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Third molar impaction prevalence and pattern: a panoramic radiography investigation

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ABSTRACT

Objectives: The most commonly encountered impacted tooth is the third molar, and potential problems include oral cysts and tumors as well as caries, periapical lesions, periodontal disease, TMJ disorders, and root resorption of adjacent teeth. The aim of this investigation was to determine the third molar impaction prevalence and pattern.

Materials and Methods: 530 panoramic radiographs of patients who visited Hasanuddin University Dental Hospital from January to December 2020 were collected. Data were recorded based on third molars region, eruption level, angulation, and impaction class from radiographs that met the criteria on Excel sheets and analyzed using SPSS 26. Chi square test was performed to assess relationship between impaction patterns with age and gender. The level of significance was fixed at $p<0.05$.

Results: 115 radiographs were included and analyzed (45.2% male and 54.8% female). Third molar impaction prevalence was higher in females, in the age group 21-30 years, with level A eruption and vertical angulation. Most #38 and #48 demonstrated class 2 impaction. Apart from angulation and impaction class on #38, there was no significant difference between impaction patterns by age and gender group ($p>0.05$).

Conclusion: Third molar impaction was more common in women aged 21-30 years with a dominant impaction pattern at level A with vertical angulation. In the mandible, class 2 of the Pell and Gregory classification are known to be dominant in third molar impaction.

Keywords: *Prevalence, third molar, impacted, impaction pattern, panoramic*
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INTRODUCTION

The word "*impactus*" in Latin, from which the English word "impact" is derived, often refers to an organ or structure that is unable to move into its natural position because of abnormal mechanical circumstances.[1] A pathological disease known as tooth impaction occurs when a tooth does not erupt fully or at all because its position is impeded by the adjacent teeth, bone, or soft tissue, preventing it from returning to its natural functional position.[2] This condition has numerous underlying causes. Local causes of impacted teeth include mechanical resistance from adjacent teeth, dense overlying bone or soft tissue, cysts, tumors, or supernumerary teeth; insufficient dental arch space as a result of micrognathia; early primary tooth exfoliation or persistence; infection and trauma; and variations in dental arch size. Prenatal variables like genetics, postnatal factors including anemia, congenital syphilis, malnutrition, and endocrine dysfunction, as well as uncommon diseases such cleidocranial dysplasia and cleft palate, are examples of systemic influences.[3–5]

Depending on the age group, method of measurement, and variance within the sample population, the prevalence of impacted teeth differs among various groups. According to reports, the prevalence of impacted teeth varies between 16.7 and 68.6% worldwide. The most frequent tooth to get impacted is the third molar. The proportion of third molars that are impacted ranges from 32 to 40.5% according to several studies from Arab nations, 25.6% in Australia, 21.9% in one study in Finland, 60% in one population in Turkey. Third molar eruption happens at various times, typically between 17 and 21. The prevalence of impacted third molars ranges from 16-73% in young adults and in almost all studies from various countries, impacted third molars are most commonly found in the 20-39 year age group. A tooth is said to be impacted when it fails to erupt more than a year after its expected eruption time.[3,6–9]

Although most impacted teeth are asymptomatic, impacted third molars are still a significant clinical problem because untreated impacted third molars can cause a number of complications, including pericoronitis, periodontitis,

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caries, root resorption of adjacent teeth, temporomandibular joint disorders, bone loss, development of odontogenic cysts, and tumors of the oral cavity.[2,4,9] Third molar pain and edema are another group of problems that call for urgent dental care during the COVID-19 pandemic.[10] These symptoms and pathology are impacted by the state, position, and angulation of the eruption.[6]

Surgical treatment in the form of tooth extraction is known to be frequently performed by oral and maxillofacial surgeons to treat impacted third molars. However, there is not general medical agreement about the removal of pathological diseases and impacted teeth that do not produce symptoms. Even though surgery is typically regarded as a safe operation, problems might happen during or after the process. Alveolitis, infection, postoperative hemorrhage, temporary and/or persistent inferior alveolar nerve dysfunction are postoperative problems related to third molar extraction. In order to design a treatment strategy and assess the difficulty of extracting the impacted teeth, the practitioner must make an accurate assessment of the classification of the impaction. Accessibility, as indicated by the nearby teeth or other structures that provided space for the teeth to erupt, is the primary determinant of difficulty. Radiographic analysis is the foundation of the vast majority of classification systems. The location, type, and severity of the impaction are the parameters that are most frequently taken into account.[3,5,6] One of the examination methods that can be used to help diagnose impacted teeth is panoramic radiographs. Panoramic radiograph (2D) is the modality most commonly used clinically as the main diagnostic radiograph to determine the location of impacted teeth and other adjacent structures, assess tooth angulation, determine treatment plans and evaluate treatment outcomes.[11] At the Hasanuddin University Dental Hospital, patients who came with complaints of impacted teeth in 2020 reached 38.9%, making this condition one of the most common complaints as the main reason for patients coming to seek treatment during the Covid-19 pandemic. Therefore, this study's objective was to look into the prevalence along with the pattern of third molar impaction in patients at the Hasanuddin University Dental Hospital.

MATERIALS AND METHODS

From January 1 to December 31, 2020, 530 individuals who had panoramic radiography examinations at the Hasanuddin University Dental Hospital provided retrospective data for this observational cross-sectional study. Data from patients aged 21-50 years, who had no history of third molar extraction and had second molars that could be used as a guide for classifying third molars, and had complete medical records with good quality panoramic radiographs were included in this study. Data from patients with incomplete third molar root formation, dentoalveolar trauma, craniofacial anomalies, congenital deformities, syndromes (such as Down's syndrome), previously or currently undergoing orthodontic treatment and having cysts, tumors, or other pathological conditions in the molar region were excluded from this study. In addition, third molars with angulation requiring additional three-dimensional imaging such as buccolingual angulation were also excluded. Data that met the criteria were then recorded based on the tooth region (18, 28, 38, 48), eruption level, angulation type, and class of impacted third molar. The study design has been approved by the Health Research Ethics Committee of Hasanuddin University Dental Hospital.

The height of the third molar in respect to the occlusal plane of the second molar was taken into account by the Pell and Gregory Classification System to define the level of eruption (Figure 1). The highest part of an impacted tooth that is above or at the second molar's occlusal plane is referred to as Level A, the highest part that is above the second molar's cervical line but below the occlusal plane but is referred to as Level B, and the highest part that is below the second molar's cervical line is referred to as Level C.

The angulation of the third molar impaction was classified using Winter Classification based on the angle created between the longitudinal axes of the intersecting second and third molars (Figure 2). Vertical angulation (between 10 and -10°), where the third molar's long axis is parallel to the second molar's; mesioangular angulation, where the impacted tooth is angled mesially (between 11 and

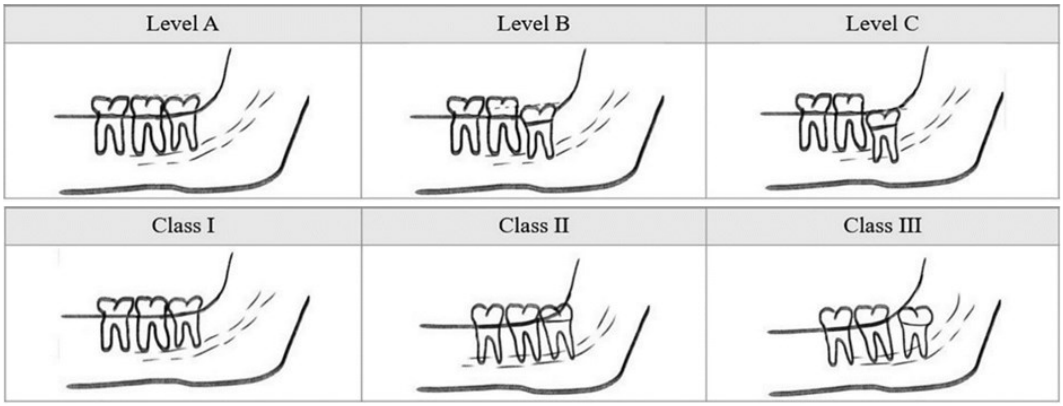

Figure 1. Eruption level (top) and class (bottom) of impacted third molars based on Pell and Gregory classification

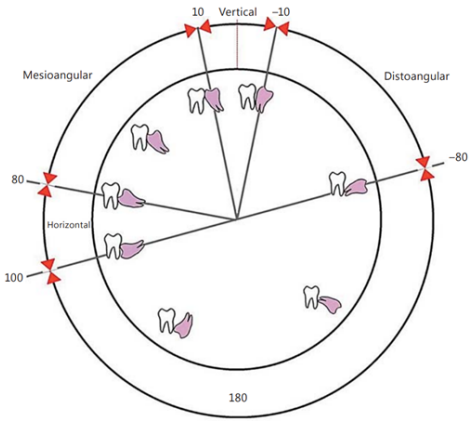

Figure 2. Winter's classification of impacted molars

79°); distoangular angulation, where the impacted tooth is tilted distally (between -11 and -79°), and horizontal angulation, where the third molar's long axis is horizontal (between 80 and 100°). Otherwise these angles are classified as other (between 101 and -80°).

By measuring the distance from the distal plane of the second molar to the anterior ramus, the Pell and Gregory Classification was used to establish the type of impaction and evaluate whether there is room for the third molar (Figure 1). Class I refers to the situation where there is enough room for the third molar's mesiodistal crown, Class II refers to the situation where the distance between the ramus and the second molar's distal side is smaller than the third molar's mesiodistal diameter, and Class III refers to the situation where the third molar is situated within the ramus.

An Excel sheet is used to record all of the data. For all analyses, SPSS 26 for windows by IBM Corp was used. To define the features of each sample, descriptive statistical analysis was used. The chi square (X^2) test was utilized to assess the influence of gender and age on impaction patterns. The level of significance was fixed at $p < 0,05$.

RESULTS

Of the total patient data at Hasanuddin University Dental Hospital who carried out radiographic examinations throughout 2020, it was found that 30.4% of patients had impacted third molars and 115 panoramic radiographs were obtained for further analysis regarding the pattern of impaction. In this study, it was found that more female patients had impacted third molars than male patients, respectively 54.8% and 45.2%. Most impacted third molars were found in the age group 21-30 (62.6%) and the least in the age group 41-50 years (12.2%). The distribution of the characteristics of the research sample is presented in Table 1.

According to the Pell & Gregory classification system, Level A is the most frequent type from both male and female groups, in the right and left region of the maxilla and mandible, and in all age groups. In this study, there was no significant difference between age or gender and the level of third molar impaction ($p>0.05$). The association between age or gender and the level of third molar impaction is shown in Table 2.

According to Winter's classification system, vertical angulation was the most dominant kind of angulation for third molar in this study. Both maxilla and mandible, the right and left sides, all age groups, and both genders showed these results. With the exception of #38, where the female group's angulation was significantly higher than the male group's ($p<0.05$), the type of angulation, gender, or age did not significantly differ ($p>0.05$). Table 3 shows the whole association between age and gender and the angulation of impacted third molar.

According to the Pell and Gregory classification system, Class 2 is the most dominant type of impaction on #38, with a rate of 24.3% in male, 30.4% in female, and 40% in those between the ages of 21 and 30. Age and the class of impacted teeth on #38 differed significantly ($p<0.05$). In contrast, Class 2 was found to be more dominant in females (24.5%) and Class 1 in males (20%) on #48. The least common impaction detected in all age groups is classified as Class 3. On #48, there was no association between the affected third molar class, gender, or age ($p>0.05$). The information is shown in Table 4.

DISCUSSION

The prevalence rate of impacted third molar worldwide varies between 16.7-68.6%, and it is well known that they are a widespread issue that affects a significant section of the world's population.[2] As an example, the proportion of third molars that have already impacted ranged from 18% to 32% in India[12] and from 21% to 72% in Saudi Arabia.[1] There was a propensity for impacted third molar prevalence to be higher in the European region compared to the Asian region. The racial, cultural,

Table 1. The distribution of research sample characteristics (n=115)

Characteristics	n (%)
Gender	
Male	52 (45.2)
Female	63 (54.8)
Age (years)	
21-30	72 (62.6)
31-40	29 (25.2)
41-50	14 (12.2)

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and dietary distinctions between each place can be used to explain this. The growth pattern of the teeth and jaws is specifically affected by hereditary factors and poor dental hygiene. Additionally, there is a propensity for jaw atrophy, which is not used as a functional matrix needed for growth so that jaw development is not optimal, when the diet shifts to softer processed foods. The variation in dental arches and tooth sizes that results in crowding and impaction is a continuation of this. A diet high in fiber encourages more muscle activity, which in turn encourages jaw growth and makes room for the emergence of third molars, minimizing the likelihood of impaction. According to the functional matrix theory, Moss stated that "bones do not grow, bones are grown", thus stressing the ontogenetic primacy of function over form. It claims that the origin, development and maintenance of all skeletal units are secondary, compensatory and mechanically obligatory responses to temporally and operationally prior demands of related functional matrices. In this case, the functional needs of the tissues surrounding the bones affect how quickly the maxillary and mandibular bones grow. Therefore, correct function is necessary for the growth of the maxilla and mandible.[2,13–14]

The findings of this study are consistent with earlier investigations by Braimah R et al.,[14] Alamri A et al.,[15] as well as Alfadil L and Almajed E.[16] regarding the predilection for impacted third

Table 2. The relationship between level of third molar impaction and sample characteristics

Level	Male n (%)	Female n (%)	p-value	21-30 n (%)	31-40 n (%)	41-50 n (%)	p-value
18			0.831				0.755
A	33 (28.7)	38 (33.0)		41 (35.7)	20 (17.4)	10 (8,7)	
B	13 (11.3)	14 (12.2)		20 (17.4)	5 (4.3)	2 (1,7)	
C	2 (1.7)	3 (12.2)		4 (3.5)	1 (0.9)	0 (0,0)	
28			0.644				0.132
A	33 (28.7)	45 (39.1)		47 (40.9)	23 (20.0)	8 (7,0)	
B	14 (12.2)	11 (9.6)		20 (17.4)	3 (2.6)	2 (1,7)	
C	2 (1.7)	2 (1.7)		2 (1.7)	1 (0.9)	1 (0,9)	
38			0.156				0.248
A	34 (29.6)	48 (41.7)		51 (44.3)	21 (18.3)	10 (8,7)	
B	14 (12.2)	7 (6.1)		17 (14.8)	3 (2.6)	1 (0,9)	
C	1 (0.9)	3 (2.6)		1 (0.9)	2 (1.7)	1 (0,9)	
48			0.516				0.951
A	38 (33.0)	49 (42.6)		54 (46.9)	23 (20.0)	10 (8,7)	
B	11 (9.5)	9 (7.8)		13 (11.3)	4 (3.5)	3 (2,6)	
C	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0,0)	

n = Number of samples for each characteristic
* = Significantly difference (p<0.05)

Table 3. The relationship between angulation of third molar impaction and sample characteristics

Angulation	Male n (%)	Females n (%)	p-value	21-30 n (%)	31-40 n (%)	41-50 n (%)	p-value
18							
Vertical	43 (37.4)	53 (46.1)	0.444	60 (52.2)	24 (20.9)	12 (10.4)	0.973
Horizontal	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Mesioangular	2 (1.7)	1 (0.9)		2 (1.7)	1 (0.9)	0 (0.0)	
Distoangular	3 (2.6)	1 (0.9)		3 (2.6)	1 (0.9)	0 (0.0)	
28							
Vertical	43 (37.4)	55 (47.8)	0.378	63 (54.8)	25 (21.7)	10 (8.7)	0.359
Horizontal	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	0 (0.0)	
Mesioangular	2 (1.7)	0 (0.0)		1 (0.9)	1 (0.9)	0 (0.0)	
Distoangular	4 (3.5)	3 (2.6)		5 (4.3)	1 (0.9)	1 (0.9)	
38							
Vertical	21 (18.3)	30 (26.1)	0.018*	32 (27.8)	9 (7.8)	10 (8.7)	0.235
Horizontal	15 (13.0)	5 (4.3)		14 (12.2)	5 (4.3)	1 (0.9)	
Mesioangular	13 (11.3)	20 (17.4)		21 (18.3)	11 (9.6)	1 (0.9)	
Distoangular	0 (0.0)	3 (2.6)		2 (1.7)	1 (0.9)	0 (0.0)	
48							
Vertical	22 (19.1)	33 (28.7)	0.229	35 (30.4)	11 (9.5)	9 (7.8)	0.796
Horizontal	12 (10.4)	6 (5.2)		12 (10.4)	5 (4.3)	1 (0.9)	
Mesioangular	15 (13.0)	18 (15.6)		20 (17.4)	10 (8.7)	3 (2.6)	
Distoangular	0 (0.0)	2 (1.7)		2 (1.7)	0 (0.0)	0 (0.0)	

n = Number of samples for each characteristic
* = Significantly difference (p<0.05)

Table 4. The relationship between mandibular third molar impaction and sample characteristics

Class	Male n (%)	Female n (%)	p-value	21-30 n (%)	31-40 n (%)	41-50 n (%)	p-value
38			0,892				0,004*
Class 1	17 (14.8)	20 (17,4)		18 (15,7)	9 (7,8)	10 (8,7)	
Class 2	28 (24.3)	35 (30,4)		46 (40,0)	16 (13,9)	1 (0,9)	
Class 3	4 (3.5)	3 (2,6)		5 (4,3)	1 (0,9)	1 (0,9)	
48			0,888				0,075
Class 1	23 (20.0)	27 (23,5)		29 (25,2)	11 (9,6)	10 (8,7)	
Class 2	22 (19.1)	28 (24,3)		33 (28,7)	15 (13,0)	2 (1,7)	
Class 3	4 (3.5)	3 (2,6)		6 (5,2)	0 (0,0)	1 (0,9)	

n = Number of samples for each characteristic
* = Significantly difference ($p<0.05$)

molars in females. The tendency for impacted third molars in females may be caused by different growth patterns between the two genders. The peak growth (growth spurt), is the time of the fastest growth followed by slower growth, which will make changes in height and weight. Female growth peak is earlier than that of males. Growth spurt in females occurs at 10–12 years, while in males aged 12–14 years. The pattern of female skeletal growth is rapid and brief, while the pattern of male skeletal growth is slow and long.[17] In contrast to males, who continue to expand their jaws during the third molars' eruption, females stop growing their jaws when the third molars erupt, leaving enough room for the third molars to emerge. Researchers generally concur that females have a higher frequency of third molar impaction due to the tendency for third molar in the mandible to erupt roughly three to six months earlier in males than in females. According to studies by Qassadi T et al.,[1], Yuvashree C and Ramani P,[5] and Soh N et al.[4], males are more likely than females to have impacted third molars, and this difference is statistically significant. The location of the healthcare facilities that provided the data and the quantity of participants in their study may both contribute to this variance.

The findings of this study concur with those of Soh N et al.[4] and Braimah et al.[14], who found a correlation between the prevalence of third molars that are impacted and age. It was discovered to be predominate in the 21–30 age group; impaction of the third molar was also observed to be 25.2% and 12.2% in the 31–40 and 41–50 age groups, respectively. In other studies, such as Yuvashree C et al.[5] at the age of 24 years, Ishwarkumar et al.[2] at the age of 20–25 years, and Al-Ramil et al.[6] at the age of 23–29 years, similar findings regarding the link between age and the occurrence of impacted third molars were also observed. It is evident that impacted third molars are less common as people mature.

According to this study, the Pell & Gregory classification system indicated that level A is known to be the most dominant level of impacted third molar. These findings disagree with studies from Singapore and Saudi Arabia that claimed that the most frequent level of impacted maxillary third molars was Level B,[1] although they are consistent with those from South Africa[2] and Iran[18]. In terms of the mandible, Qassadi T et. al.[1] and Hatem M et.al.[19] both reported that Level A was the most prevalent level of eruption throughout their studies. Genetic and racial factors may account for the variant in impaction levels between populations.

This study did not report any impacted third molars with other categories of angulation in the study sample. In the maxilla, horizontal angulation is known to be the rarest type of angulation. Whereas in the lower jaw, the angulation that is rarely encountered is the distoangular angulation. Ayranci F et.al.,[20] and Yilmaz S et.al.,[21] reported similar findings regarding impacted third molar angulation based on jaw and gender. In addition, Qassadi T et al.,[1] Ishwarkumar et al.,[2], and Hatem M et al.,[19] showed similar results in angulation of impacted maxillary third molars but differing outcomes in angulation of impacted mandibular third molars, all three of which obtained angulation results. Mesioangular third molar impacts are the most typical. According to the reviewed literature, root formation is the primary period during which the occlusal surface changes from a mesial-straight to a vertical-straight orientation. It is therefore possible that during this phase, the tooth rotates primarily from a horizontal to a mesioangular to a vertical position. Additionally, the Belfast group at Queen's University argued that depending on the level of development in the root, differences in mesial and distal roots' rates of root growth cause roots to either remain mesially or shift to a vertical posture.[2]

According to the Pell & Gregory categorization system, Class 2 impaction is the most prevalent form on #38, while Class 1 impaction is more prevalent in male and Class 2 impaction in females on #48. The least common impaction detected in all age groups is classified as Class 3. The results of a study in Saudi Arabia that also included gender and tooth area variables revealed findings that are comparable to those of the class of third molars that are impacted.[1] Khouri C et.al.,[22] in their study also reported something similar regarding the predominance of the prevalence of impacted class 2 in mandibular third molars. Whereas Hatem M et.al.,[19] reported similar results in the male group, but opposite the results with the female group, namely class 1 impaction was most common in teeth 48 (26.5%).

Tooth impaction is a frequent phenomenon, and the number of patients referred to dentists and oral surgeons with impacted third molars is increasing every year. All impacted teeth should be evaluated for definitive treatment, including observation, sustained oral hygiene improvements, operculectomy, surgical extraction or even ortho-surgically assisted eruption. Before making treatment decisions on retaining or removing the impacted teeth, dentists should depend on clinical and radiographic examinations using their knowledge, training and expertise. Classifications of the impacted teeth allow defining the type and degree of retention, as well as assessing the degree of difficulty of the procedure. Planning the treatment procedures after a comprehensive evaluation can makes it possible to reduce the risk of complications.

This study's unicenter, constrained demographic scope, and reduced sample size are its main limitations. Expanding our understanding of the epidemiology of diseases linked to impacted teeth and enhancing clinical care to reduce misunderstandings can both be accomplished by examining the occurrence and pattern of impaction and its relationship to pathological disorders.

CONCLUSION

In this study, female aged 21-30 were more likely to have impacted third molars with a prominent impaction pattern at level A and vertical angulation. In class 2 of Pell and Gregory's classification, impacted third molars are known to predominate, particularly in the jaw. By understanding the classification and pattern of impaction of third molars, appropriate management strategies can be implemented and the risk of post-treatment complications can be minimized.

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FOOTNOTES

All authors have no potential conflict of interest to declare for this article. The study design has been approved by the Health Research Ethics Committee of Hasanuddin University Dental Hospital. All procedures conducted were in accordance with the ethical standards.

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