

THE ASSESSMENT OF THE DIFFICULTY INDEX OF IMPACTED THIRD MOLAR BASED ON PEDERSON'S DIFFICULTY INDEX

Karamatullah¹, Hammad Wazir², Muhiyuddin Malik³, Tahir Saeed⁴, Maidah⁵,
Usman Ul Haq⁶, Manzoor Khan⁷

How to cite this article

Karamatullah, Wazir H, Malik M, Saeed T, Maidah, Haq UU, et al. The Assessment of the Difficulty Index of Impacted Third Molar Based on Pederson's Difficulty Index. J Gandhara Med Dent Sci. 2025;12(3):54-58. <https://doi.org/10.37762/jgm.12-3.690>

Date of Submission: 13-02-2025

Date Revised: 27-05-2025

Date Acceptance: 05-06-2025

¹Oral & Maxillofacial Surgeon Health Department, KPK

²Oral & Maxillofacial Surgeon Health Department, KPK

³Oral & Maxillofacial Surgeon Health Department, KPK

⁴Oral & Maxillofacial Surgeon Health Department, KPK

⁵Oral & Maxillofacial Surgeon Health Department, KPK

⁶Oral & Maxillofacial Surgeon Health Department, KPK

Correspondence

⁷Manzoor Khan, Oral & Maxillofacial Surgeon Health Department, KPK

☎: +92-302-8809637

✉: ilyas_khan526@yahoo.com

ABSTRACT

OBJECTIVES

The study aimed to determine the frequency of difficulty indices associated with impacted mandibular third molars using the Pederson difficulty index for impacted third molars.

METHODOLOGY

A descriptive cross-sectional study was conducted on 119 patients who presented at the Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar, from January to December 2024, with impacted third molars. A clinical examination of the oral cavity, along with confirmation via intraoral peri-apical x-rays and orthopantomograms, was used to assess the molar difficulty index. The difficulty index was further analysed across different age groups and genders to identify potential effect modifiers using the Chi-square test. A significance level of $p \leq 0.05$ was considered statistically significant.

RESULTS

The mean age presentation was 33.5 ± 9.12 years. Pell and Gregory's classification was utilised to assess angulation, depth, and relation with the ramus. Winters classify impactions according to angulations. The most common impactions were mesioangular (38 cases, 32%), level A (61 cases, 51%), and class 1 (59 cases, 50%), followed by horizontal (17 cases, 14%), level B (46 cases, 39%), level 2 (42 cases, 35%). The least common impaction type was vertical (12 cases, 10%), level C (12 cases, 10%), and level 3 (18 cases, 15%). The Pederson difficulty index was applied to the 119 patients analysed, revealing that 12 patients (10%) were classified as "very difficult", 26 patients (22%) as "moderately difficult", and 81 patients (68%) as "slightly difficult".

CONCLUSION

The frequency of difficulty index in removing impacted mandibular third molars was 10% for very difficult, 22% for moderately difficult, and 68% for slightly difficult.

KEYWORDS: Molars, Pederson's Index of Complexity, Trismus

INTRODUCTION

Mandibular third molars represent the most commonly impacted teeth within the human dentition.¹ The surgical extraction of impacted mandibular third molars is a frequently conducted minor oral surgical procedure performed by oral maxillofacial surgeons.² An impacted tooth fails to erupt into the dental arch within the expected timeframe due to factors such as malposition, lack of space, or physical barriers obstructing its path of eruption. The indications for third molar extraction include dental caries, pericoronitis, cysts, periodontal disease, orthodontic treatments, tumour formation associated with impacted third molars, and orthognathic surgery.³ According to research conducted by Elyse and Rock, mandibular third molar impaction is found in approximately 73% of young adults in Europe.⁴ Typically, mandibular third

molars are expected to erupt between the ages of 17 and 24 years; however, the eruption timing may vary among different races and genders.⁵ In males, mandibular third molars tend to erupt approximately 3-6 months earlier than in females.⁶ Additionally, the incidence of third molar impaction is observed to be higher in females.⁷ Infections are common in removing the mandibular third molar following partial or complete removal of bony impaction. Apart from infection, other complications include swelling, pain, nerve injuries, mandibular fracture and space infections. The other complication is that the fracture of the apical third root of impacted teeth results in more bone retrieval, leading to an increased risk of damage to adjacent structures.^{8,9,10} Therefore, adequate knowledge regarding the difficulty index is necessary to reduce complications and facilitate atraumatic surgical extraction of impacted mandibular third molars. This

study aims to gather data to evaluate the challenges encountered and the time required for the surgical extraction of impacted mandibular third molars. Additionally, it seeks to determine the optimal timing for referring patients to oral and maxillofacial surgeons for effective management. The findings of this research will help determine whether the surgery should be conducted in a dental specialist clinic under local anaesthesia or in a hospital setting. The findings of this study will be advantageous for dental practitioners as they endeavour to devise optimal treatment plans aimed at minimising complications associated with the removal of impacted mandibular third molars.

METHODOLOGY

This descriptive cross-sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Khyber College of Dentistry, Peshawar, from January 2024 to December 2024, utilising a consecutive, non-probability sampling technique. The study received ethical approval from the hospital (#403-AD/R/PG/KCD). Verbal informed consent was obtained from all participants after they were provided with a detailed explanation of the study. The total sample size of 119 was determined using a frequency of 8.4% (10 cases) for the Pederson index (PI), categorised as "very difficult", while maintaining a 95% confidence interval and a 5% margin of error, calculated using the WHO calculator. The study included patients presenting to the department with impacted lower third molars, encompassing both genders and aged between 18 and 40 years. Medically compromised patients, recurrent pericoronitis or infection and previously attempted third molar extractions were excluded from this study. Pell and Gregory's classification was employed to ascertain the position of the impacted mandibular third molars. Its horizontal component indicates the amount of space available between the ramus and the lower second molar as described below:

Class I: There is sufficient space for a third molar eruption.

Class II: Space for third molar eruption is inadequate.

Class III: The lower third molar is partially or completely located within the ramus.

Regarding the vertical component of this classification, it indicates the vertical relationship of the impacted third molar crown to the lower second molar crown:

Class A: The crown of the mandibular third molar is at the level of the occlusal plane.

Class B: The crown of the mandibular third molar is positioned between the cemento-enamel junction (CEJ) of the second molar and the occlusal plane.

Class C: The crown of the mandibular third molar is positioned beneath the cemento-enamel junction (CEJ) of the second molar.

Winter's classification is used to describe the angulation of the impacted third molar;

Mesioangular: The tooth tilted towards the second molar.

Distoangular: The tooth tilted away from the second molar.

Vertical: Long axis of the tooth

Horizontal: The long axis of the third molar is perpendicular to (90°) to the second molar.

Pederson difficulty index: Pederson (1988) introduced a difficulty index scale designed to predict the challenges encountered during the surgical extraction of impacted mandibular third molars. This scale considers the angulation, depth, and relationship with the ramus of the tooth, assessed through clinical and radiological examination, typically utilising an orthopantomogram (OPG). Each anatomical and radiological characteristic of the impacted mandibular third molar is assigned a specific score ranging from 1 to 4, with 1 indicating the least difficulty and 4 signifying the most challenging scenario. The difficulty index values are determined based on the following classification:

Angulation Score: Mesioangular = 1, Horizontal = 2, Vertical = 3, Distoangular = 4

Depth Score: Level A = 1, Level B = 2, Level C = 3

Ramus Relationship: Class I=1, Class II=2, Class III=3

The overall difficulty index value is calculated by summing up the scores obtained from the angulation, depth, and ramus relationship classifications. A total score ranging from 7 to 10 indicates a "Very difficult" scenario necessitating general anaesthesia. A total score between 5 and 7 suggests a "Moderately difficult" situation. A total score between 3 and 4 signifies a "Slightly difficult" condition. SPSS 22.0 version software was utilised for data analysis. The mean and standard deviation (SD) were calculated for continuous variables, such as age. Frequency and percentages were computed for categorical variables, including gender, classification, depth, ramus relationship, and difficulty index. To investigate potential effect modifiers, the difficulty index was stratified by age and gender, and the Chi-square test was employed. A significance level of $p \leq 0.05$ was considered statistically significant.

RESULTS

The mean age was 33.5 ± 9.12 years. In this study, the gender distribution among 119 patients revealed that 68 (57%) were male, while 51 (43%) were female (Figure 1). Regarding age distribution, 73 (61%) patients were between 18 and 30 years old, whereas 46 (39%) patients fell within the 31-40 years age group. The mean age was 33 years, with a standard deviation of ± 9.12 (Table 1). The most common angulation, based on the Pell and Gregory classification, was Mesioangular, observed in 52 (44%) cases, followed by horizontal/transverse in 38 (32%) cases. In terms of

vertical classification, the most frequent classification, according to Pell & Gregory, was level A, observed in 61 (51%) cases, followed by 46 (39%) cases. Additionally, the most common horizontal classification based on Pell & Gregory was class 1, noted in 59 (50%) cases, followed by class 2 in 42 (35%) cases. Regarding the difficulty index among the 119 patients, it was observed that 12 (10%) patients had a difficulty index classified as "very difficult", 26 (22%) patients had a difficulty index classified as "moderately difficult", and 81 (68%) patients had a difficulty index classified as "slightly difficult" (Table 3).

Table 1: Age Distribution of Patients with Impacted Mandibular Third Molars (n=119)

Age (years)	Frequency	%Age
18-30	73	61
31-40	46	39
Total	119	100

Table 2: Stratification of Difficulty Index by Age (n=119)

Difficulty Index		18-30 Years	31-40 Years	Total	P-Value
Very difficult	Yes	07	05	12	0.8212
	No	66	41	107	
Total		73	46	119	
Moderately difficult	Yes	16	10	26	0.9816
	No	57	36	93	
Total		73	46	119	
Slightly difficult	Yes	49	32	81	0.7808
	No	24	14	38	
Total		73	46	119	

Table 3: Stratification of Difficulty Index with Respect to Gender (n=119)

Difficulty Index		Male	Female	Total	P-Value
Very difficult	Yes	07	05	12	0.9299
	No	61	46	107	
Total		68	51	119	
Moderately difficult	Yes	15	11	26	0.9489
	No	53	40	93	
Total		68	51	119	
Slightly difficult	Yes	46	35	81	0.9096
	No	22	16	38	
Total		68	51	119	

DISCUSSION

Third molars in the mandible are frequently impacted by human dentition.¹ The surgical removal of impacted mandibular third molars is a commonly conducted minor oral surgical procedure, usually performed by oral and maxillofacial surgeons.² An impacted tooth does not emerge into the dental arch within the anticipated timeframe due to factors such as misalignment, inadequate space, or physical obstructions blocking its path of eruption.³ According to Elsey and Rock, the impaction of mandibular third molars affects up to 73% of young adults in Europe.⁴

Normally, mandibular third molars are observed to erupt between the ages of 17 and 24 years; however, the eruption timing may vary among different races and genders.⁵ In males, the mandibular third molar tends to erupt approximately 3-6 months earlier than in females.⁶ Moreover, there's a higher incidence of third molar impaction observed in females.⁷ In our study, the mean age of the participants was 33 years, with a standard deviation of ± 9.12 years. Among the patients, 57% were male, and 43% were female. Furthermore, the difficulty index analysis revealed that 10% of patients had a difficulty index classified as "very difficult", 22% had a difficulty index classified as "moderately difficult", and 68% had a difficulty index classified as "slightly difficult". Our study findings align with those of another study conducted by Kyeong-Lok Park et al.¹¹ In their study, they analysed the Pederson index (PI) values. Among 131 extractions, 95 were classified as not difficult (72.5%), 25 were categorised as moderately difficult (19.1%), and 11 were deemed very difficult (8.4%). In a separate study conducted by Susarla et al. (SM12), they analysed 762 extractions. Among these, 542 were identified as not difficult (71.1%), 124 were classified as moderately difficult (16.3%), and 96 were deemed very difficult (12.6%). Interestingly, the distribution of difficulty groups varied among operators ($P < 0.000$). In a study conducted by Bali A et al. involving 90 surgical extractions of impacted mandibular third molars performed between October 2003 and April 2004, the authors utilised univariate analysis and multiple linear regression analysis to identify the most significant factors.⁵ The relationship between these variables and the total intervention time was used to establish a preoperative index of difficulty. The sensitivity and specificity of this new index were then compared with the Pederson index. For easy extractions, the sensitivity and specificity of the new index were found to be 70% and 75%, respectively, resulting in an overall accuracy rate of 76%. In contrast, the Pederson index showed a sensitivity and specificity of 43% and 74%, respectively, with an accuracy rate of 49%. The positive and negative likelihood ratios for the Pederson index were 1.88 and 0.698, respectively. For moderately difficult extractions, the sensitivity and specificity of the new index were both 70%, yielding an overall accuracy rate of 73%. In comparison, the Pederson index demonstrated a sensitivity and specificity of 52% and 48%, respectively, resulting in an accuracy rate of 49%. For difficult cases, the new index demonstrated 80% sensitivity and 97% specificity, resulting in a 98% accuracy rate. In contrast, the Pederson index demonstrated a 20% sensitivity and 89% specificity, yielding an overall accuracy rate of 86%. The positive and negative likelihood ratios for the Pederson index

were 1.72 and 0.113, respectively. In another study conducted by Mahdey HM et al.¹³, involving 1249 panoramic views, 918 (73.5%) were considered for the study, revealing 1812 impacted third molars (fully or partially impacted) with complete patient data. The other studies found a significant difference between the sexes regarding impacted third molars, with women exhibiting a higher prevalence of impacted molars at 81.3% (n = 746) compared to men at 18.7% (n = 172).^{11,12} The prevalence of impacted third molars was highest among Chinese patients at 63.4% (n = 582), followed by Malay patients at 28.1% (n = 258) and Indian patients at 8.5% (n = 78). The most frequent age group affected was 20-24 years, representing 66% (n = 606) of third molar impactions, while the least frequent impaction, at 1.5% (n = 14), was observed in the 40-44 years age group.^{16, 17, 18} The level of difficulty encountered during the extraction of impacted third molars was categorised into three categories: very difficult, moderately difficult, and slightly difficult. The study offers valuable insights that can aid both general dentists and maxillofacial surgeons in devising effective surgical plans for the removal of mandibular third molars, enhancing patient care and outcomes. By examining various factors associated with surgical difficulty, the study contributes to predicting the level of difficulty involved in removing impacted mandibular third molars, facilitating better preparation and management during surgeries.

LIMITATIONS

The study's limitation lies in its relatively small sample size, which may affect the generalizability of findings to broader populations. A larger sample size would provide more robust and representative data. The study relies on the Pederson scale for assessing surgical difficulty, which may no longer be considered as reliable as newer methodologies. This could potentially introduce bias or inaccuracies in the difficulty assessment process. Utilising more contemporary and validated scales would enhance the study's reliability.

CONCLUSIONS

The study found that 69% (n = 632) of cases fell into the very difficult category, 25% (n = 232) into the moderately difficult category, and 6% (n = 54) into the slightly difficult category.

CONFLICT OF INTEREST: None

FUNDING SOURCES: None

REFERENCES

1. Clinical AH, Dentistry Cosmetic and Investigational. Pattern of third molar impaction in a Saudi population. *Clin Cosmet Investig Dent*. 2010;2:109-13. <https://doi.org/10.2147/CCIDEN.S12345>.
2. Msagati F, Simon ENM, Owibingire S. Pattern of occurrence and treatment of impacted teeth at the Muhimbili National Hospital, Dar es Salaam, Tanzania. *BMC Oral Health*. 2013;13:37. <https://doi.org/10.1186/1472-6831-13-37>. PMID: 23914842.
3. Juodzbalys G, Daugela P. Mandibular third molar impaction: review of literature and a proposal of a classification. *J Oral Maxillofac Res*. 2013;4(2):e1. <https://doi.org/10.5037/jomr.2013.4201>. PMID: 24422029.
4. Elsey MJ, Rock WP. Influence of orthodontic treatment on development of third molars. *Br J Oral Maxillofac Surg*. 2000;38(4):350-3. <https://doi.org/10.1054/bjom.2000.0347>. PMID: 10922167.
5. Bali A, Bali D, Sharma A, Verma G. Is Pederson Index a True Predictive Difficulty Index for Impacted Mandibular Third Molar Surgery? A Meta-analysis. *J Maxillofac Oral Surg*. 2013;12(3):359-64. <https://doi.org/10.1007/s12663-012-0435-x>. PMID: 24431870.
6. Majid OW, Mahmood WK. Use of dexamethasone to minimise post-operative sequelae after third molar surgery: Comparison of five different routes of administration. *Oral Surg*. 2013;6(4):200-8. <https://doi.org/10.1111/ors.12032>. PMID: 24472004.
7. Latt M, Chewprecha P. Prediction of difficulty in impacted lower third molars extraction; review literature. *J Dent Assoc Thai*. 2015;65(3):123-9.
8. Bouloux GF, Steed MB, Perciaccante VJ. Complications of third molar surgery. *Oral Maxillofac Surg Clin North Am*. 2007;19(1):117-28. <https://doi.org/10.1016/j.coms.2006.11.013>. PMID: 18088870.
9. Vijayakumar Jain S, Muthusekhar MR, Baig MF, Senthilnathan P, Loganathan S, Abdul Wahab PU, et al. Evaluation of three-dimensional changes in pharyngeal airway following isolated Le Fort I osteotomy for the correction of vertical maxillary excess: A prospective study. *J Maxillofac Oral Surg*. 2019;18(1):139-46. <https://doi.org/10.1007/s12663-018-1125-5>. PMID: 31040826.
10. Kamisetty SK, Verma JK, Arun Sundari S, Chandrasekhar S, Kumar A. SBS vs. inhouse recycling methods – An in vitro evaluation. *J Clin Diagn Res*. 2015;9(3):C04-8. <https://doi.org/10.7860/JCDR/2015/11737.5666>. PMID: 25954689.
11. Park K. Which factors are associated with difficult surgical extraction of impacted lower third molars? *J Korean Assoc Oral Maxillofac Surg*. 2016 Oct;42(5):251-8. <https://doi.org/10.5125/jkaoms.2016.42.5.251>. PMID: 28053904.
12. Susarla SM, Dodson TB. Risk factors for third molar extraction difficulty. *J Oral Maxillofac Surg*. 2004;62(11):1363-71. <https://doi.org/10.1016/j.joms.2004.03.015>. PMID: 15522639.
13. Mahdey HM, Arora S, Arora R. Prevalence and difficulty index associated with the 3rd mandibular molar impaction among Malaysian ethnicities: a clinico-radiographic study. *J Clin Diagn Res*. 2015;9(4):ZC65-8. <https://doi.org/10.7860/JCDR/2015/12494.5835>. PMID: 26023644.
14. Jeyashree T, Kumar MPS. Evaluation of difficulty index of impacted mandibular third molar extractions. *J Adv Pharm Technol Res*. 2022;13(Suppl 1):S98-S101. https://doi.org/10.4103/japtr.japtr_37_22. PMID: 36465478.

15. Bhansali SP, Bhansali S, Tiwari A. Review of Difficulty Indices for Removal of Impacted Third Molars and a New Classification of Difficulty Indices. J Maxillofac Oral Surg. 2021;20(2):167–79. doi:10.1007/s12663-020-01452-6. PMID: 33623364.
16. de Carvalho RWF, Vasconcelos BC. Pernambuco index: predictability of the complexity of surgery for impacted lower third molars. Int J Oral Maxillofac Surg. 2017;46(2):234–40. <https://doi.org/10.1016/j.ijom.2016.10.010>. PMID: 27840014.
17. Zhang X, Wang L, Gao Z, Li J, Shan Z. Development of a New Index to Assess the Difficulty Level of Surgical Removal of Impacted Mandibular Third Molars in an Asian Population. J Oral Maxillofac Surg. 2019;77(7):1358.e1–1358.e8. <https://doi.org/10.1016/j.joms.2019.02.003>. PMID: 30851375.
18. Ansari MAMF, Mutha A. Digital Assessment of Difficulty in Impacted Mandibular Third Molar Extraction. J Maxillofac Oral Surg. 2020;19(3):401–6. <https://doi.org/10.1007/s12663-019-01290-1>. PMID: 32836693.

AUTHORS CONTRIBUTION

Karamatullah - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval

Hammad Wazir - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval

Muhyuddin Malik - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Final Approval

Tahir Saeed - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Final Approval

Maidah - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Supervision; Final Approval

Usman Ul Haq - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Supervision; Final Approval

Manzoor Khan - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Final Approval

The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



LICENSE: JGMDS publishes its articles under a Creative Commons Attribution Non-Commercial Share-Alike license (CC-BY-NC-SA 4.0).

COPYRIGHTS: Authors retain the rights without any restrictions to freely download, print, share and disseminate the article for any lawful purpose.

It includes scholarly networks such as Research Gate, Google Scholar, LinkedIn, Academia.edu, Twitter, and other academic or professional networking sites.