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Prevalence and Characteristics of Impacted Third Molars in a Kosovar Population: A Cross-Sectional Study

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Abstract

Background: The goal of this randomized cross-sectional study was to determine the prevalence of impacted third molars in the Kosovar population and to assess the site of impaction using the Winter and the Pell and Gregory classifications.

Methods and Results: A total of 5515 digital panoramic radiographs (PANs) were reviewed to determine the number of impacted third molars, their angulation, and depth. The age range was from 18 to 77 years (29.3±12.8 years). The prevalence of impacted third molars in the sample of the Kosovar population was 73.7%. Of all PANs, one or more impacted third molars were observed in a total of 710 PANs, including 296(41.7%) in men and 414(58.3%) in women, with a sex ratio of 1:1.4; this difference was not significant (*P*=0.616). The mandible exhibited a substantially greater prevalence of impacted third molars than the maxilla 62.1% vs. 37.9% (*P*=0.001). In the mandible, significantly higher frequencies of third molar impaction were noted in the distoangular and vertical positions (36.9% and 33.5%). In the maxilla, the most common angulation of impacted third molars was mesioangular (52.8%). Most impacted third molars recorded a Class C depth of impaction (62.3%) followed by Class B (34.9%), and only 2.8% recorded a Class A depth of impaction.

Conclusion: The samples of third molar impaction in the Kosovar population are characterized by a high prevalence of impaction, especially in the mandible. The most common angulation was the mesial in the maxilla as well as in the mandible. The most common level of impaction in the maxilla and mandible was level C.(**International Journal of Biomedicine. 2022;12(2):284-288.**)

Key Words: impaction • panoramic radiograph • dental radiograph

Abbreviations

OPG, orthopantomogram; **PAN**, panoramic radiograph; **TMI**, third molar impaction.

Introduction

Tooth impaction is a condition in which a tooth fails, or is not expected, to erupt into the dental arch, based on clinical and radiographic findings. Failure of these teeth to erupt may be a consequence of local or systemic factors. Local factors consist of the presence of supernumerary teeth, early loss of deciduous teeth, discrepancies between the size of the tooth and the dental arch, tumors or cysts acting as mechanical barriers, and space deficiencies in the size of the dental arch due to micrognathia.[1-3] Systemic factors related to tooth impaction include childhood diseases, ankylosis of the temporomandibular joint, hereditary factors, cleft palate, syphilis, and cleidocranial dysostosis.[4,5]

Several studies have reported tooth impaction as a common phenomenon with a wide range in the incidence of impaction.[3,6-8] The last tooth to develop and erupt is the third molar, so it is the tooth that most frequently fails to erupt into the dental arch.[2-4] Therefore, impaction of the third molar is

the most commonly reported in the literature, and the incidence of TMI seems to be increasing in adults.[9,10]

Studies report a variable prevalence of impacted third molars, with a range of 15.2%–94.8%.[10-13] Most studies underscore that mandibular TMI exhibits a high prevalence prevalence, compared with its counterpart in the maxilla.[3,10,14,15]

Given their relationship with various diseases and other serious clinical conditions, such as caries and root resorption of the neighboring tooth to the impacted third molar, impacted third molars are a common health issue.[5,16-18] TMI is linked to the formation of cystic lesions and tumors, but the frequency is limited (2.77%).[19] As a result, extraction is one of the most common treatments [20,21] and is based on an assessment of the degree of impaction, angulation, and interaction with the mandible's anterior ramus.[22,23] The Winter and the Pell and Gregory categorization methods, which employ the connection between the longitudinal axis of the tooth, the occlusal surface of the neighboring tooth, and the ascending ramus of the mandible vigilant,[22,23] are the most reliable in usage.

Information about all teeth in the maxilla and mandible, including their surrounding anatomical structures provided by OPGs, is widely used in dentistry to diagnose impacted teeth and is the main method for evaluation in epidemic research due to its economic and rational characteristics for use.[5,6]

Therefore, given that the prevalence of TMI has not been determined in the Kosovar population and that its prevalence varies in different regions, this study aimed to evaluate the prevalence of TMI in the Kosovar population and their angulation while using panoramic radiographs (PANs). The findings of this study will contribute to expanding current epidemiological knowledge of the pathology of TMI. Moreover, these data might be useful for all dental health workers, specifically those involved in oral health care and preventive dentistry, via the development of efficient prevention approaches.

Materials and Methods

In this cross-sectional study, 5515 PANs were randomly obtained from the radiology unit at the University Dentistry Clinical Center of Kosovo (UDCCK), which were obtained as part of patients' random clinical treatment between 2011 and 2015. Of these 5515 OPGs, 2724 belonged to men and 3620 to women. The age range was from 18 to 77 years. OPGs were retrieved as digitalized images from the UDCCK database using Sidexis Next Generation imaging software, version 2.4®, integrated with the I-Max Touch Line (Owandy, Champs-sur-Marne, France)® at 220-240 V-7A 50/60 Hz with a maximum exposure time of 15 sec.

Patient data, such as date of birth and sex, were collected. The study inclusion criteria for PAN were records of patients aged 18 years or older and both males and females of Kosovo origin with all forms of impaction. Exclusion criteria were OPGs of patients under 18, absence of birth records, incomplete third molar root formation, and recorded congenital anomalies.

This study was approved by the Ethics Committee of UDCCK, the Faculty of Medicine, the University of Prishtina,

and the University of Zagreb. Written informed consent was obtained from each patient.

An impacted third molar was defined as the third molar with fully formed roots that did not erupt into the dental arch and had no functional occlusion because it was impeded in its eruption path by another tooth, bone, or soft tissue (Figure 1).[5]

Fig. 1. *OPG of a 22-year-old female patient. Impacted third molars in the maxilla and third right molar in the mandible.*

Winter's classification, which is based on the angle created between the longitudinal axis of the second and third molars, was used to identify the angulation of an impacted third molar in the current investigation. Corel DRAW was used to examine the angulations on the digital photos (Graphics Suite X7, U.S.). The tools 'Magnify' and 'Ruler' were utilized during the analysis. Angulation of the impacted third molar was determined by evaluating the angle formed between the intersected longitudinal axes of the impacted third molar and the adjacent second molar: vertical impaction (10° to -10°), mesioangular impaction (11° to 79°), horizontal impaction (80° to 100°), distoangular impaction (-11° to -79°), other impaction (111° to -80°), and buccolingual impaction (tooth oriented in a buccolingual direction with the crown overlapping the roots).[22]

Classification by Pell and Gregory is extensively used to predict the difficulty of extracting impacted third molars. The level of difficulty is measured by the thickness of the overlying bone, and the level of difficulty increases as the depth of the impacted tooth increases. Pell and Gregory's assessments were used in this study to measure the depth of impacted third molars in relation to the occlusal plane.[23]

The Pell and Gregory classification (Class I to III) was exclusively used for impacted mandibular third molars. The classification is based on the spatial relationship of the third molar to the ascending ramus of the mandible and the second molar.

Statistical analysis was performed using statistical software package SPSS version 18.0 (Chicago: SPSS Inc.). Baseline characteristics were summarized as frequencies and percentages for categorical variables. Continuous variables with normal distribution were presented as mean±standard deviation (SD). The frequencies of categorical variables were compared using Pearson's chi-squared test or Fisher's exact test (2-tail), when appropriate. A value of $P<0.05$ was considered significant.

Using Kappa statistics, the validity of the OPG readings was verified for 99 impacted third molars detected on 50 randomly selected OPGs.[24] Without the ability to assess age or sex, all OPGs were evaluated in a blind manner. The average of the coefficients derived for the study's key variables was significant (0.756).

Results

The prevalence of impacted third molars in the Kosovar population was 73.7%. In our total sample, 42.9% of participants were males and 57.1% were females. The percentage of female participants was significantly higher than that of males (*P*<0.001). Of all PANs, one or more impacted third molars were observed in a total of 710 PANs, including 296(41.7%) in men and 414(58.3%) in women, with a sex ratio of 1:1.4 (Table 1); this difference was not significant (*P*=0.616).

Table 1.

Distribution of impacted third molars according to sex and in PANs

Number of impacted third molars	Male n (%)	Female n (%)	Total n (%)
1	155 (52.4)	202 (48.8)	357 (50.3)
2	91 (30.7)	138 (33.3)	229 (32.3)
3	32 (10.8)	41 (9.9)	73 (10.3)
4	18 (6.1)	33 (8.0)	51 (7.2)
Total	296 (100)	414 (100)	710 (100)

Pearson Chi-Square value = 1.79, df = 3, P = 0.616

The age range was from 18 to 78 years (29.3±12.8 years). The mean age of men was greater than that of women (32.1±14.6 years vs. 27.2±10.9 years; *P*<0.001). Six working-age groups were included in this research: 18–20, 21–30, 31–40, 41–50, 51–60, and > 60 years. TMI was most prevalent in the two younger age groups (27.5% in the group of 18–20 years and 42.3% in the age group of 21–30; total =69.8%). However, in the older age group (31–78), men had a higher number of TMI than did women, while in the younger age groups (18–30), TMI were more common in women than in men, resulting in a statistically significant difference (*P*<0.001).

In both jaws, a total of 1310 impacted third molars were observed. The distribution of impacted third molars between the maxilla and the mandible is shown in Table 2. The mandible exhibited a substantially greater prevalence of impacted third molars than the maxilla 62.1% vs. 37.9%; *P*=0.001. A total of 814 of the 1310 impacted third molar teeth were found in the mandible, and 496 in the maxilla. As a result, impacted third molars were 1.64 times more likely to occur in the mandible than in the maxilla (Table 2).

Based on Winter's classification, the most common angulations of impacted third molars were mesioangular impactions (*P*=0.000) (Table 3). In the mandible, significantly higher frequencies of TMI were noted in the distoangular and vertical positions (36.9% and 33.5%). On the other hand, in the maxilla, the most common angulation of impacted third molars was mesioangular (52.8%).

Table 2.

Distribution of impacted third molars according to jaw location and sex

Jaw	Male n (%)	Female n (%)	Total n (%)
Maxilla	227 (43.1)	269 (34.4)	496 (37.9)
Mandible	300 (56.9)	514 (65.6)	814 (62.1)
Total	527 (100)	783 (100)	1310 (100)

Pearson chi-square value = 10.18, df = 1, Fisher's exact test P = 0.001

Table 3.

Distribution of Winter's angulations according to jaw location

Winter angulations	Maxilla n (%)	Mandible n (%)	Total n (%)
Mesial	262 (52.8)	181 (22.2)	443 (33.8)
Distal	53 (10.7)	300 (36.9)	353 (26.9)
Vertical	80 (16.1)	273 (33.5)	353 (26.9)
Horizontal	76 (15.3)	18 (2.2)	94 (7.2)
Bucco-lingual	25 (5.0)	42 (5.2)	67 (5.1)
Total	496 (100)	814 (100)	1310 (100)

Pearson Chi-Square value = 272.10, df = 4, P = 0.000

Most impacted third molars recorded a Class C depth of impaction (62.3%), and only 2.8% recorded a Class A depth of impaction. No significant difference was noted between the sexes related to the ethical depth of impaction. However, a statistically significant difference in depth of impaction was noted between the maxilla and mandible (*P*=0.000) (Table 4).

Table 4.

Distribution of Pell-Gregory depth classes of impacted third molars according to jaw location

Pell-Gregory	Maxilla n (%)	Mandible n (%)	Total n (%)
Class A	36 (7.2)	1 (0.1)	37 (2.8)
Class B	113 (22.8)	344 (42.7)	457 (34.9)
Class C	347 (70.0)	469 (57.6)	816 (62.3)
Total	496 (100)	814 (100)	1310 (100)

Pearson Chi-Square value = 96.61, df = 2, P = 0.000

In the mandible, most impacted third molars [390(47.9%)] were classified with a Class II position followed by Class I [258(31.7%)] and Class III [166(20.4%)].

Discussion

The frequency of impacted teeth was estimated to be 73.7% in this research of 5515 PANs of Kosovar patients, with 710 PANs having at least one impacted tooth. The current study's prevalence of TMI is similar to that of Morris and Jerman,[25] who reported a frequency of 66% in a study of 5000 participants in the United States.[10] In a survey of 1000 PANs in the Singapore Chinese community, a frequency of 69% was discovered. Impacted third molars were found in 72.09% of

cases by Obiechina et al.,[26] whereas impaction in Scandinavian cultures varied from 22% to 76.1% (Figure 2).[27-29]

Fig. 2. *OPG of a 24-year-old male patient. Impacted third molars are located in the maxilla and the mandible.*

Our results outperform those of Eliasson et al. (33%),[17] Hashemipour et al. (44.3%),[6] and Pillai et al. (50.20%).[9] The results are considerably higher than those of Hattab et al.,[12] who investigated 232 PANs in Jordanians and found a 28.2% frequency of impacted third molars, whereas Hellman found a 15.3% incidence of TMI in 433 Columbia University students.[30]

However, the results were significantly lower than those reported by Gisakis et al.[4] in a Greek population (91.6%). Kramer and Williams[13] reported an incidence of 94.8% from 3,748 radiographs (a survey at Harlem Hospital, NY, U.S), and Kazemian et al.[31] reported an incidence of 95.6% from 10,000 participants in Iran's population. The documented variability in the TMI prevalence might be due to a variety of factors, such as genetic and ethnic characteristics, differences in sampling, quantity of samples, age group studied, radiographic criteria, or definition of impaction.

The distribution of impacted third molars in the mandible was 62.1%, which differed from that noted in the maxilla (37.9%). The results are similar to those of Quek et al.,[10] who reported that impacted third molars occurred 1.33-fold more frequently in the mandible than in the maxilla. However, some studies have discovered that the maxilla has a higher percentage of impacted third molars than the mandible. Dachi and Howell (21.9%),[32] Hattab et al. (54%),[12] and Kramer and Williams (63%)[13] all verified a maxillary prevalence.

More female patients than male patients were included in our study. Pedro et al.[2] and Quek et al.[10] also reported a female preponderance. Despite the higher incidence of female patients, this study found no statistically significant difference (*P*=0.616) between males and females in terms of TMI. Hattab et al.,[12] Kramer and Williams,[13] Dachi and Howell,[32] and Ayranci[33] also found no sex difference. After the third molars erupt, female jaws cease developing but male jaws continue to expand.[6,14,31] In addition, contrary to our findings, Hashemipour et al.[6] and Quek et al.[10] discovered a larger percentage of impacted third molars in females, whereas Haidar and Shalhoub[11] found that males (34%) had a greater rate of TMI than females (29%).

Winter's categorization of angulation of impacted third molars revealed that among 1310 affected third molars, mesioangular impaction was the most common (33.8%). The results are compatible with conclusions reported by Obiechina et al.(48.20%)[26] and Hattab et al.(50%)[12] However, these findings are incompatible with Pillai et al.,[9] who found that the vertical position of impacted third molars was more common (46.6%), followed by the mesioangular position. Similar results of the predominance of vertical angulation were reported by Haidar and Shalhoub.[11]

Using the Pell and Gregory categorization, the depth of impacted third molars revealed that 816(62.3%) of impacted third molars were classified as Class C (Figure 3). Compared to the mandible, the maxilla had a greater incidence of profoundly impacted third molars, with a Class C frequency of 70.0% versus 57.6%. Similarly, Pillai et al.,[9] Quek et al.[10] Venta et al.,[34] and Kruger et al.[35] found the highest prevalence of profoundly impacted third molars in the mandible. No statistically significant association was noted between impaction level and gender.

Fig. 3. *OPG of a 22-year-old female patient. Impacted third molars are located in maxilla right side level C and left side level B.*

According to Pell and Gregory, a high majority of impacted third molars in the mandible have half of their crown in the ramus (48%) and are classed as Class II. This conclusion is consistent with the findings of several previous studies that revealed Class II impaction to be the most prevalent for mandibular third molars.[6,20] In the 710 PANs, 357 patients had at least one impacted third molar, 229 had two, 73 had three, and 51 had four. Thus, the most common number of impacted third molars was one per patient. Nanda et al.[36] noted that one impacted third molar per patient was the most common frequency. In contrast, Quek et al.[10] and Pillai et al.[9] reported that the most frequent number of impacted third molars in their retrospective radiographic study of 1000 and 1100 PANs was two per patient.

Conclusion

The samples of TMI in the Kosovar population are characterized by a high prevalence of impaction, especially in the mandible. The most common angulation was the mesial in the maxilla as well as in the mandible. The most common level of impaction in the maxilla and mandible was level C.

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