maxillary unerupted canine, precisely correct localization and thus selected into groups. We analyzed the morphology of the lateral incisor (normal, atypical) and frequency of missing of lateral maxillary incisors with canine impaction. Then, from the mentioned examinees sample with the maxillary canine teeth formed is a subgroup. The criteria for selection were those with unilateral palatal impacted canines (33 subjects, 22 female and 11 male; mean age 17.8 years). The linear variables of the maxillary lateral incisor were measured by using digital measurements tools. T test was used to test the differences between groups. Results. In our study, 72% of subjects with the impacted canines had normal morphology of the lateral incisors, 11.2% of the peg-shaped lateral incisors, 6% had a bilateral and 4% had unilateral deficiency of lateral incisors. In the subgroup of patients with unilateral palatal impaction the middle value of the length of the lateral incisors is 1.9 mm shorter, and the middle value of the width of the lateral incisors is smaller by 0.9 mm. Conclusion. The frequency of the deficiency of lateral incisors was statistically higher in the group with palatal canine impaction. The maxillary lateral incisors on the side with palatal impacted canines are smaller than those on the side where there is no impaction.

Keywords: canine impaction, lateral incisor, peg-shaped, missing, CBCT
UČESTALOST HIPODONCIJE I ATIPIČNIH LATERALNIH SEKUTIĆA UDRUŽENA SA IMPAKTIRANIM MAKSILARNIM OČNJACIMA

APSTRAKT

Uvod/Cilj. Mnogi autori pronašli su da su atipični lateralni sekutići kao i njihov nedostatak udruženi sa impakcijama maksilarnih očnjaka. Cilj ovog istraživanja je da se ispita učestalost atipičnih lateralnih sekutića i njihov nedostatak kod pacijenata sa impaktiranim maksilarnim očnjacima; uporediti veličine maksilarnih lateralnih sekutića na strani gde postoji palatinalno impaktiran očnjak i na suprotnoj strani vilice gde ne postoji impakcija. Dužina i širina lateralnih sekutića merene su na trodimenzionalnim snimcima. Metode. Istraživanje je obuhvatalo 64 ispitanika sa 80 impaktiranih maksilarnih očnjaka (23 muškog pola i 41 ženskog pola, prosečne strosti 16,3). Za svaki impaktirani očnjak je precizno određena njegova lokalizacija (bukalno, palatinalno ili sredinom alveole) pomoću trodimenzionalnog snimka maksile i tako su podeljeni u grupe po mestu impakcije. Analizirali smo morfologiju laeralnih sekutića (normalni, atipični) i učestalost nedostatka lateralnih sekutića u grupi sa bukalnim i palatinalnim impakcijama. Zatim je iz pomenute grupe ispitanika izdvojena podgrupa. Kriterijum za odabir su bile unilateralne palatinalne impakcije očnjaka (33 ispitanika, 22 ženskog pola i 11 muškog pola, prosečne starosti 17,8 godina). T test je korističen za testiranje razlika između grupa. Rezultati. U našoj studiji 72% ispitanika sa impaktiranim očnjacima imalo je lateralne sekutiće normalne morfologije, 11,2% konične lateralne sekutiće, 6% ispitanika je imalo bilateralni nedostatak lateralnih sekutića i 4% je imalo unilateralni nedostatak lateralnog sekutića. U podgrupi ispitanika sa unilateralnim palatinalnim impakcijama srednja vrednost za dužinu lateralnih sekutića je za 1,9 mm kraća, a srednja širina lateralnih sekutića je manja za 0,9 mm u poredjenju sa kontrolnom grupom. Zaključak. Učestalost nedostatka lateranih sekutića je statistički veća u grupi sa palatinalnim impakcijama očnjaka nego u grupi sa bukalnim impakcijama očnjaka. Lateralni sekutići na strani palatinalno impaktiranih očnjaka su manji od onih na strani gde nema impakcije.

Ključne reči: očnjak, impakcija, lateralni sekutić, mali, nedostatak, CBCT
INTRODUCTION

The impaction of maxillary canines is associated with lateral incisor anomalies and the other orthodontics malocclusion, some of which can be a cause or consequence for impaction canine. Broadbent\textsuperscript{1} the most common reason given for palatal displacement of the permanent maxillary canine was the fact that it had a long and tortuous eruption path, beginning close to the floor of orbit. It was considered that, compared with other permanent teeth, this tooth had much further to travel before it erupted into the mouth and that it therefore had a great chance of “losing its way”. This has been standard teaching for many decades. Hitchin\textsuperscript{2} considered that crowding of the dentition was the reason for this condition, although he offered no evidence to support his contention. In a series of other studies Jacoby\textsuperscript{3}, Becker\textsuperscript{4,5} and Brin\textsuperscript{6} pointed out that the likelihood of palatal displacement is much reduced where crowding is present. They have shown it to be a far more prevalent occurrence when there is excessive space in dental arch. Miller\textsuperscript{7} and Bass\textsuperscript{8} have recorded a high prevalence of congenitally anomalies of maxillary lateral incisors associated with the palatal impacted maxillary canines. The canine initially has a strong mesial developmental path, which alters early on, with the canine being guided downwards, apparently along the distal aspect of the lateral incisor root. They concluded that, in the absence of this guiding influence, the canine continues in its mesial and palatal path. The tooth then becomes impacted in palatal area, posterior to the central incisors, and fails to erupt in its due time, if at all. Miller assumed that since a peg-shaped or otherwise abnormally small lateral incisor develops a root of more or less normal length, such a tooth would provide the required guidance for normal eruption of its adjacent canine. He therefore rationalized that these anomalous teeth could not be an aetiological factor in canine impaction.

In series of clinical studies that have followed indicate a statistically significant number of normal, small and peg-shaped lateral incisors associated with impacted maxillary canines compared with the general population. In the general population, 93\% of all lateral incisors have normal morphology, compared with only 52\% in subjects with impacted canine. The deficiency of lateral incisor was founded in 1.8\% of general population, compared with 5.5\% in cases of impacted maxillary canine, which is three times more often.\textsuperscript{9} These results clearly support Bass's
and Miller's theory that lateral incisor manage in normal eruption of the permanent canine. Without this guidance, normal eruption of permanent canines is compromised even five times.

It was reported that, in Israel population, the prevalence values of small lateral incisors were 4%; peg-shaped 1.8% and missing lateral incisor were 1.3%. In one study, 42.6% of palatal displaced canines were found to be associated with lateral incisor anomalies; 25.3% of palatal displaced canines were adjacent to small lateral incisor, 13.3% had peg-shaped lateral incisor and 4% of the subjects had missing lateral incisor.\textsuperscript{10}

A meta-analysis showed that the prevalence values of congenital absence of maxillary lateral incisors were 1.55% for males and 1.78% for females, there was no statistically significant difference between the sexes.\textsuperscript{11}

Becker and Chaushu\textsuperscript{12} found that approximately half of their subjects with palatal displaced canines had delayed dental development. Chaushu et al.\textsuperscript{13} subsequently stated that there might be two distinct palatal displaced canines subgroups among the male subjects but not among the female subjects. Nevertheless, Oliver\textsuperscript{14} found that both sexes with palatal displaced canines had delayed dental development, with a familial trend of delayed dental development among their siblings.

The latest study\textsuperscript{15} was to investigate the prevalence of peg-shaped maxillary lateral incisors and the incidence of associated dental anomalies in children. Among children with peg-shaped lateral incisors, the frequencies of associated dental anomalies were as follows: congenitally missing teeth, 31.8%; dens invaginatus, 19.7%; palatal displaced canines, 12.1%; supernumerary teeth, 7.6%; and transposition, 7.6%.

It has been reported that the mesiodistal width of crown of the lateral incisors was smaller in a palatal displaced canines sample\textsuperscript{16}. Palatal displaced canines have also been shown to be associated with short lateral incisor roots; thus, it was suggested that there is a link between lateral incisor crown size and root length.\textsuperscript{17,18}
AIM
The aim of this research was to analyze morphology of maxillary lateral incisors and examine the prevalence of peg-shaped and missing of maxillary lateral incisors which are associated with maxillary impacted canines. Then, compare the size of maxillary lateral incisors between the group of lateral incisors with palatal displaced canines and the control group (on the contralateral side of jaw where there is no canine impaction). In this study, the width and the length of the lateral incisor was measured using three-dimensional CBCT images.

MATERIAL AND METHODS
The study included 64 examinees with 80 impacted maxillary canines (23 male and 41 female; mean age 16,3 years). Each patient underwent clinical examination, intraoral and extraoral photographed and done the CBCT image of maxilla.
For each maxillary unerupted canine, precisely correct localization is determined by impaction (bucal, palatal or midalveolar) and thus divided into groups. We analyzed the morphology of the lateral incisor (normal, atypical) and frequency of missing of lateral maxillary incisors in subjects in the group with the bucal impaction and the group with palatal impaction canines.
Then, from the mentioned examinees sample with the maxillary displaced canine formed is a subgroup. The criteria for selection were those with unilateral palatal impacted canines (33 examinees, 22 female and 11 male; mean age 17,8 years). Subjects with buccal or midalveolar impacted canines, transposed canines and premolars, transposed canines and lateral incisors, severely resorbed maxillary lateral incisors were excluded. 30 palatal impacted canine fulfilled the inclusion criteria and were available
We measured the length and the width of the lateral incisors on the side where there were palatal impacted canines and compared with lateral incisors on the contralateral side, where there was no impaction of canine.
Cone-beam volumetric tomography DICOM files were imported into OnDemand software (Cybermed.Inc version 2011.) and the volumetric images (voxel size 0,2mm, field of volume 75*100mm) were reoriented with the long axis of lateral incisor vertical and then reconstructed into images of sagittal slice through the maxillary lateral incisors. The linear variables of the maxillary lateral incisors were measured by using digital measurement tools. The length of lateral
incisors was measured on the sagittal slice image. The width of crown were measured on the axial slice image across the equator of lateral incisor crown.

The data primarily obtained were analyzed with descriptive methods and methods for testing statistical hypotheses. From descriptive methods, measures of central tendency (median), measures of variability (SD, variation interval) and the relative numbers (structure indicators) were used. For testing hypotheses, the methods used were $\chi^2$ test, Student’s t-test, Fisher’s test.

RESULTS

In this study, a total of 64 patients with CBCT images were enrolled and 80 impacted maxillary canines were diagnosed and analyzed individually. The mean age of the patients was 16,3 years (range: 12–33 years, SD ± 4,3 years). Of 64 examinees in research 41 (64,1%) were female which is significantly more important than the representation of male examinees whose number was 23 (35,9%). Total of 80 impacted maxillary canines 19 (23,75%) were buccally impacted, 3 (2,75%) in the middle of alveolus and 58 (72,5%) palatally impacted canines. The frequency of unilaterally impactions of maxillary canines is three times higher 48 (75%) in comparison to bilaterally impactions 48 (75%). Then, 39 (48.8%) impacted maxillary canines were located on the right side and 41 (51.2%) on the left side. (table 1.)

The subjects with unilaterally impacted maxillary canine was 48; which are more common among female subjects - 32 (50%) and male subjects - 16 (25%), which was statistically significant ($\chi^2$=0,846; p<0,01). (figure 1)

There was statistically significant difference between buccal and palatal impaction groups, for missing lateral incisors (Fisher's exact probability test, p=0,498). The missing of lateral incisor was present in 13 (16,3%) examinees only within the group of palatal impactions maxillary canines; unlike atypical lateral incisor which were present within both groups, in the case with palatally impacted canines (7,5%) and with buccally impacted canine (3,7%). There was no statistically significant differences between sexes for frequency of missing lateral incisors (Fisher's exact probability test, p=0,757). (table 2)

There is an interesting information in the study of the morphology of lateral incisors in the subjects with maxillary canine impaction. The results concerning our examinees with impacted maxillary canines were: 72% of all lateral maxillary incisors had normal morphology, 11,2% -peg
shaped, 4% of subjects had bilaterally missing lateral incisors and 6% had unilaterally missing lateral incisors. (figure 2)

In the table 3, variables are given measured parameters (the length of the lateral incisors and the width of lateral incisors in subgroup). The average value of the width of the tested lateral incisors is 5.9±0.6mm, while the control lateral incisors was 6.1±0.5mm, a statistically significant difference (Student’s t test, t=2.353; p=0.022).

The average value of the length of the tested lateral incisor is 19.7±3.0mm, while the control lateral incisors was 20.6±1.7mm, which is a statistically significant difference (Student’s t test, t=2.362; p=0.022), respectively lateral incisors on the side with canine impaction are shorter than those in the control group.

Our results indicate that there is a statistically significant difference in the length of the lateral incisors, more precisely; palatal displaced canines are associated with shorter lateral incisor roots by 1.9mm compared with lateral incisor roots in the control group. (table 3, figure 3)

Also, there is statistically significant difference for the mesio-distal width of the lateral incisor; where tested lateral incisors were smaller than the lateral incisors in the control group for 0.9mm. (table 3, figure 4)

**DISCUSSION**

Palatal displaced canines have been associated with missing lateral incisor and other anomalies.19-22 In another study, palatal displaced canines were reported to be associated with peg-shaped or missing lateral incisors, other impacted and missing teeth and deep bite with retroclined maxillary incisors.23

Lai24 founded that 70.9% of lateral incisors were normal within his subjects with impacted maxillary canines; 26.1% were peg-shaped and 2.99% missing lateral incisor. Garib25 founded in subgroup of patients with peg-shaped maxillary lateral incisors (aged 10years or older) the prevalence of palatal displaced canines was elevated 5.2%.

The similar results are in our subjects with impacted maxillary canines: 72% of all lateral maxillary incisors have normal morphology; 11.2% -peg-shaped; 45 of subjects have bilaterally missing lateral incisors and 6% have unilaterally missing lateral incisors.

In their researches, Becker8, Liu26 and Woelful27 also founded a statistically significant difference in length and width of lateral incisors, compared with a control group of lateral incisors, in the
subjects where there was no canine impaction. However, the mean length of the lateral incisors reported in their study was much greater than those in our study, because their measurements were mostly based on panoramic radiographs or periapical radiographs. Liuk used CBCT imaging and noted the difference for the length of lateral incisors by 2.1mm, and for the width by 0.7mm. Our study has demonstrated that CBCT measurements are reliable and accurate, too. In this study, the mean length of maxillary lateral incisors in the palatal displaced canine group is significantly shorter than those in control group by 1.9mm, and the mean widths in dimension of the maxillary lateral incisors in palatal displaced canine group are significantly smaller than those in control group by 0.9mm.

The authors have conducted a comparison of the lateral dimensions of the maxillary incisors in subjects with palatal impacted canines and other subjects of the control group without impacted canine. The difference in our study than the lateral maxillary incisors is therefore important because it was done in the same subjects on different sides of the maxilla (therefore the appropriated subgroup with unilateral palatal impaction was isolated).

It was suggested that the smaller mesiodistal crown width of lateral incisors associated with palatal impacted canine might just reflect the shorter root length. The limitation of this study was that the palatal displaced canine group from the radiology practice cannot represent the general population is unlikely.

In patients with impacted maxillary incisors there is a higher incidence of peg-shaped or missing lateral maxillary incisors and other malocclusion, it is important to carefully plan the curing to the end of the treatment were satisfied aesthetic and functional criteria of occlusion.

CONCLUSIONS

- The missing lateral incisors was present in 16.3% of cases, only among subjects with palatal impacted canines. Atypical lateral incisors were present in 11.2% of cases, which explains that the palatal impacted canine associated with missing and atypical lateral incisors are one of the important hereditary phenomena.

- The prevalence of missing lateral incisors is of greater statistical importance in group with palatal impacted canines than in the group with the bucal impacted maxillary canines.
• The differences of width and length of lateral incisors in the group of palatal impacted canines is statistically significant in comparison to lateral incisors in the control group, on the side where there is no impacted canine.

Table 1.

Descriptive data regarding morphology and location of impacted canines.

<table>
<thead>
<tr>
<th>Canines</th>
<th>n = 80, unilateral = 48 (75%), bilateral = 16 (25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>n = 64</td>
</tr>
<tr>
<td>Age (mean)</td>
<td>16.3±4.3 y, range = 12–33 y</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23 (35.9%)</td>
</tr>
<tr>
<td>Female</td>
<td>41 (64.1%)</td>
</tr>
<tr>
<td>Canine type</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>39 (48.8%)</td>
</tr>
<tr>
<td>Left</td>
<td>41 (51.2%)</td>
</tr>
<tr>
<td>Canine localization sagittal</td>
<td></td>
</tr>
<tr>
<td>Labial</td>
<td>19 (24%)</td>
</tr>
<tr>
<td>Palatal</td>
<td>57 (72%)</td>
</tr>
<tr>
<td>Midalveolar</td>
<td>3 (4%)</td>
</tr>
</tbody>
</table>
Figure 1. Distribution of unilateral and bilateral impacted maxillary canines

Table 2.

Distribution of missing and peg-shaped lateral maxillary incisors with impacted maxillary canines

<table>
<thead>
<tr>
<th>Morphology of lateral incisor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing</td>
<td>13 (16.3%)</td>
</tr>
<tr>
<td>Normal</td>
<td>58 (72.5%)</td>
</tr>
<tr>
<td>Peg shaped</td>
<td>9 (11.2%)</td>
</tr>
</tbody>
</table>
Missing lateral incisor

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>p = 0.757*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>4 (13.3%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>9 (18%)</td>
<td></td>
</tr>
</tbody>
</table>

Missing lateral incisor

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>p = 0.498*</th>
</tr>
</thead>
<tbody>
<tr>
<td>With bucal impacted canine</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>With palatal impacted canine</td>
<td>13 (16.3%)</td>
<td></td>
</tr>
</tbody>
</table>

Peg-shaped lateral incisor

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>p = 0.638*</th>
</tr>
</thead>
<tbody>
<tr>
<td>With bucal impacted canine</td>
<td>3 (3.7%)</td>
<td></td>
</tr>
<tr>
<td>With palatal impacted canine</td>
<td>6 (7.5%)</td>
<td></td>
</tr>
</tbody>
</table>

*Fisher’s exact probability test

Figure 2. Morphology of lateral incisors with impacted maxillary canines
Widths and lengths of lateral incisors.

<table>
<thead>
<tr>
<th>Variables (mm)</th>
<th>Lateral incisors</th>
<th>$x;\bar{}$</th>
<th>SD</th>
<th>Med</th>
<th>Min</th>
<th>Max</th>
<th>$p^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>Tested</td>
<td>5,9</td>
<td>0,6</td>
<td>6,0</td>
<td>4,0</td>
<td>7,0</td>
<td>0,022</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>6,1</td>
<td>0,5</td>
<td>6,2</td>
<td>4,2</td>
<td>7,3</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>Tested</td>
<td>19,7</td>
<td>3,0</td>
<td>20,3</td>
<td>12,5</td>
<td>22,3</td>
<td>0,022</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>20,6</td>
<td>1,7</td>
<td>20,9</td>
<td>13,4</td>
<td>23,3</td>
<td></td>
</tr>
</tbody>
</table>

$x;\bar{}$-mean; SD-standard deviation; Med-median; Min-Max – minimal-maximal value; $^*$Student’s t-test

Figure 3. Length of lateral incisor in control and tested group
Figure 4. Width of lateral incisor in control and tested group

Literature


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