

Research Article

The Association of Indications of Third Molar Coronectomy and Surgical Removal with Pell & Gregory and Winter Classification

Mazhar Khan¹, Riaz Khan², Salman Ashraf³, Jawad Ahmad Kundi⁴, Talal Ahmad⁵,
Amna Muzaffar⁶, Irfan Khan⁷, Muhammad Ilyas⁸

¹BDS, FCPS, Consultant Oral & Maxillofacial Surgeon, Spring North Hospital Bahria Town Phase 7, Rawalpindi, Pakistan

²Senior Registrar, Oral and Maxillofacial Surgery Peshawar Dental College Peshawar, Pakistan

³BDS, FCPS, Assistant professor, Department of Oral & Maxillofacial Surgery, Quaid-e-Azam Medical College, Bahawalpur, Pakistan

⁴BDS, FCPS. Professor & Head of Department Oral & Maxillofacial Surgery, Sardar Begum Dental College, Peshawar, Pakistan

⁵MPhil (Oral Biology). Oral Biology Department, Avicenna Dental College, Lahore, Pakistan

⁶Assistant Professor, Dental Section, Rawal Institute of Health Sciences, Rawalpindi, Pakistan

⁷Assistant Professor, Department of Oral & Maxillofacial Surgery, Lady Reading Hospital, Peshawar, Pakistan

⁸Oral & Dental Surgeon, Health Department, KPK, Pakistan

Corresponding Author: Dr. Irfan Khan, FFDRCI, FDS RCS, MFDRCSI, MFDS RCS, BDS, BSc.

Assistant Professor, Department of Oral & Maxillofacial Surgery, Lady Reading Hospital, Peshawar. Pakistan, **Email:** drirfankahn@gmail.com

Received: 27.12.25, Revised: 24.03.26, Accepted: 10.04.26, Published: 25.04.2026

ABSTRACT

Objective: This study aimed to assess the association between the choice of third molar treatment, coronectomy or surgical extraction and their classification based on Pell & Gregory and Winter Classification systems

Methodology: A descriptive cross-sectional study conducted in the department of Oral & Maxillofacial Surgery, Lady Reading Hospital, Peshawar from January 2023 to January 2024. This study includes 150 patients. Age selected was 18-40 years. The mandibular third molar impaction was assessed using Digital panoramic radiograph. Eligible patients were further assessed by CBCT to know the mandibular impaction and IAN relationship. The Data was analyzed using SPSS 23.0. Chi-square statistics was used for association and $p < 0.05$ was considered statistically significant.

Results: 27.9 ± 7.30 years were the mean age. The most common patients were male 115 (76.6%) and female were 35 (23.3%). The most common impaction was mesioangular 76 (50.7%), Class II 72 (48%) and Class A 84 (56%). The most common surgical procedure was surgical removal 104 (69.3%) of mandibular third molar impaction. Chi-square statistics revealed that surgeon's choice of procedure was significantly associated with depth of impaction ($p = 0.000$) and not significant with inclination ($p = 0.664$) and distance between second molar and ramus ($p = 0.302$).

Conclusion: This study found a significant association between the depth of impaction and the choice of surgical procedure (coronectomy or surgical removal) for impacted third molar.

Key words: Third molar impaction, IAN, coronectomy.

INTRODUCTION

The most commonly impacted teeth amongst teeth are mandibular third molars with a global incidence ranging from 16.7% to 68.6% and this variable percentage is due to demographics, region and the diagnostic criteria. The impacted third molar results in different pathological conditions which includes pericoronitis, root resorption of adjacent teeth, cyst formation, contributing to crowding and even resorption of the second molar.

Asymptomatic impacted teeth may not be advisable to extract while those teeth that are symptomatically or pathologically affected may require intervention. Complete surgical extraction has been the gold standard of impacted third molar but there is doubts of injuring the neurovascular bundles particularly inferior alveolar nerve, then these conditions require alternative procedure to preserve inferior alveolar nerve.^{1,2,3}

The mandibular third molar impaction assessment usually required panoramic radiograph. Loss or interruption of white lines, deflection or narrowing of the roots, diversion and narrowing of the canal and periapical radiolucent area are the radiographic signs which can be seen on radiograph and these signs indicate the prediction of exposure and having greater chances of alveolar nerve injury during mandibular impacted teeth surgical removal.^{1,2} The relative difficulty index of mandibular impacted teeth preoperatively is well assessed by using panoramic radiograph. The routinely used classification to evaluate the difficulty index of impacted third molar is Pell & Gregory and Winter's classification.^{3,4,5}

After removing an impacted wisdom tooth surgically, the occurrence of temporary injury to the IAN ranges from 0.35% and 8.4% while the risk of permanent injury varies from 0% to 2%.^{6,7} Such nerve damage can lead to sensory disturbances including numbness or tingling (paresthesia or anesthesia) in the buccal gingiva, lower lip, and chin on the affected side.⁸ This complication is among the most concerning outcomes of third molar surgery and related to a decline in standard of living.⁹ Knutsson et al¹⁰ introduce the alternative option for surgical extraction of lower third molar impacted teeth, coronectomy. In coronectomy the tooth crown portion is removed and roots are left intact in the alveolar bone which helps in avoiding injury to the IAN either directly or indirectly.⁹ Coronectomy has gained traction as a nerve-sparing technique specially in those cases in which impacted teeth, nearby location of IAN to the apex of horizontally or distoangular impacted teeth, a greater chance of trauma to the IAN exist.¹¹ Furthermore, third molar embedded in the ramus of alveolar bone and those below cervical line are linked with high incidence of damage to the IAN injury. Cone-beam computerized tomography (CBCT) has further revolutionized preoperative diagnosis which allows for three-dimensional assessment of canal proximity and root morphology.^{6,12}

Despite widespread use, the relationship between classification systems and the indications for coronectomy and complete surgical removal has not been fully elucidated in the literature. Many studies mostly focus on the postoperative outcomes or demographic assessments without exploration of initial decision-making process. Limited studies regarding coronectomy and their association with Pell & Gregory and Winter's classification may result in high risk of nerve injury while better understanding of these associations could

lead to limited nerve injuries and selecting appropriate surgical procedures. The study will help to bridge the gap by analyzing the association between indications for coronectomy and surgical removal with Pell and Gregory and Winter's classification.

The objective of this study was to evaluate the relationship of decision whether to perform coronectomy or surgical removal with Pell & Gregory & Winter's classification.

METHODOLOGY

A descriptive cross-sectional study was carried out in the Department of Oral & Maxillofacial Surgery, Lady Reading Hospital, Peshawar from January 2023 to January 2024. Approval was taken from the ethical review committee of the Lady Reading Hospital. A total of 150 patients of both genders were selected from age 18 to 40 years. Digital panoramic radiograph was made under clinical standard resolution. Patients were eligible for this study if the preoperative panoramic image of the patient has at least one of the following signs;

- i. Narrowing of the root
- ii. Narrowing of the canal
- iii. Diversion of the canal
- iv. Interruption of white lines
- v. Darkening of the root

Pell Gregory classification was used to assess impaction depth relative to occlusal level (Class A, B & C) and relationship to the ramus (Class I, II & III).

Winter's classify third molar impaction into mesioangular, vertical, distoangular, horizontal and others (those having other than these angulations were considered as others).

All eligible patients underwent CBCT to evaluate the nearness of IAN with mandibular impacted third molar. After confirming, all those who have close proximity with nerve coronectomy was carried out while in those patients whose roots were not near the IAN surgical extraction was performed. Patients who displayed no evidence of closeness to the IAN on preoperative panoramic radiograph and need no further intervention following the CBCT scan assessment were not included in this study.

The data was analyzed using SPSS 23.0. Descriptive statistics were used for age and impacted teeth classification. Chi-square test was used for association between surgical technique used and Pell & Gregory and Winter classification. $P < 0.05$ was considered statistically significant.

RESULTS

The mean age in this study was 27.9 ± 7.30 years. Male patients were 115 (76.6%) and female were 35(23.3%). The summary of descriptive statistics is given in table 1. The most common impaction class II 72(48%) followed by class 66(44%) while class A was seen the most dominant 84(56%). In terms of inclination the most common impaction was mesioangular 76(50.7%) followed by horizontal 31(20.7%) The most prominent surgeon assessment was surgical removal 104(69.3%)

while in 46(30.7%) impactions coronectomy was performed as shown in table 2. Chi-square statistics revealed that surgeon's choice of procedure is statistically significant with depth of impaction ($p=0.000$) as shown in table 2. Table 3 showed that there is no significant association exist between ramus position and surgical technique ($p=0.302$). Table 4 also revealed that no statistically significant association between Winter's classification and surgical decision was found ($p=0.664$).

Table 1. Summary of Descriptive statistics.

Number of Patients	150
Mean Age of patients	27.9 ± 7.30
Gender	
Male	115 (76.6%)
Female	35(23.3%)
Surgeon's Assessment	
Surgical Removal	104(69.3%)
Coronectomy	46(30.7%)
Pell & Gregory; Space between Ramus and second molar	
I	66(44%)
II	72(48%)
III	12(12%)
Impaction Depth	
A	84(56%)
B	44(29.3%)
C	22(14.7%)
Winter Classification	
Mesioangular	76(50.7%)
Horizontal	31(20.7%)
Vertical	19(12.7%)
Distoangular	24(16%)
Others	0

Table 2. Frequency of surgical technique by impaction depth.

		Pell_Gregory_Classification_ A_B_C			Total	Chi-square (df)	P value
		A	B	C			
Procedure	Surgical Removal	69	30	5	104	28.98	0.000
	Coronectomy	15	14	17	46		
Total		84	44	22	150		

Table 3. Frequency of surgical technique by distance between ramus and second molar.

		Pell_Gregory Classificaion_I_II_III			Total	Chi-square (df)	P value
		I	II	III			
Procedure	Surgical Removal	46	52	6	104	2.39	0.302
	Coronectomy	20	20	6	46		
Total		66	72	12	150		

Table 4. Frequency of surgical technique at different inclination.

		Winters Classification				Total	Chi-square (df)	P Value
		Mesioangular	Horizontal	Distoangular	Vertical			
Procedure	Surgical Removal	56	21	15	12	104	1.58	0.664
	Coronectomy	20	10	9	7	46		
Total		76	31	24	19	150		

DISCUSSION

In the landscape of impacted third molar surgery, where the procedural efficacy and patients safety are of paramount importance, the use of classification systems as decision making tool is indispensable. Understanding the association of these classification system and type of procedure to be carried out is not only an academic exercise but mandatory clinically. This study helps to provide an evidence based that informs surgical planning, reduces postoperative morbidity and enhance patient outcomes through personalized procedural strategies. This study revealed the anatomic position of impacted third molars using Pell & Gregory and Winter's classification systems and the surgical decision to perform either coronectomy or surgical removal of impacted third molar. This study also demonstrates the frequency and patterns of impaction of lower impacted teeth. Panoramic radiograph was used to assess the mandibular impaction and relation to the IAN was evaluated by CBCT. Simons et al¹³ also utilize panoramic radiograph as well as CBCT.

The findings of this study demonstrates that the most frequent impacted teeth was mesioangular impaction in terms of inclination. This research aligns with study conducted by Simon et al and Prajapati et al.^{13,14} Numerous other studies also indicated that mesioangular impaction was the most prevalent type of impaction found in terms of inclination which is in accordance with this study.^{15,16,17} On the other hand various studies found the most prominent impaction is vertical.^{18,19,20} In the present study the most prevalent relationship of the impaction with ramus was Class II followed by Class I and Class III. Many additional studies back up this research.^{15,21,22} While Simon et al opposes this study in which Class III was the most prevalent impaction relation to the ramus. The current investigation showed that Class A was the most common type of impaction in terms of depth which is in line with the research done by Jaroń et al.⁵ Simon et al¹³ opposes this study.

Coronectomy was performed in mesioangular , Class II and class C impaction which in

accordance with Simon et al.¹³ This research identified a notable link between the surgeon's selected procedure and the depth of impaction which is in accordance with study done by Monaco et al¹² in which they revealed that position C carried out 8-10 times higher risk of IAN injury during complete surgical removal than position A or B impacted teeth. Kang et al²³ in their systemic review found that distoangular and horizontal impactions had a significantly higher rates of nerve-related complications after extraction of impacted teeth. The incorporation of Winters classification provides an additional assessment of decision making. Simon et al¹³ in their study found no significant association of angulation and surgeon's choice of procedure which is in align to this study.

To the extent of research, a limited research has been carried worldwide with no study yet carried out nationally and this is the first study nationally to reveal the association of surgeon's choice with Pell & Gregory and Winters classification. Furthermore relying on this study more 3D scan will not be advised resulting in limitation of exposure to radiation.

The small sample size is the limitation of this study with most number of patients is male. The other limitation was the panoramic review, only a single reviewer assessed the panoramic radiograph and no consistency was established statistically. Moreover, this is a single center study that could influence the applicability of the results. The future study may include longitudinal follow up of coronectomy patients to assess root migration, nerve recovery and long term outcomes by incorporating CBCT-based risk stratification models.

The clinical implications of these results are noteworthy. By recognizing the patterns of impaction radiographically with high risk, the surgeon can predict better the safer procedure in order to reduce the chances of permanent neurosensory deficit. The decision can be sfurther strengthened by using 3D CBCT which give you more accurate visualization of nerve and root relationship. However coronectomy is not without risks. Complications like root migration, infection or the need of the second

surgery may be required. Therefore it is imperative to involve a comprehensive assessment before selecting the appropriate intervention.

CONCLUSION

This study concluded that coronectomy was most commonly performed for Class II, Class C and mesioangular impaction. Significant association was seen in depth of impaction (Class A/B/C) and surgeon's choice of procedure and no notable association was observed between distance of ramus and second molar (Class I/II/III) and mesioangular impaction and surgeon's choice of procedure.

REFERENCES

1. Rood JP, Shehab BA. The radiological prediction of IAN injury during third molar surgery. *Br J Oral Maxillofac Surg*. 1990 Feb;28(1):20-5.
2. Weiss R, Read-Fuller A. Cone beam computed tomography in oral and maxillofacial surgery: an evidence-based review. *Dentistry journal*. 2019 May 2;7(2):52.
3. Lima CJ, Silva LCF, Melo MRS, Santos JAAS, Santos TS. Evaluation of the agreement by examiners according to classifications of third molars. *Med Oral Patol Oral Cir Bucal* 17(2).2012:e281-6.
4. Santosh P. Impacted mandibular third molars: Review of literature and a proposal of a combined clinical and radiological classification. *Annals of medical and health sciences research*. 2015 Jul 21;5(4):229-34.
5. Jaroń A, Trybek G. The pattern of mandibular third molar impaction and assessment of surgery difficulty: A Retrospective study of radiographs in east Baltic population. *International journal of environmental research and public health*. 2021 Jun 3;18(11):6016.
6. Cheung LK, Leung YY, Chow LK, Wong MC, Chan EK, Fok YH. Incidence of neurosensory deficits and recovery after lower third molar surgery: a prospective clinical study of 4338 cases. *International journal of oral and maxillofacial surgery*. 2010 Apr 1;39(4):320-6.
7. Gülicher D, Gerlach KL. Sensory impairment of the lingual and IANs following removal of impacted mandibular third molars. *International journal of oral and maxillofacial surgery*. 2001 Aug 1;30(4):306-12.
8. Leung YY, Lee TC, Ho SM, Cheung LK. Trigeminal neurosensory deficit and patient reported outcome measures: the effect on life satisfaction and depression symptoms. *PLoS One*. 2013 Aug 29;8(8):e72891.
9. Sarikov R, Juodzbals G. IAN injury after mandibular third molar extraction: a literature review. *Journal of oral & maxillofacial research*. 2014 Oct;5(4).
10. Knutsson K, Lysell L, Rohlin M. Postoperative status after partial removal of the mandibular third molar. *Swedish dental journal*. 1989 Jan 1;13(1-2):15-22.
11. Kipp DP, Goldstein BH, Weiss WW. Dysesthesia after mandibular third molar surgery: a retrospective study and analysis of 1,377 surgical procedures. *The Journal of the American Dental Association*. 1980 Feb 1;100(2):185-92.
12. Monaco G, Montevicchi M, Bonetti GA, Gatto MR, Checchi L. Reliability of panoramic radiography in evaluating the topographic relationship between the mandibular canal and impacted third molars. *The Journal of the American Dental Association*. 2004 Mar 1;135(3):312-8.
13. Simons RN, Gonesh MS, Tuk .G. et al. Association of indications for mandibular third molar coronectomy and the Pell and Gregory and the Winter classification systems. *Oral Maxillofac Surg*. 2024;28:885-92.
14. Prajapati VK, Mitra R, Vinayak KM. Pattern of mandibular third molar impaction and its association to caries in mandibular second molar: A clinical variant. *Dent Res J (Isfahan)*. 2017 Mar-Apr;14(2):137-142.
15. Mahdey HM, Arora S, Wei M. Prevalence and difficulty index associated with the 3(rd) mandibular molar impaction among Malaysian ethnicities: a clinico-radiographic study. *J Clin Diagn Res*. 2015;9(9):ZC65-8.
16. Ye ZX, Qian WH, Wu YB, Yang C. Pathologies associated with the mandibular third molar impaction. *Sci Prog*. 2021;104(2):368504211013247.
17. Zaman MU, Almutairi NS, Abdulrahman Alnashwan M, Albogami SM, Alkhamash NM, Alam MK. Pattern of mandibular third molar impaction in nonsyndromic 17760 patients: A retrospective study among Saudi population in Central Region, Saudi Arabia. *BioMed Research International*. 2021;2021(1):1880750.
18. Kumar VR, Yadav P, Kahsu E, Girkar F, Chakraborty R. Prevalence and pattern of mandibular third molar impaction in

- Eritrean population: a retrospective study. *J Contemp Dent Pract.* 2017;18(2):100–6.
19. Al-Dajani M, Abouonq AO, Almohammadi TA, Alruwaili MK, Alswilem RO, Alzoubi IA. A cohort study of the patterns of third molar impaction in panoramic radiographs in Saudi population. *Open Dent J.* 2017;11:648–60.
 20. Yilmaz S, Adisen MZ, Misirlioglu M, Yorubulut S. Assessment of third molar impaction pattern and associated clinical symptoms in a central Anatolian Turkish population. *Med Princ Pract.* 2016;25(2):169–75.
 21. Hatem M, Bugaighis I, Taher EM. Pattern of third molar impaction in Libyan population: a retrospective radiographic study. *Saudi J Oral Dent Res.* 2016;7(1):7–12.
 22. Haddad Z, Khorasani M, Bakhshi M, Tofangchiha M, Shalli Z. Radiographic position of impacted mandibular third molars and their association with pathological conditions. *Int J Dent.* 2021;2021:8841297.
 23. Kang F, Sah MK, Fei G. Determining the risk relationship associated with inferior alveolar nerve injury following removal of mandibular third molar teeth: A systematic review. *J Stomatol Oral Maxillofac Surg.* 2020 Feb;121(1):63–69.