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Original Research Article

Prevalence and Pattern of Third Molar Impaction among the Saudi Population in Jazan Region, Saudi Arabia

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Abstract

Introduction: Mandibular third molars are the most frequently affected by impaction. No previous study had been conducted in the Jazan region. ***Aim of the study:*** To evaluate the prevalence and patterns of third molar impaction among the Jazanian subpopulation in the southwestern region of Saudi Arabia. ***Materials and methods:*** A retrospective study was conducted involving the analysis of the orthopantomograms (OPG) of 1012 patients who attended the Jazan University College of Dentistry. The OPGs were selected randomly from patient records to examine the frequency and pattern of third molar impaction. Data were analyzed, and $p < 0.005$ was set as significant. ***Results:*** A total of 1012 subjects were included, among whom 550 (54.3%) were males. The largest age group was 18–32 years old and accounted for 533 (52.67%) of the subjects. The number of subjects with impacted tooth/teeth was 668 (66%), and frequencies and percentages among the right and left sides did not considerably differ. The number of impacted third molars in mandibular arches was higher than that in maxillary arches. Impactions in Position C were usually in the maxillary arch (116, 11.47%), whereas those in Position A were common in the mandible. Vertical and mesioangular impacted angulations were frequent in the mandibular arch (162, 22.0% and 118, 11.7%). Cases of distolingual impaction were high in the maxillary arch (96, 9.6%). Class II impacted teeth in relation to the ramus were the highest in the right (259, 25.6%), and left (239, 23.62%), followed by Class I impactions. ***Conclusion:*** The prevalence of impacted third molars was slightly higher in the Jazan region than in other regions in Saudi Arabia.

Keywords: Angulation, Depth, Impacted tooth, Pattern, Prevalence, Saudi Arabia, Third molar.

INTRODUCTION

The term impaction is derived from the Latin word “impactus” and generally means an organ or structure that has been prevented from assuming its normal position due to an abnormal mechanical condition [1]. Impaction is also a condition wherein a tooth is partially or completely unerupted and positioned against another tooth, bone, or soft tissue such that its further eruption is unlikely in accordance with its anatomical position [3]. An impacted tooth is defined as a tooth that fails to erupt into its normal functional position in the oral cavity beyond the usually expected time [4] because it is embedded in the alveolus [2].

Third molars mostly commonly experience impaction in the oral cavity [5-7], and the percentage of this case increases and falls in the range of 27%–68.6% [8-10]. Their eruption has occurs at varying periods mainly at 20 years of age with a range from 14 years to 24 years [11-12]. The etiologies of third molar impaction are multifactorial and usually due to adjacent teeth, dense overlying bone or soft tissue, increased crown size, the distal eruption of dentition due to lack of space, and malposition or limited skeletal growth [6, 13-14]. The most common cause of this condition is the lack of space in the arches due to either insufficient maxillofacial skeletal development or the low correlation between maxillofacial skeletal development and complete third molar development [9, 15- 18].

Observational studies concluded that impacted third molars adjacent to second molars may cause the development of pathologic conditions, such as pericoronitis, caries, dental crowding, second-molar root resorption, and odontogenic cysts, over time and thus constitutes an important clinical issue [11, 19-22]. Previous studies on different cities in Saudi Arabia concluded and specified that orthopantomogram (OPG)

radiography is a necessary image screening technique for teenagers and adults with permanent dentition. This simple technique can screen patient records because it is available in most dental centers and colleges of dentistry, well recognized by dental technicians, and can be used with software [23-30].

During our daily oral examinations, we noticed poor patient awareness of oral health and its implications in Saudi Arabia. Previous data on the prevalence of third molar impaction in the subpopulation of the Jazan region, Saudi Arabia are nonexistent. Therefore, this study aimed to assess the prevalence and pattern of third molar impaction, angulation, and eruption level among different genders and ages based on OPG radiograph screening.

MATERIALS AND SUBJECTS

Study design and ethical consideration

This cross-sectional retrospective study was undertaken with a group of subjects who attended the College of Dentistry, Jazan University for dental treatment. Ethical approval was obtained from the College of Dentistry Board with reference No. COSJU-17025.

Participants and setting

A total of 1012 OPG views of subjects consisting of 550 males and 462 females were obtained. The required data were collected retrospectively from the College of Dentistry records of patients who came for dental treatment.

Inclusion and exclusion criteria

Inclusion criteria were as follows: aged 18 years and above (given that third molars erupt at ages between 18 and 21 years), complete third molar root formation, no history of third molar extraction and no congenitally missing third molars, complete records with good quality OPG, and absence of any pathological dentoalveolar or craniofacial conditions. Exclusion criteria were as follows: absence of adjacent second molars, presence of any bone pathology that affect the alignment of third molars, incomplete patient records, and poor-quality OPG.

Examiners and standardization

The examiners were graduated dentists of both genders who were given a training session prior to the interpretation of OPGs. They were also trained and calibrated in a standardization session held prior to starting data collection. A pilot study of 30 OPGs were re-examined unknowingly by these examiners to assess intra-examiner reliability.

OPG assessment and data collection

The OPGs of each subject were retrospectively assessed from their records by CS-R4 program (CSR4 Software, Carestream Dental LLC, USA) with regard to different parameters, including the number of impacted third molars for each subject, missing third molar, arch of the impacted third molar, angulation of impacted third molars, level of impacted third molars, and classes of impacted mandibular third molars. Comparison between genders and different age groups was also conducted.

Recording impaction position, angulation, and relation to the ramus

Assessments followed the classification of third molar impaction by Winter and Pell & Gregory, in which any third molar is labeled as impacted when it is incompletely erupted to the assumed normal functional position in the occlusal plane, and the root must be completely formed [10,31,32].

Depths or levels of the impacted tooth were categorized as reported by Pell & Gregory [10,31-32], by setting a relationship between the cementoenamel junction (CEJ) of the third molar with the bone level. This parameter has three levels as shown in Table 1.

Table-1: Classification of third molar impaction according to position [10]

Position	Definition
Position A	not buried in bone
Position B	Partially buried in bone (if any part of the CeJ* was lower than the bone level)
Position C	Completely buried in bone

Cej*: cemento-enamel junction

The angulation of impacted third molar was recorded in accordance with Winter's classification used by [10, 21, 31], and the results are summarized in Table 2.

Table-2: Classification of third molar impaction according to angulation [10]

Angle of impaction	Angulation of the third molar to the second molar
Vertical	10° to -10°
Mesioangular impaction	11° to -79°
Horizontal impaction	80° to 100°
Distoangular impaction	-11° to -79°
Buccolingual impaction	Any tooth oriented in a buccolingual direction with crown overlapping the roots (when crowns and roots were superimposed)
Others	111° to -80°

The relationship between the distal part of the crown of the third molar and the anterior border of ramus was categorized into the following (Figure 1), three classes as described by Pell & Gregory [10, 30-32]:

Class I: Anterior to the border
Class II: Half of the crown is covered by the border
Class III: Crown completely embedded into the ramus

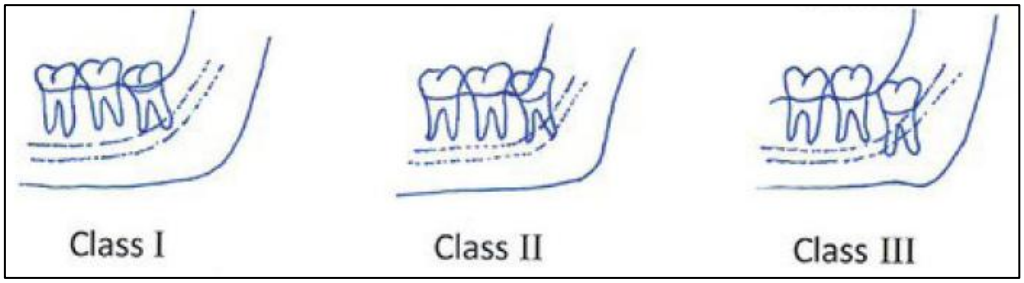

Fig-1: Classification of the depth of mandibular impacted molars to the ramus according to Pell & Gregory [30]

DATA ANALYSES

All data were recorded in Excel sheets during the assessment and were analyzed using descriptive statistics by age groups, gender, arches, angulation of impacted third molars, and classes of impacted mandibular third molars. All analyses were performed using SPSS package version 23.0 (SPSS, Inc., Chicago, IL). Chi square test was performed to detect any significance between genders with third molar impaction parameters, and the level of significance was set at 0.05 or less.

RESULTS

Subject characteristics

This study was conducted retrospectively using the OPGs of subjects who attended the College of Dentistry, Jazan University. The study consisted of 1012 subjects, among whom 550 (54.3%) were males and 462 (45.7%) were females. The mean age of the participants was 31.51 years with 7.918 standard deviation, the minimum age of the subjects was 19 years old, and the maximum age was 84 years old (table 3). The 18–32 age group recorded the maximum frequency and percentage (533, 52.67%), followed by the 33–45 age group (447, 44.17%), and the minimum frequency and percentage was recorded for the group comprising patients aged 46 years old and above (32, 16%). The overall frequency and percentage of subjects with impacted tooth/teeth were 668 and 66%, respectively, and those of subjects without impaction were 444 and 44%, respectively. No considerable differences in frequencies and percentages were recorded between the right and left side (left, 561 and right, 601). The frequency of impacted third molars in mandibular arches (766) was higher than that in maxillary ones (398). Impactions in the form of Position C were abundant in the maxillary arch (116, 11.47%), whereas those in Position A were abundant in the mandible (440, 21.74%). Vertical, mesioangular, and horizontal impacted angulation were frequent in the mandibular arch (162, 22.0%; 118, 11.7%; and 37, 3.7%), whereas distolingual impaction was common in the maxillary arch (96, 9.6%). Class II impacted teeth in relation to the ramus had the highest frequency and percentages in the right (259, 25.6%) and left (239, 23.62%), followed by Class I impactions (121, 11.96% and 118, 11.67%) in the right and left sides (Table 3).

Table-3: Demographic and sample characteristics of subjects in relation to gender, age group, impaction position, angulation, and relation of impacted teeth to the ramus (n = 10120)

PARAMETER	Gender		Age group		
	Male	Female	18–32	33–45	46 and above
Number	550	462	533	447	32
Percentage	54.3	45.7	52.67	44.17	3.16
Total	1012		1012		
Impacted tooth / Position type					
	Impacted #18 **N (%)**	Impacted #28 **N (%)**	Impacted #38 **N (%)**	Impacted #48 **N (%)**	No Impaction **N (%)**
A	20/1.98	26/2.57	239/23.62	201/19.86	486/4.80
B	56/5.53	64/6.32	109/10.78	113/11.17	342/33.79
C	111/10.97	121/11.96	44/4.35	60/5.93	336/33.20
No Impaction	825/81.52	801/79.15	620/61.27	638/63.04	7210/71.25
Total	1012/100	1012/100	1012/100	1012/100	

Impacted tooth/ Type of angulation*				
	Impacted #18 **N (%)**	Impacted #28 **N (%)**	Impacted #38 **N (%)**	Impacted #48 **N (%)**
Vertical	64/6.3	78/7.8	176/17.4	147/14.5
Mesioangular	26/2.6	32/3.2	109/10.8	126/12.5
Horizontal	1/0.1	3/0.3	37/3.7	36/3.6
Distolingual	95/9.4	97/9.6	69/6.8	64/6.3
No Impaction	826/81.6	801/79.2	621/61.4	639/63.1
Total	1012/100	1012/100	1012/100	1012/100
Impacted teeth relation to ramus				
	Class I **N (%)**	Class II **N (%)**	Class III **N (%)**	No Impaction **N (%)**
Impacted #38	121/11.96	259/25.60	12/1.29	620/61.27
Impacted #48	118/11.67	239/23.62	18/1.78	637/63.03

**No cases were recorded in the buccolingual or other type of impaction in relation to angulation type*

Genders and position of impactions:

The different levels of impaction are shown in Table 4. In the maxillary arch, Position C impactions were the most common in males and females in teeth #18 and #28 (males: 46, 8.4% and 60, 10.8% and females: 65, 14.1% and 61, 13.2%). A significant difference was observed between genders in maxillary arch with $p < 0.050$. In mandibular arches, Position A was the most prevalent for both genders in teeth # 38 and #48 (males, 124, 22.6% and 102, 18.5%) and among females (tooth #38: 115, 24.9% and tooth #48: 99, 21.4%). No significant differences were observed in tooth #38 in the mandible ($p = 0.126$). However, tooth #48 was at the border of significant differences between male and females ($p = 0.047$).

Table-4: Comparison between genders in relation to impacted tooth position, Chi-square test (n = 1012)

Gender	Position A N (%)	Position B N (%)	Position C N (%)	No Impaction N (%)	Total N (%)	P value
Male #18	6 (1.1)	26 (4.7)	46 (8.4)	472 (85.8)	550 (100)	0.007*
Female #18	14 (3.0)	30 (6.4)	65 (14.1)	353 (76.4)	462 (100)	
Male #28	13 (2.4)	25 (4.6)	60 (10.8)	452 (82.2)	550 (100)	0.034*
Female #28	15 (3.2)	38 (8.2)	61 (13.2)	348 (75.3)	462 (100)	
Male #38	124 (22.6)	53 (9.7)	26 (4.8)	374 (63.1)	550 (100)	0.126
Female #38	115 (24.9)	56 (12.0)	18 (3.9)	273 (59.1)	462 (100)	
Male #48	102 (18.5)	52 (10.1)	28 (5.1)	368 (66.9)	550 (100)	0.047*
Female #48	99 (21.4)	61 (13.2)	32 (6.9)	270 (58.4)	462 (100)	

**Significant differences*

Table 5 shows the pattern and prevalence of impacted tooth angulation type with gender in the maxillary arch. The frequency and percentages in distoangular angulation type were high for males at 41 and 7.4%, respectively, and were 56 and 12.2%, respectively, for tooth #18 and #28 in females. The p value was significant and less than 0.05 for tooth #18 but not for tooth #28. The vertical angulation type of impacted teeth was the highest in the mandibular arch (79, 14.6% for males and 88, 17.9% for females) and was significant in the left side but not in the right side with p-value (o, 464).

Table-5: Comparison between genders in relation to impacted tooth angulation type, Chi-square test (n = 1012)

Gender	Vertical N (%)	Mesioangular N (%)	Horizontal N (%)	Distoangular N (%)	No Impaction N (%)	Total N (%)	P value
Male #18	30 (5.5)	10 (1.8)	1 (0.2)	37 (6.7)	472 (85.8)	550 (100)	0.002*
Female#18	34 (7.4)	16 (3.5)	0 (0.00)	58 (12.6)	354 (76.6)	462 (100)	
Male #28	36 (6.5)	17 (3.1)	0 (0.0)	44 (8.0)	453 (82.4)	550 (100)	0.061
Female #28	42 (9.1)	16 (3.4)	2 (0.4)	54 (11.7)	348 (75.3)	462 (100)	
Male #38	85 (15.5)	59 (10.7)	22 (4.0)	37 (6.7)	347 (63.1)	550 (100)	0.464
Female #38	91 (19.7)	50 (10.8)	15 (3.2)	32 (6.9)	274 959.3)	462 (100)	
Male #48	72 (13.1)	55 (10.0)	24 (4.4)	31 (5.6)	368 (66.9)	550 (100)	0.010*
Female #48	75 (16.2)	71 (15.4)	12 (2.6)	33 (7.1)	271 (58.7)	462 (100)	

**Significant differences*

Analysis of the relationship between gender and the pattern of impacted mandibular teeth with the ramus showed that the highest percentage and frequency in the left side (teeth # 38) were exhibited by Class II for males (134, 24.4%) and females (125, 27.1%), and the differences were significant (p = 0.027). In addition, Class II was the highest in the right side (117, 21.2% for males and 122, 26.4% for females) and was significantly different (p < 0.050). The lowest frequency and percentages were recorded for Class III in both genders and sides (Table 6).

Table-6: Comparison between genders in relation to impacted teeth with the ramus (n = 1012)

Gender	**Class I N (%)**	**Class II N (%)**	**Class III N (%)**	No Impaction **N (%)**	Total **N (%)**	P value
Male #38	67 (12.2)	134 (24.4)	2 (0.4)	347 (63.1)	550 (100)	0.027*
Female#38	54 (11.6)	125 (27.1)	10 (2.1)	273 (59.1)	462 (100)	
Male #48	62 (11.3)	117 (21.2)	3 (0.5)	368 (66.9)	550 (100)	0.002*
Female #48	55 (11.9)	122 (26.4)	15 (3.2)	270 (58.4)	462 (100)	

**Significant differences*

DISCUSSION

Researchers have emphasized the importance of the removal or continuous follow-up of impacted maxillary and mandibular third molars because their localized effect on the second molar may result in traumatic/pathological effects or overall remaining dentition [25]. Orthodontic treatment with first premolar extraction can improve third molar angulation during eruption and consequently support the orthodontic extraction therapy approach in borderline cases [26]. Although the percentage of pathosis associated with impaction is considerably low, regular oral examinations are necessary to preserve asymptomatic impacted third molars in good conditions [25].

OPGs are the "workhorse" in impacted third molar surgery, and they should be prepared for all surgical cases according to clinicians' opinion. These images show a large area of dental and facial tissues in one view. OPGs assist dentists in diagnosis and clinical decision-making concerning surgical interventions near vital structures, such as the inferior alveolar nerve, and the proximity of maxillary tooth roots to the sinus [23].

Jazan City is located in the southwestern region of Saudi Arabia and is bounded to the north by the Assir region, to the south by the state of Yemen, and the Red Sea to the west. The population of Jazan is 1,603,659, representing 4.8% of the total population of the kingdom. The sample size recruited for the present study were 1012 subjects, which was equal to sample size of other local studies published by Haidar & Shalhoub (1000-Riyadh), and Hassn AH (1039-Jeddah). However, it was smaller than subjects that from other large cities as reported by Syed et al (3800-Abha), ALFERGANI et al (1869-Al-Qurayyat), Al-Dajani et al (1551- Aljouf), and Bayoumi et al (1866-Jeddah), but it was larger than that collected on studies by El-Khateeb *et al*. in Al-Madinah with 359 participants [9-10, 23-25,28,30].

All studies in different cities of SA that investigated the prevalence of third molars in relation to arches had mentioned that mandibular third molars are more frequently impacted than maxillary ones [10,23-24,27,30]. The percentage of impacted third molars could reach approximately 72.5% [10], 64.87% [30], 40.5 [24], 32.3% [9], and is approximately 21.1% [29], among the Saudi population. The percentage recorded in the current study was high at 57% of the total subjects.

Males and females are susceptible to third molar impaction, indicating that sex is not a potential risk factor for this condition. A single study involving the Saudi population found that females are frequently affected by third molar impaction [30], whereas other studies found that third molar impaction is common among male participants at a female-to-male ratio of 1/5 [28]. However, Haidar and Shalhoub [9], Hassan AH [10], Bayoumi et al [24], and El-Khateeb *et al*. [25], recorded no significance differences between males and females. Our findings recorded a significant difference between genders as shown in Tables 4–6. This difference can be explained by the location of the clinics that provided the data and the number of subjects involved in their studies.

Impaction depth in relation to the adjacent tooth is an important predictor of the difficulty of surgical interference. For example, removing a level A third molar can be easier than removing a level B molar, and removing a level B molar can be easier than removing a level C molar. In our study, Position C was the most frequent in the maxillary arch, whereas Position A had the highest incidence. Percentages among males and females showed a significant difference in the maxillary arch only. These findings completely disagree with local results for subjects from Jeddah and Al-Qurriate [10,30], which showed that Position B is the most frequent.

Numerous controversies in the angle of impacted third molars have been reported among many studies among Saudi populations. Syed *et al.* Al Khateeb *et al*. and Al Fergani et al [25,28,30], reported that mesioangular impaction is the most common. By contrast, Al Dajanei [23], reported that overall impaction is most common in the maxillary arch, with mesionagular and distoangular in the mandibular arches as the second most common type of angulation. In addition, Hassan AH [10]. found that vertical angle impaction is the most prevalent impaction type in the maxillary arch, and mesioangular is the most common impaction type in the mandibular arches. The present study also showed that distoangular impaction is the most common impaction type in the maxillary arch, and the vertical type of impaction has the highest frequency and percentage in the mandibular arch. This difference might be due to the use of various classification systems to determine tooth angulation. A significant gender difference was also observed between arches in terms of the angulation of the impacted third molars.

This study revealed the relationship between impacted mandibular third molars and the ramus, in which Class II impaction was the most frequent in both genders and sides with significant differences (Table 6). This result is in agreement with those from other local studies conducted by Bayoumi et al., El-Khateeb et al., and ALFERGANI et al., in cities of Jeddah, Al-Madinah, and Al Qurayyat, respectively [24-25,30]. Hassan AH, conducted a study to assess the pattern and frequency of the third molar in relation to the ramus and demonstrated that Class I is the highest in frequency and percentages [10]. The deviation between this result and our finding could be explained by the different races in Jeddah as mentioned by Hassan AH [10].

Al-Dajani *et al.* [23], stated that third molar impaction is likely to occur in patients aged 20–39 years old, whereas El-Khateeb *et al.* [25], concluded that its incidence reduces with age. However, Bayoumi et al, and Syed et al, [24,28], found that individuals aged 20–25 years old have the highest percentage and frequency of third molar impaction, which has an inverse relation with age. In summary, previous findings for both genders are in parallel with our findings considering that most of our samples were between 18-32 years-old, and only 32;3.16% were in the age-group of more than 46 years old.

Similar to most studies on third molar impaction, the present work used a hospital-based sample that lacks randomization because of the sample size. In addition, the site of subject collection was located in different areas in the Jazan region. We also did not record the relationship of impacted teeth with important anatomical structures, such as inferior dental canal and maxillary sinus. No clinical examinations were conducted to determine the effect of an impacted third molar on second molars in the form of caries/pericoronitis on mandibular or maxillary arches.

CONCLOUSIONS

This first retrospective radiographic study investigated the prevalence and pattern of third molar impaction in Jazan region, and the following conclusions can be obtained within its limitations.

- High frequency and percentage were observed, and almost more than half of the examined OPGs had at least one impacted third molars in different sites of the arches. Males accounted for slightly more than half of the examined OPGs.
- The distribution of total impacted teeth in males was slightly higher than that in females. However, most of the parameters showed a significant difference between males and females in both arches.
- Position C was the most prevalent in the maxilla, and Position A was the most prevalent in the mandibular arch with a significant difference in the maxillary arch only.
- Vertical impacted angulation was the most prevalent and frequent pattern in the mandibular arch, and distoangular impaction was the highest in the maxillary arches for all subjects.
- Class II impaction in relation to the ramous was the most frequent in both genders and the right or left sides.

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