ORIGINAL ARTICLE

CONTENTS

The effect of demographic and radiographic variables on surgical difficulty of impacted mandibular third molar: A prospective observational study

Mohammed Ahmed Muter[1], Omer Tareq Al-Hashimi[1], Shahad Ihsan Kadhum[2], Ali Abdulridha Alsaffar[3]

[1]DEPARTMENT OF ORAL SURGERY, COLLEGE OF DENTISTRY, AL HIKMA UNIVERSITY COLLAGE, BAGHDAD, IRAQ

[2]DEPARTMENT OF ORAL DIAGNOSIS, COLLEGE OF DENTISTRY, AL HIKMA UNIVERSITY COLLAGE, BAGHDAD, IRAQ

[3]DEPARTMENT OF ORTHODONTICS, COLLEGE OF DENTISTRY, BILAD ALRAFIDAIN UNIVERSITY, DIYALA, IRAQ

ABSTRACT

Aim: The aim of this study was to evaluate the effect of varies demographical and radiographical variables including retromolar space on surgical difficulty of impacted mandibular third molar.

Materials and Methods: Materials and methods: This prospective observational study included a total of 53 patients who underwent surgical removal of impacted lower third molars. The independent variables included demographic data (age, sex) and radiographic findings (Winter's angulation, Pell and Gregory's classification, and retromolar space), retromolar space was measured from the anterior border of mandibular ramus and the distal surface of mandibular second molar in millimeter. Dependent variables were surgical difficulty determined by technique and operation time.

Results: There was a statistically significant relationship between the retromolar space and Pell and Gregory's classification with the duration of surgery and technique of extraction. There was a non-significant difference in the duration of surgery among the age, sex of patients and angulation of impacted teeth.

Conclusions: This study shows that the retromolar space and Pell and Gregory's classification have a strong influence in lower third molar surgical difficulty.

KEY WORDS: impaction, duration of surgery, third molar, retromolar, and Pell and Gregory's classification

Wiad Lek. 2025;78(7):1375-1380. doi: 10.36740/WLek/205603 DOI

INTRODUCTION

Extraction of mandibular third molar is the most common surgical procedure performed in oral surgery, however many complications are associated with this procedure, to avoid them, proper clinical and radiographic assessments are mandatory before third molar surgery [1]. An impacted third molar occurs in 73% of Europeans. Mandibular third molars usually erupt at age 17-21 years old, eruption in males occurs earlier than females by 3-6 months. The eruption among Europeans occurs at the age of 26 years, while in Nigerian occurs at the age of 14 years [2]. Mohammed and Hassan in their study of Iraqi populations observed that eruption of mandibular third molars in males occurred at the age of 16 while in females occurred at the age of 17 and this time of eruption is close to that in European and Japanese populations [3]. Classification system was introduced by George Winter in 1926. It depends on the third molar angulation relative to the second molar as (Mesioangular, vertical, horizontal, distoangular, buccoangular, lingoangular, inverted, and unusual), [2]. Pell and Gregory, classified impacted mandibular third molars into two categories according to the relationship with the anterior border of the ramus and the relationship with the occlusal plane of the tooth [4]. In 2018, De Carvalho and Vasconelos developed an index of difficulty based on surgical technique and time by studying various variables including Winter's and Pell and Gregory classifications, roots number and morphology, the relation with the second molar, age, body mass index, crown width, and associated pathologies. Regarding the surgical procedure, the degree of difficulty is low when the tooth is extracted solely by elevator, moderate when bone removal is necessary, and high when both ostectomy and tooth sectioning is necessary. The difficulty of extraction is rated according to the duration of operation as low when it takes less than 15 minutes, moderate when it takes between 15 and 30 minutes, and high when it takes more than 30 minutes [5]. The retromolar space, located behind the mandibular second molar and in front of the anterior border of the ramus, is a key factor influencing the complexity of extracting impacted mandibular third molars

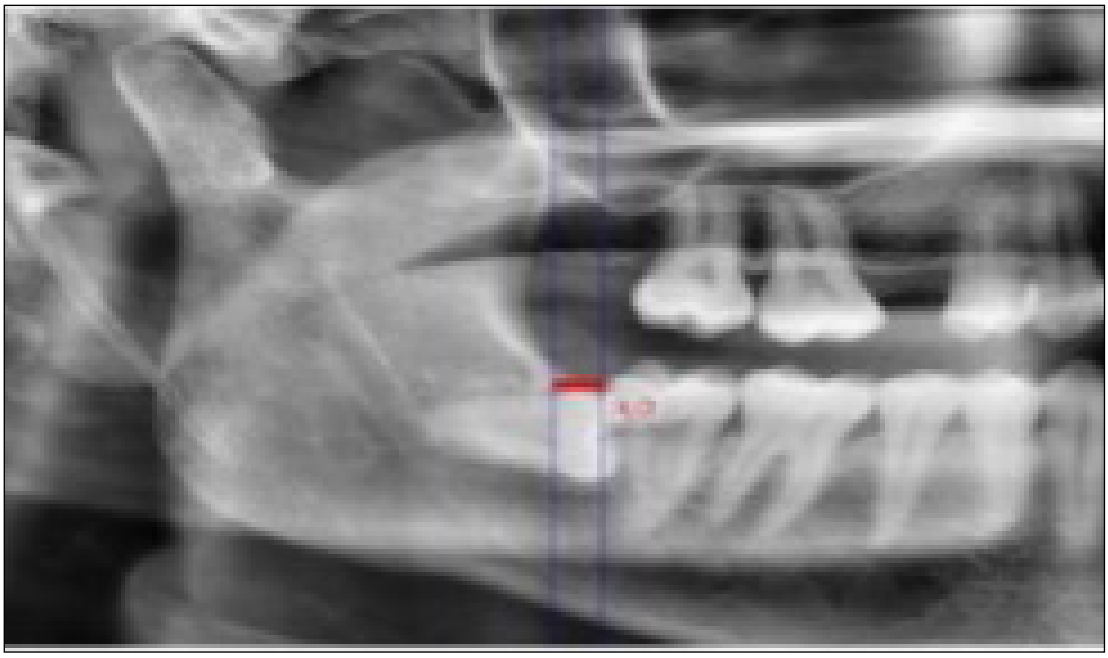

Fig. 1. Measurement of retromolar space by using Planmeca viewer

Table 1. The distribution of the impacted teeth according to study variables

Classification	Number	%
Angulation (Winter's classification)		
Mesioangular	29	52.7
Horizontal	26	47.3
Pell and Gregory's classification		
A I	25	45.5
A II	4	7.3
B I	10	18.2
B II	16	29
Degree of impaction		
Partial impaction	45	81.8
Complete impaction	10	18.2

[6-7]. When this space is inadequate, the third molar often remains impacted due to insufficient room for eruption. Other factors, such as the tooth's angulation, depth of impaction, and proximity to vital anatomical structures like the inferior alveolar nerve, also contribute to the difficulty of the procedure [8]. Evaluating the retromolar space and associated variables is crucial for effective surgical planning, as it aids in predicting potential challenges and implementing strategies to minimize complications [9].

AIM

The aim of this study was to evaluate the effect of varies demographical and radiographical variables including retromolar space on surgical difficulty of impacted mandibular third molar.

MATERIALS AND METHODS

This prospective observational study included 53 patients who met the eligibility criteria for surgical removal of impacted mandibular third molars under local anesthesia, each patient signed an informed consent to participate in the study. The study was registered at clinicaltrials.gov (NCT05320744) and was guided by STROBE guidelines.

INCLUSION CRITERIA

Requires participants to be over 18 years of age, of either gender, with an American Society of Anesthesiologist (ASA) physical status classification of ASA I or II, and presenting with mesioangular or horizontal impacted mandibular third molars.

EXCLUSION CRITERIA

Includes patients with vertically or distoangularly impacted teeth, uncontrolled systemic diseases, and active infections at the surgical site, cysts or tumors associated with the impacted teeth, signs of intimate contact between the impacted tooth and the inferior alveolar nerve on panoramic radiographs, or missing mandibular second molars.

The primary indications for extraction included recurrent pericoronitis, orthodontic preparation, caries involving the impacted or adjacent mandibular second molars, and periodontal disease. Preoperative panoramic radiographs were obtained for each patient using the Planmeca ProOne® (Helsinki, Finland) system with specifications of 66 kV, 9 mA, 14.9 s, and 97 mGy*Cm^2, to classify impacted mandibular third molar according

Table 2. The correlation of the predictor variables with the duration of surgery

Correlation	Duration of extraction/min vs. Retromolar space	Duration of extraction/min vs. Age	Duration of extraction/min vs. Sex	Duration of extraction/min vs. Angulation	Duration of extraction/min vs. Pell and Gregory's classification
r	-0.8096*	0.02907#	-	-	-
P value	< 0.0001	0.8332	0.2855 **	0.2556 **	< 0.0001 ##

* Pearson correlation; #Spearman correlation; ** Mann-Whitney test; ## Kruskal Wallis test

Table 3. The relationship of the predictor variables with the technique of extraction

The technique of extraction	Variables									
	Retromolar space/ mm (mean± SD)	Age/ years (mean± SD)	Sex (number)		Angulation (number)		Pell and Gregory's classification (number)			
			Male	Female	Mesioangular	Horizontal	AI	AII	BI	BII
Low	6.65±0.64	24.35±3.64	10	6	17	0	16	0	1	0
Moderate	5.56±0.76	24.78±7.01	2	7	9	0	2	1	4	2
High	4.74±1.03	25.031±4.48	16	12	3	26	7	3	5	14
P Value	P<0.0001*	P =0.6826**	P=0.1229#		P<0.0001#		P<0.0001 #			

SD: standard deviation; *ANOVA; ** Kruskal Wallis test; # Chi-square test

to Winter's angulation as mesoangular or horizontal, and according to Pell and Gregory's classification according to

The relationship with the anterior border of the ramus [4]:

Class I: Enough space available distal to the lower second molar for the third molar crown.

Class II: Less than mesiodistal space of the third molar crown is available. The relationship with the occlusal plane of the tooth [4]:

Position A: The tooth's highest point is either with or above the occlusal plane.

Position B: The tooth's highest point lies above the cervical line of the second molar but below the occlusal plane.

All surgical procedures were performed by a single operator under local anesthesia (2% lidocaine with 1:100,000 adrenaline). The procedure involved reflecting a buccal mucoperiosteal flap, performing buccal bone removal (guttering) and/or tooth sectioning with copious irrigation using sterile saline, followed by extraction, thorough socket irrigation, and suturing with 3/0 black silk suture. The difficulty level was categorized based on the technique: low (elevator-only extraction), moderate (requiring bone removal), and high (requiring both bone removal and tooth sectioning). Surgery duration was recorded in minutes, from the first incision to the final suture. The independent variables included demographic data (age, sex) and radiographic findings (Winter's angulation, Pell and Gregory's classification, and retromolar space), retromolar space was measured from the anterior border of mandibular ramus and the distal surface of mandibular second molar in millimeter, figure (1). Dependent variables were surgical difficulty determined by technique and operation time.

STATISTICAL ANALYSIS

Statistical analysis was conducted using GraphPad Prism v. 9 for Windows. Descriptive statistics included frequencies (as numbers and percentages), means, and standard deviations (SD). Inferential statistics utilized the Shapiro–Wilk normality test, ANOVA, and Spearman and Pearson correlation tests. A p-value <0.05 was considered statistically significant.

RESULTS

This prospective study included 53 patients with 55 cases of impacted mandibular third molars (2 patients had bilateral impacted mandibular third molars), the age of the sample range was 18-38 years, with a mean (SD) of 24.78 (4.66) and a median of 24 years. The patients consisted of 28 males (52.8%) and 25 females (47.2%). The retromolar space range was 3.1 to 7.9 millimeters, with a mean (SD) of 5.467 (1.22) and a median of 5.5 millimeters. Table 1 shows the distribution of the impacted teeth according to winter, Pell and Gregory classifications, and degree of impaction.

Table 2 summarized the correlation between the predictor variables and the duration of surgery, it indicates that decreased in retromolar space resulted in increased duration of surgery, and also showed there was a significant difference in the duration of surgery among the different categories of impacted teeth according to Pell

and Gregory's classification. There was a non-significant difference in the duration of surgery among the age, sex of patients and angulation of impacted teeth. According to the technique of extraction, most of the cases, 52.7% were categorized as having high difficulty, followed by low (30.9%) and moderate (16.4%) difficulty categories.

Table 3 summarized the relationship between the predictor variables and the technique of surgery. Only retromolar space, winter's classification (angulation) and Pell and Gregory's classification were associated with increased difficulty determined by the surgical technique.

DISCUSSION

An adequate assessment must be performed to anticipate surgical difficulty and complications, develop an appropriate treatment plan, and inform the patient throughout the surgical procedure. The study evaluated the effects of demographic variables (age and sex) and radiographic variables (angulation, Pell and Gregory's classification and retromolar space) on the surgical difficulty measured by the duration of surgery and surgical technique. The mean age of patients in this study (24.78 years) is close to that reported by other Iraqi and international studies (23.1-26.16 years) [10- 14]. The results of this study showed that there was no relationship between the age of the patients and the surgical difficulty. In contrast to our results, other studies such as Renton, Smeeton and McGurk, and Carrillo Rivera and Bello had shown a positive correlation between age and surgical difficulty possibly due to the wider age range of the patients included in their studies reaching to more than 60 years in addition to other variables such as radiological, demographic, and operative variables [15-16]. It is suggested that the relationship between age and surgical difficulty is related to the increase in bone density, complete root formation, and ankylosis of the third molar with increasing age [17-18]. Although many studies such as Vargas, González and Zurita; and Vranckx et al., reported the relationship between sex and surgical difficulty of third molar surgeries [19-20], the results of this study demonstrated a non-significant difference between males and females, and this finding is consistent with many other studies that reported no relationship between sex and an increasing of extraction difficulty [21-23]. According to Sánchez et al., the association between the angulation of impacted teeth and the duration of surgery was not statistically significant, which is consistent with the findings of this study [18]. In their systematic review, Gay-Escoda et al., correlated various variables (patient factors, radiological and surgical technique) with the difficulty of surgery and they stated that the mesioangular type was of low difficulty while the horizontal type was of high difficulty, which is consistent with the results of this study as there was a significant difference in the distribution of the categories of difficulty according to the technique of extraction between mesioangular and horizontal impaction [24]. According to Alvira-González et al., and Khojastepour et al., there was a significant association between Pell and Gregory classification and surgical difficulty, which is consistent with the findings of this study [25-26]. In the current study, there was an inverse relationship between the retromolar space and the surgical difficulty. A sufficient retromolar space allows easier accommodation for the third molar and smoother surgical extraction. If the retromolar space is narrow or insufficient, the third molar may be more deeply impacted or angulated (mesioangular, horizontal, or distoangular), increasing surgical difficulty [27]. Increased surgical duration is directly associated with more complex impactions, which correlate with limited retromolar space. Narrow space requires additional bone removal or tooth sectioning to access and extract the tooth, and complex techniques (ostectomy and tooth Sectioning): Often required for teeth in cases with insufficient retromolar space [28], this is in line of the results of our study.

LIMITATIONS

The results of this study need to be interpreted after considering its main limitations which are related to the small sample size that may decrease the generalizability of the results obtained and the study included only two types of angulation (mesioangular and horizontal), and excluded class III and position C of Pell and Gregory classification.

CONCLUSIONS

Within the limitation of this study, it shows that the retromolar space and Pell and Gregory's classification are clinically relevant in determining surgical difficulty of impacted mandibular third molar.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

CORRESPONDING AUTHOR
Shahad Ihsan Kadhum
AL Hikma University Collage
8C2P+78Q, Uqba ibn Nafi Square,
Karada Kharidge, Baghdad, Iraq
e-mail: sgahmed1331962@outlook.com

ORCID AND CONTRIBUTIONSHIP
Mohammed Ahmed Muter: 0000-0001-7699-6711 B C
Omer Tareq Al-Hashimi: 0009-0008-8014-9951 C D
Shahad Ihsan Kadhum: 0009-0008-4127-4290 A E F
Ali Abdulridha Alsaffar: 0000-0001-9061-5911 B F

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article

RECEIVED: 02.03.2025
ACCEPTED: 27.05.2025