Pattern of Third Molar Impactions in the Kuwaiti Population: Retrospective Radiographic Study

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Abstract

To evaluate the pattern of third molar impaction by assessing the angulation of impaction, impaction level, and ramus relationship using orthopantomogram radiographs. In addition, assessing the correlation between impaction patterns, gender, and dental arch.

This is a retrospective radiographic study that included 932 patients (411 males and 521 females), ages 20 years and older, with at least one impacted third molar. A total of 1453 impacted third molars were identified after evaluating the 932 radiographs. Third molar impactions were assessed using Winter's, Archer's, in addition to Pell and Gregory classifications.

The study group composed of 411 (44%) males and 521 (56%) females with a mean age of 24 ± 3.2 years. Impacted maxillary third molars totalled 665 (45.8%), while impacted mandibular third molars totalled 788 (54.2%). Mesioangular impaction was the most frequent (53.3%), followed by vertical impaction (32.9%). The Class IB position was the most frequent pattern (58.6%), followed by the Class IIA (54.5%). A statistically significant association was observed between the ramus relationship and the impaction level ($P < 0.05$).

The pattern of impacted third molars in this study was comparable to that reported in preceding studies. There was correlation between angular position, gender, and dental arch.

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Introduction

Third molars have the highest incidence of impaction due to the obstruction in the path of eruption.[1,2] A thorough evaluation of the impacted molars facilitates a smooth procedure and minimizes post-extraction complications.[3] This is the first study that explored the pattern of third molar impaction among the Kuwaiti population. Thus, the aim of this study was to explore the pattern of third molar impactions in a sampled Kuwaiti population by assessing the angulation of impaction, impaction level, and ramus relationship using orthopantomogram radiographs. In addition, assessing the correlation between impaction patterns, gender, and dental arch.

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Materials and methods

This retrospective study composed of 932 subjects (411 males and 521 females) with at least one impacted third molar each diagnosed on orthopantomogram views. The Ethics Committee of the Health Science Centre at Kuwait University approved this study. The patients attended the Departments of Oral and Maxillofacial Radiology and Admissions at Kuwait University Dental Center from January 2013 to December 2019. The selected age of participants was 20 years and older. The exclusion criteria consisted of age <20 years, any presence of pathological dentoalveolar disorder that may disrupt teeth alignment in the occlusal plane, a history of any dental extraction or orthodontic procedure, any craniofacial anomaly or syndrome, inadequate patient records or poor quality panoramic views, partially complete root formation of third molars or absence of neighboring second molars.

Patients' dental charts and radiographs were accessed from Titanium dental software and Planmeca Romixexis® dental imaging

software, respectively. A single examiner reviewed all radiographic records of impacted third molars to avoid inter-examiner errors. Thirty radiographs were examined per day to reduce the chance of missed assessments caused by vision fatigue and stress. After evaluating 932 panoramic radiographs, 1453 impacted third molars were identified. A third molar was considered impacted when it failed from reaching its functional position on the occlusal plane.

The assessment of third molar impactions included the angular position of impaction, which was documented based on Winter's classification for mandibular third molars[4] and Archer's classification for maxillary third molars.[5] The angulation of an impacted third molar was documented based on the angle between the intersected longitudinal axes of the second and third molars. The angular classification that was adopted to prevent errors arising from visual detection was as follows: vertical impaction: 10° to -10°; mesioangular impaction: 11° to 79°; horizontal impaction: 80° to 100°; distoangular impaction: -11° to -79°; and other: 111° to -80°. Uncommon classifications such as mesioinverted, distoinverted, and distohorizontal were combined in one category labeled "others".

The impaction level was verified based on Pell and Gregory[6] classification, which describes the location of the third molar's occlusal surface relative to the cementoenamel junction of the neighboring second molar. The classification system was as follows: Position A: the highest point of the impacted third molar and the occlusal plane of the neighboring second molar were at the same level. Position B: the highest point of the impacted third molar was lower than the occlusal plane but higher than the cementoenamel junction of the neighboring second molar. Position C: the highest point of the impacted third molar was lower than the cementoenamel junction of the neighboring second molar.

The ramus relationship was also evaluated with reference to the Pell and Gregory[6] classification, which evaluates the ramus relationship according to the space between the anterior border of the mandibular ramus and the distal surface of the second molar. Class I is when there is sufficient space available between the anterior border of the ascending ramus and the distal aspect of the second molar for the eruption of the third molar. Class II is when partial space is available between the anterior border of the ramus and the distal aspect of the second molar, however, this space is less than the mesiodistal width of the impacted third molar. Class III is an absolute lack of space, resulting in the total embedment of the third molar within the bone of the ascending ramus of the mandible.[6]

The Statistical Package for Social Sciences, version 22.0 software (SPSS Inc., Chicago, IL) was used for data analysis. The data were analyzed for frequency distributions among different variables. The correlation between independent variables was assessed with Pearson's correlation. Significant differences between selected groups were determined with Student's t-tests. The intra-rater reliability test, Cohen's kappa test, was used to quantify the consistency in readings given by the examiner. One hundred panoramic radiographs were chosen for the re-evaluation process with a one-month interval. The kappa correlation ranged from 0.82 to 0.94. A *P* value < 0.05 was considered statistically significant.

Results

Of the 932 evaluated panoramic views, 411 (44%) were males and 521 (56%) were females, and the mean age of the study group was 24 ± 3.2 years. Table 1 shows the distribution of impacted third molars by age group detailing which arch and side of impaction. After evaluating the 932 panoramic views, a total of 1453 impacted third molar teeth were identified. Impacted maxillary third molars totaled 665 (45.8%), while impacted mandibular third molars totaled 788 (54.2%).

Age Group	Maxilla			Mandible			Total(%)
	Rt(%)	Lf(%)	Total(%)	Rt(%)	Lf(%)	Total(%)	
20-24	151(24.7)	132(21.6)	283(46.3)	172(28.2)	156(25.5)	328(53.7)	611(42.0)
25-29	119(22.2)	135(25.2)	254(47.5)	134(25.0)	147(27.5)	281(52.5)	535(36.8)
30-34	36(25.6)	32(22.7)	68(48.2)	38(27.0)	35(24.8)	73(51.8)	141(9.7)
35-39	27(22.7)	22(18.5)	49(41.2)	37(31.0)	33(27.8)	70(58.8)	119(8.2)
> 40	5(10.6)	6(12.8)	11(23.4)	19(40.4)	17(36.2)	36(76.6)	47(3.2)
Total	338(23.3)	327(22.5)	665(45.8)	400(27.5)	388(26.7)	788(54.2)	1453(100)

Table 1. Distribution of impacted third molars according to age group.

The difference between the right and left sides in both dental arches was statistically insignificant (*P* = 0.735). There is also no association between the total number of impactions and gender (*P* = 0.352). Table 2 shows the distribution of impacted third molars by gender, dental arch, and side.

Mesioangular impaction was the most frequent within the sampled group (53.3%). Vertical impaction was the second most frequent (32.9%), followed by distoangular impaction (24.6%), (Table 3). There were considerably more mesioangular (64.4%) and vertical impactions (52.4%) in the mandible, whereas distoangular impactions were more in the maxilla (68.5%). The correlation test revealed that there was a significant correlation between the angular position of impacted third molars and arch ($P < 0.001$). Furthermore, there was a significant correlation detected between the angular position of impaction and gender ($P < 0.04$). Distal inclination was more often observed in females (57%), (Table 3).

Sex	Male			Female			Total (%)
Arch	Rt (%)	Lt (%)	Total (%)	Rt (%)	Lt (%)	Total (%)	
Maxilla	162(24.4)	165(24.8)	327(49.2)	168(25.3)	170(25.5)	338(50.8)	665(46)
Mandible	185(23.5)	187(23.7)	372(47.2)	205(26.0)	211(26.8)	416(52.8)	788(54)
Total	347(23.9)	352(24.2)	699(48.1)	373(25.7)	381(26.2)	754(51.9)	1453(100)

Table 2. Distribution of impacted third molars by sex, arch and side.

Arch	Maxilla			Mandible			Total(%)
Angulation	Male(%)	Female(%)	Total(%)	Male(%)	Female(%)	Total(%)	
Mesioangular	85(16.5)	98(19.1)	183(35.6)	172(33.5)	159(30.9)	331(64.4)	514(53.3)
Distoangular	108(30.2)	137(38.3)	245(68.4)	46(12.8)	67(18.7)	113(31.6)	358(24.6)
Vertical	125(26.2)	103(21.5)	228(47.7)	113(23.5)	137(28.7)	250(52.3)	478(32.9)
Horizontal	7(8.8)	0(0.0)	7(8.8)	35(43.8)	38(47.5)	73(91.3)	80(5.5)
Buccolingual	2(11.1)	0(0.0)	2(11.1)	4(22.2)	12(66.7)	16(88.9)	18(1.2)
Other	0(0.0)	0(0.0)	0(0.0)	2(40.0)	3(60.0)	5(100.0)	5(0.3)
Total	327(22.5)	338(23.3)	665(45.8)	372(25.6)	416(28.6)	788(54.2)	1453(100)

Table 3. Distribution of angulation of impaction in maxilla and mandible.

The evaluation of the impaction level revealed that 26.4% of impacted third molars were situated at level A, while 49.3% were at level B, and 24.3% were at level C. A significant association exists between the impaction level and arch ($P < 0.001$). At level B impaction, the percentage of impacted third molars in the mandible was significantly higher (67.9%) than that in the maxilla (32.1%). On the other hand, at level C, the percentage of impacted third molars in the mandible was lower (27.8%) than that in the maxilla (72.2%), (Table 4).

With respect to the ramus relationship, Class II was the most commonly associated with impacted mandibular third molars (53.8%), followed by Class I (38.6%) and Class III (7.6%). Furthermore, the results strongly indicated that there was a significant association between the ramus relationship and gender ($P < 0.05$), (Table 5).

The ramus relationship was cross-tabulated with the impaction level of the third molar. The most frequent pattern was a Class I ramus relationship with the impaction level B (58.6%). The second most common was a Class II ramus relationship with the impaction level A (54.5%). This association between the ramus relationship and the impaction level was significant ($P < 0.05$).

Arch	Maxilla			Mandible			Total (%)
Level	Male (%)	Female (%)	Total(%)	Male (%)	Female (%)	Total (%)	
A	88(23.0)	92(24.0)	180(47.0)	91(23.8)	112(29.2)	203(53.0)	383(26.4)
B	113(15.8)	117(16.3)	230(32.1)	234(32.6)	253(35.3)	487(67.9)	717(49.3)
C	126(35.7)	129(36.5)	255(72.2)	47(13.3)	51(14.4)	98(27.8)	353(24.3)
Total	327(22.5)	338(23.3)	665(45.8)	372(25.6)	416(28.6)	788(54.2)	1453(100)

Table 4. Distribution of the level of impaction in the maxilla and mandible.

Sex	Male			Female			Total (%)
Class	Rt (%)	Lt (%)	Total (%)	Rt (%)	Lt (%)	Total (%)	
Class I	68(22.4)	70(23.0)	138(45.4)	82(27.0)	84(27.6)	166(54.6)	304(38.6)
Class II	102(24.1)	105(24.8)	207(48.8)	108(25.5)	109(25.7)	217(51.2)	424(53.8)
Class III	15(25.0)	12(20.0)	27(45.0)	15(25.0)	18(30.0)	33(58.0)	60(7.6)
Total	185(23.5)	187(23.7)	372(47.2)	205(26.0)	211(26.7)	416(52.8)	788(100)

Table 5. Retromolar space distribution of impacted mandibular third molars.

Discussion

Numerous studies have explored the prevalence and pattern of impacted third molars around the world, including the United States, Sweden, China, Malaysia, Thailand, Saudi Arabia, and Jordan.[7-11] To the best of our knowledge, the current study was the first to assess the pattern of third molar impactions in the Kuwaiti population, which is composed of a mix of racial and indigenous ancestries. Extensive clinical and radiographic examination is essential prior to third molar extraction to minimize the chances of having post-extraction complications.

The youngest age selected for this study was 20 years. Since the maxillofacial growth ceases by the age of 20, the prediction of the third molar eruption could be confidently projected.[12]

The current study showed a higher occurrence of impacted third molars in females than males and higher third molar impactions in the mandibular arch than in the maxilla (Table 2).

However, the statistical analysis showed no significant association between gender and impacted third molars, which contradicted observations made by Gupta et al.[13], Hazza et al.[14]. Hellman stated that the jaw growth in females ceases before the third molar eruption period,[15] whereas in males, jaw growth continues even after the third molar eruption period.[13] Therefore, resulting in more impactions in females than males.[13] However, this was not significant in this study.[13]

The most frequent angulation of third molar impaction was mesioangular, followed by vertical and distoangular impactions; Hattab et al. [9] and Padhye et al. [2] provided a similar frequency pattern. Mesioangular impactions were found in 53.3% of the study sample. This finding supports the results of Hattab et al.,[9] Quek et al.,[8] however, the percentage is higher than that reported by Yilmas et al.[16] and Padhye et al.[2] The possible explanation for the high occurrence of mesioangular impactions was attributed to the differential growth noticed between the mesial and the distal roots of third molars. Underdevelopment of the mesial root may result in mesioangular impaction, whereas overdevelopment of the same root may result in distoangular impaction.[17]

The impaction level was explored based on the level of the third molar's occlusal surface relative to the neighboring second molar. The results showed that level B was the most frequent (49.3%), which supports the results of Padhye et al.,[2] and Quek et al.[8] There was a strong statistical evidence of a relationship between the impaction level and arch. In the mandibular arch, level B was more common, while in the maxillary arch, level C was more common. This result was also found by Quek et al.[8]. On the other hand, Hattab et al.[9] found a higher percentage of level B impactions in the maxilla than in the mandible.

Conclusions

The current study reported that 53.8% of mandibular third molars were in Class II relationship with the mandibular ramus, while 38.6% were Class I and 7.6% were Class III. These results supported other studies.[2,3,13] Moreover, the cross-tabulation test conducted between the impaction level and the ramus relationship revealed that 58.6% were Class IB, which makes it the most common pattern, followed by Class IIA at 54.5%. The least common pattern of mandibular third molar impaction was Class IIC. The results of previous studies corresponded with our findings by reporting Class A and B as the most common classes of mandibular third molar impaction.[5] However, other studies contradicted our findings.[17]

To the best of our knowledge, this is the first study to explore the impaction pattern of third molars in Kuwait. This study provides beneficial information regarding the clinical pattern of third molars in the Kuwaiti population. The pattern of third molar impaction reported in this study is categorized by a high prevalence of mandibular third molar impactions. The most common angulation encountered was mesioangular impaction followed by vertical and distoangular third molar impactions. Furthermore, the most common pattern of ramus relationship with the impaction level was Class IIB. Although the pattern of impacted third molars in this study was comparable to that reported in preceding studies in the Middle and Far East, it was apparent that there was an absence of a comprehensive global consensus on the prevalence or patterns of third molar impactions.

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Declaration of Interest

The author declares that no conflict of interests.

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