Original Article

Study of pattern and prevalence of mandibular impacted third molar among Delhi-National Capital Region population with newer proposed classification of mandibular impacted third molar: A retrospective study

ABSTRACT

Aim/Objective: The mandibular third molar is the most frequently impacted tooth with incidence varies from 9.5% to 68% in different populations. Hence, the aim was to study the prevalence and pattern of mandibular impacted third molar among Delhi-National Capital Region (NCR) population.

Materials and Methods: The study was conducted with data collected from registered hospitals and dental clinics of Delhi NCR region. The study represents a retrospective analysis of panoramic radiographs and intraoral periapical radiograph of patients at these centers from June 2014 to June 2016.

Results: Out of 960 patients with the third molar investigated, a total of 250 patients having impacted mandibular third molar (152 [60.8%] males and 98 [39.2%]) females between June 2014 and June 2016 were included in the study. The age ranged from 20 to 55 years, with a mean age of 27.6 years and the standard deviation was 5.8 years. The prevalence of impacted mandibular third molars for this study was 26.04%.

Conclusion: This study demonstrated that males (60.8%) were more likely to present with impacted mandibular third molars than females (39.2%). The prevalence of third molar impactions was almost the same on both the left (45.8%) and right (54.2%) sides. This study also noted that mesioangular impactions (49.2%) were the most common type of impaction. The least common form of impactions was the transverse types (2%). The prevalence of impacted mandibular third molars for this study was 26.04%.

Keywords: Alveolar osteitis, impaction, nerve injury, pericoronitis, ramus relationship

INTRODUCTION

The word impaction is originated from the Latin word "impact" means organ or structure, which because of an abnormal mechanical condition has been prevented from assuming its normal position. William stated impacted tooth as one which is completely or partially unerupted and is positioned against another tooth, bone, or soft tissue so that its further eruption is unlikely.[1] Impacted teeth are those which fail to erupt or develop into the proper functional location in oral cavity beyond the time usually expected. Etiology may be multifactorial usually due to adjacent teeth, dense overlying bone or soft tissue, size of the mandible or maxilla with the resultant lack of space in the jaw, aberrant path of the eruption, abnormal positioning of tooth bud, differential root growth between the mesial and distal roots, or pathological lesions.[2]

Deepak Passi, Geeta Singh¹, Shubharanjan Dutta², Dhirendra Srivastava³, Lokesh Chandra³, Sonal Mishra³, Anchal Srivastava⁴, Manish Dubey⁵

Department of Oral and Maxillofacial Surgery, Inderprastha Dental College and Hospital, Ghaziabad, ¹Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, King George Medical University, ⁵Departmemt of Dentistry, T. S. Misra Medical College and Hospital, Lucknow, Uttar Pradesh, ³Department of Oral and Maxillofacial Surgery, ESIC Dental College and Hospital, Delhi, ⁴Department of Oral Pathology, Govt. Dental College and Hospital, Aurangabad, Maharashtra, India, ²Department of Oral and Maxillofacial Surgery, M. B. Kedia Dental College, Birgunj, Nepal

Address for correspondence: Dr. Manish Dubey, Department of Dentistry, T. S. Misra Medical College and Hospital, Lucknow, Uttar Pradesh, India.
E-mail: manishomfs1910@gmail.com

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Impacted teeth can lead to impaction of food, pericoronitis, caries, pain, and development of pathology. Therefore, impacted third molar prophylactic removal is becoming a common practice nowadays.

The current study aims to compare and assess the prevalence and pattern of impacted mandibular third molars in Delhi National Capital Region (NCR) region with the proposal of newer classification of impacted mandibular third molars.

MATERIALS AND METHODS

A retrospective study of patients was carried out from January 2014 to January 2016 in the Dental Department of Hospitals and Dental Clinics of Delhi-NCR region. A total of 960 cases of patients aged between 20 and 55 years were selected for the study. The clinical and radiographic records of these patients were evaluated after the consent of patients. Parameters studied into the study were an age group, gender, location of the impacted third molar (left/right), angulation, position, and level of the impacted tooth.

The exclusion criteria were patients below 20 years of age, incomplete clinical radiological records, incomplete root formation of the third molar, severe systemic disease conditions, craniofacial anomalies or syndromes such as achondroplasia, progeria, oxycephaly, cleidocranial dysostosis, and Down's syndrome, any previous trauma or pathology.

They were analyzed for the angulation, position, and depth of impaction. Only teeth which had not attained functional occlusion were taken as impacted tooth. The angulation was assessed using Quek's adaptation of the Winter's classification, which incorporated the use of an orthodontic protractor to quantify the angulation to reduce the errors associated with the evaluation by visual impression alone. The position and level of the impacted teeth were assessed using the Pell and Gregory classification. The analysis of the collected data was performed using the Pearson's Chi-square test with the help of Statistical Package for Social Sciences (version 18.0) software IBM , Chicago, Illinois, United States of America (USA).

RESULTS

Among 960 patients, a total of 250 patients having third molar impactions in the year 2014–2016 were evaluated. The age ranged from 20 to 55 years, with a mean age of 27.6 years and the standard deviation was 6.2 years [Table 1]. Among the 250 patients, there were 152 (60.8%) male patients and 98 (39.2%) female patients [Graph 1]. The male to female ratio of the study group was 1.5:1 (152:98).

The patients were divided into 5 years of age groups ranging from 20 to 55 years. The 25–30 years of age group had the highest prevalence of tooth impaction (48.8%), but decreases with increasing age except in the 30–35 years of age group showed an increase in impactions when compared to age group of 20–25 years. The patients were divided into seven groups, ranging from 20 to 55 years, each group spanning over a 5 years' period [Table 2].

Presentation of angulations in impacted mandibular third molars reveals that the mesial angulation is most prevalent – 49.2% [Figure 1], vertical position – 24% [Figure 2], horizontal position – 20% [Figure 3], and distal
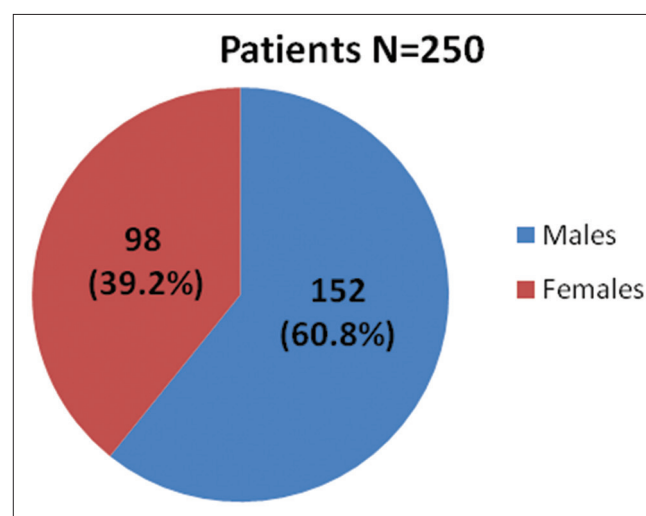
Graph 1: Distribution of impacted teeth in different gender

Table 1: Basic data for number of patients and age in years

	Basic data for age and years		Total
	Male	Female	
n	152	98	250
Mean	28.2	26.6	27.6
SD	6.6	5.4	6.2

SD: Standard deviation

Table 2: Number of patients at different age groups

Age groups (years)	Patient with impacted teeth		Total (%)
	Male	Female	
20-25	21	13	34 (13.6)
25-30	73	49	122 (48.8)
30-35	28	20	48 (19.2)
35-40	16	9	25 (10)
40-45	8	4	12 (4.8)
45-50	4	2	6 (2.4)
50-55	2	1	3 (1.2)

position – 4.8% [Figure 4]. The transverse position was the least prevalent – 2% [Figure 5 and Table 3]. Based on a Chi-square test, it was found the prevalence of mesioangular angulation (49.2%) was significantly higher than other angulations [Graphs 2 and 3].

Among the three impaction levels, Level B (64.2%) was significantly more prevalent than Level A and Level B additionally, the Class II ramus relationship was significantly more prevalent followed by Class I and Class III, respectively [Table 4]. The distributions of the angulations of impaction on the right and left sides do not differ significantly (Fisher's exact test [$P = 0.78$]).

The most common pathologies associated with impacted third molars were caries of impacted teeth (35.6%) and pericoronitis (30.8%) with or without trismus. Other problems were periodontal pockets between second and third molar causing food lodgment (14.8%), caries of second molar (11.2%) [Figure 6], and root resorption of second molar (7.2%) [Figure 7]. Associated odontogenic cyst was also found [Figure 8 and Table 5].

Complications during surgical removal include bleeding, damage to the second molar, displacement of root into lingual space, and dentoalveolar fracture. Postoperatively, complications were persistent pain, swelling, bleeding, ecchymosis, trismus, and dry socket. Few potential complications include paresthesia of lower lip and tongue,

Table 3: Types and percentage of impacted teeth in different gender

Angulation of impaction	Male	Female	Total (%)
Mesioangular	73	50	123 (49.2)
Vertical	38	22	60 (24.0)
Horizontal	30	20	50 (20.0)
Distoangular	8	4	12 (4.8)
Transverse	3	2	5 (2)
Inverted	-	-	-
Total (%)	152 (60.8)	98 (39.2)	250 (100)

Figure 1: Mesioangular impacted teeth

Figure 2: Vertically impacted teeth

Figure 3: Horizontally impacted teeth

Figure 4: Distoangular impacted teeth

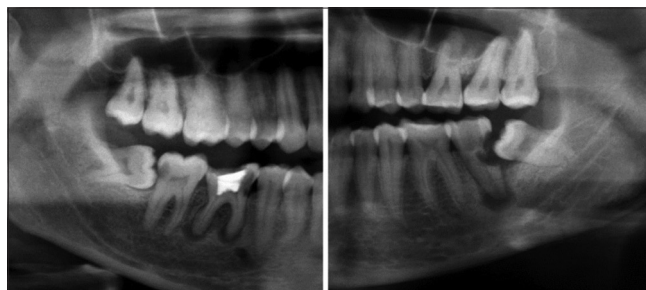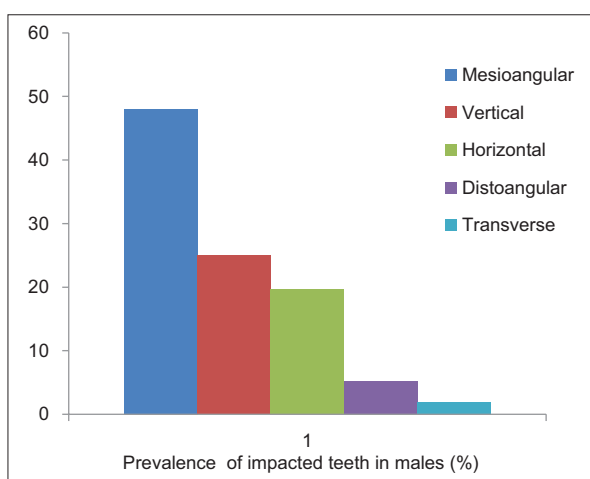Figure 5: Transverse placed impacted teeth
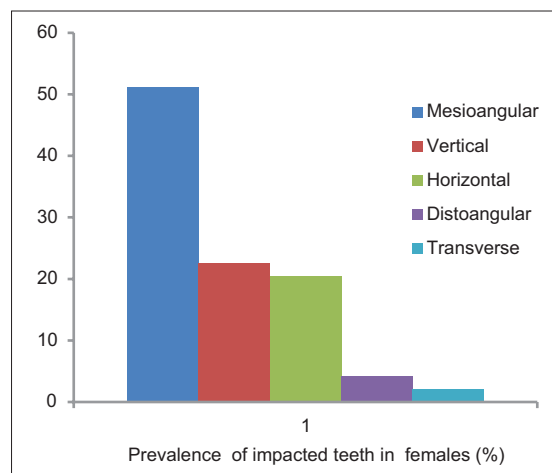

Figure 6: Caries of second molars

Figure 7: Root resorption of second molar

Figure 8: Impacted third molar associated with odontogenic cyst

Graph 2: Prevalence of impacted teeth in males

Graph 3: Prevalence of impacted teeth in females

Table 4: Distributions of the different level and class of impacted teeth

Level/Class of impaction	Total (%)
Level/depth of impaction (Pell and Gregory) (%)	
Level A	24.8
Level B	64.2
Level C	11.0
Ramus relationship (Pell and Gregory) (%)	
Class I	36
Class II	48
Class III	15

temporomandibular joint pain, and fracture of angle of mandible.

DISCUSSION

A tooth which is unable to erupt physiologically into its functional anatomic position with time is said to be impacted. The normal age of occurrence of third molars is 18–25 years.[3] More than one-third of third molars get impacted due to insufficient space. Third molar teeth are the last to erupt and have a relatively high chance of becoming impacted. The etiology of third molar impactions has been reviewed by various authors over the years. Lack of space, retardation of facial growth, distal direction of eruption, early physical maturity, late third molar mineralization or lack of sufficient eruption force follicular collision, obstruction by physical/mechanical barriers, such as scar tissue, fibromatosis, compact bone, unattached mucosa, odontogenic cyst, and tumors are the common reasons. Higher rates of impaction in the lower jaw can also be attributed to the imbalance of the bone deposition-resorption process at the mandibular ramus, resulting in either a decrease in the angulation of the mandible or increase in the angulation of the mandibular plane.[4] Pathologies associated with impacted third molar are pericoronitis, caries, food lodgment, pocket formation, periodontal bone loss, root resorption of adjacent teeth, and development of cysts and tumors.[5]

Third molar impaction is a common pathological deformity of modern civilization. The prevalence of impaction in different populations ranges from 9.5% to 68% according to various authors.[6]

Table 5: Distribution of pathologies with different type of impacted teeth

Pathology	Mesioangular	Vertical	Horizontal	Distoangular	Total
Pericoronitis	31	28	7	11	77
Caries third molar	52	17	18	2	89
Caries second molar	14	2	12	-	28
Periodontal pocket	16	13	4	4	37
Root resorption of second molar	9	-	9	-	18
Cyst/tumor	1	-	-	-	1

Because of the increased incidence of unerupted third molars and the association of numerous complications with these retained teeth, assessment of third molars in terms of its position, angulation, and level in relation to gender, and arch is a necessary intervention for better patient management and decision-making of whether to retain or remove these teeth.

In our study, the prevalence of an impacted third molar was 26.4%. Other study shows variable finding depending on region. Morris and Jerman[7] reported (65.6%) and Quek *et al*.[6] reported (68.6%) a higher prevalence of impaction in a study population from the USA and Singapore, respectively. However, a lower prevalence has been reported by Hashemipour *et al*. (44.3%) in the Southeast region of Iran.[8] Other authors reported rate Eliasson *et al*. 30.3%,[9] Montelius 32%,[10] Hattab *et al*. 33%,[11] Rajasuo *et al*. 38%,[12] and Hassan 40.8%.[13]

We found that the incidence of mandibular third molar impaction was significantly higher in males in comparison to females. This is in contrast with the study of Muhamad *et al*.,[14] Hashemipour *et al*.,[8] Quek *et al*.,[6] Hugoson and Kugelberg,[15] Ma'aita and Alwrikat,[16] and Kim *et al*.[17] They reported a gender predilection for females. However, Brown *et al*.[18] and Montelius[10] studies no sexual predilection gender-wise for incidence of mandibular third molar.

The distribution of angulation of impacted third molars in our study showed that mesioangular impaction was the most frequent (49.2%) followed by vertical (24%), horizontal (20%), and distoangular (4.8%). Our finding is supported by studies of Kramer and Williams,[19] Quek *et al*.,[6] Moris and Jerman,[7] Hassan,[13] and Hashemipour *et al*.[8] who reported that mesioangular impaction was the most prevalent type of impaction in the mandibular third molars of African American, Singaporean, American, Arabian, and Iranian populations, respectively.

Evaluation of the level of impaction showed that 24.8% impacted third molars were positioned at Level A, 64.2% were positioned at Level B, and 11% were positioned at Level C. Hence, the most common type of impaction level was Level B which means impacted tooth with an occlusal surface between the occlusal plane and the cervical line of the second molar. Similar results were shown by the studies of Blondeau and Daniel,[20] Almendros-Marqués *et al*.,[21] Quek *et al*.,[6] and Hassan[13] that Class B was the most common impaction level. In contrast, Monaco *et al*.,[22] Obiechina *et al*.,[23] Hugoson and Kugelberg,[15] and Hashemipour *et al*.[8] reported Class A as the predominant impaction level. The different findings of different studies can be explained by the difference in classification methods used for their studies.

Our study showed that Class II ramus relationship was the most frequently occurred ramus relationship class in mandibular impacted third molars (48%), followed by Class I (36%) and Class III (15%). Class II relation means tooth is positioned posteriorly so that approximately one half is covered by the ramus. Similar results were reported by Monaco *et al*.,[22] Obiechina *et al*.,[23] Blondeau *et al*.,[20] Almendros-Marqués *et al*.,[21] and Hashemipour *et al*.[8]

Wisdom teeth have long been identified as a source of problems and continue to be the most commonly impacted teeth in the human mouth. The classification of impacted teeth should help the clinicians to determine the probabilities of impaction, infections, and complications associated with wisdom teeth removal. It should help in the best possible path of removal of impacted teeth and amount of difficulty. There exist number of classification of impacted mandibular third molar in medical literature based on spatial relationship and angulations, in relation with ramus and second molar, on the basis of status of eruptions and roots, the amount of soft tissue or bone (or both) that covers them, etc. Some of the classifications are listed with their merits and demerits.

Quek *et al*. proposed a classification system using orthodontic protractor. In their study, angulation was determined by the angle formed between the intersected long axis of second and third molars. They classified mandibular third molar impaction as follows.[6]

a. Vertical (0°–10°)
b. Mesioangular (11°–79°)
c. Horizontal (80°–100°)
d. Distoangular (−11°–−79°)
e. Others (−111°–−80°).

The classification is based on angulation only. It is easy and quick to use but parameters such as depth of impaction, difficulty level, nerve relation with injury predictability, and association with pathology is not mentioned.

Pell and Gregory classification

Classified impacted mandibular third molars; first, according their position according to the distance between the second molar and the anterior border of the ramus of the mandible. Second, according to the depth of impaction and proximity to the second molar.[24] [Table 6 and Figure 9] This classification is helpful in predicting surgical difficulty. A composite relationship of angulation, ramus relationship, and depth of impaction can provide a surgical extraction difficulty index, as described by Pedersen[25] [Table 7].

Archer and Kruger classification

1. Mesio Angular: (Most Common) 43% and least difficult to remove
2. Horizontal: (Less Common) only 3%. More difficult than mesioangular
3. Vertical impactions: Second greatest frequency, 38%. Considered third in ease of removal
4. Distoangular impaction: Only approximately 6%. Most difficult to remove
5. Buccoangular
6. Linguoangular
7. Inverted.

The classification is based on angulation, prevalence, and prediction of difficulty but parameters such as depth of impaction, nerve injury predictability, and association pathology is not given.[26,27]

American Dental Association's-American Association of Oral and Maxillofacial Surgeons classification of impacted teeth

The American Dental Association's-American Association of Oral and Maxillofacial Surgeons classification describes type of impacted teeth tissue/partial bony/complete bony types, surgical steps and was given particular numerical designation for it. No description of angulation, relevant depth, nerve relation, and associated pathology was there [Table 8].

Winter's classification (based on angulations)

According to the position of the impacted third molar to the long axis of the second molar.[28]

Table 6: Pell and Gregory classification

Based on the amount of tooth covered by the anterior border of the ramus		
Class I relationship	**Class II relationship**	**Class III relationship**
If the mesiodistal diameter of the crown is completely anterior to the anterior border of the mandibular ramus	If the tooth is positioned posteriorly so that approximately one half is covered by the ramus	The tooth is located completely within the mandibular ramus
If the mesiodistal diameter of the crown is completely anterior to the anterior border of the mandibular ramus	If the tooth is positioned posteriorly so that approximately one half is covered by the ramus	The tooth is located completely within the mandibular ramus
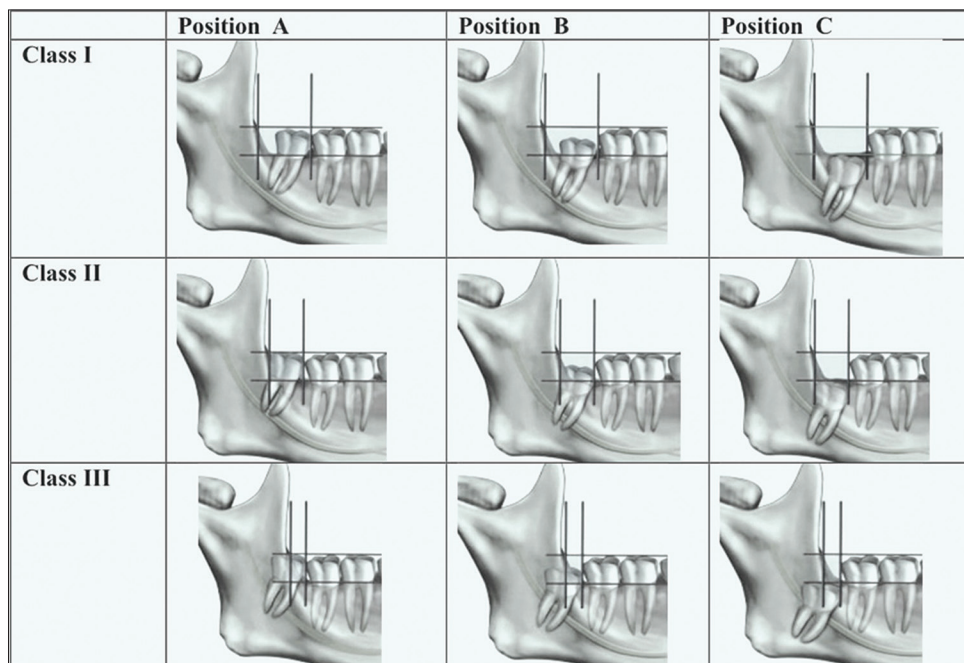
Figure 9: Pell and Gregory classification of impacted mandibular third molars

- Mesioangular – 45%
- Horizontal – 10%
- Vertical – 40%
- Distoangular – 5%.

These may occur simultaneously in buccal version, lingual version, and torsoversion Killy and Kay classification of mandibular impacted teeth[29] [Table 9].

Classification of the third molar in relation to inferior alveolar nerve (IAN) superimpositions predicting significantly

Table 7: Difficulty level prediction for impacted mandibular third molar removal (Pederson Scale-1998)

Classification	Score
Spatial relationship	
Mesioangular	1
Horizontal	2
Vertical	3
Distoangular	4
Depth	
Level A	1
Level B	2
Level C	3
Ramus relationship	
Class I	1
Class II	2
Class III	3
Difficulty level	
Very difficult	7-10
Moderately difficult	5-7
Minimally difficult	3-4

Table 8: ADA-AAOMS classification of impacted teeth

ADA codes	Description
07220	Soft tissue impaction (requires incision of overlying soft tissue and removal of tooth)
07230	Partially bony impaction (incision of overlying soft tissues, elevation of flap and either removal of bone and tooth or sectioning and removal of the tooth)
07240	Completely bony impaction (incision of overlying soft tissues, elevation of flap, removal of bone and sectioning of the tooth)
07241	Completely bony with unusual surgical complications (incision of overlying soft tissues, elevation of flap, removal of bone and sectioning of the tooth and/ or presents with unusual difficulties and circumstances)

Table 9: Killy and Kay classification of mandibular impacted teeth

Parameter	Classification
Based on angulation and position	Mesioangular/horizontal/vertical/distoangular
Based on state of eruption	Completely erupted/partially erupted/unerupted
Based on roots	Number of roots-fused roots/two roots/ multiple roots Root pattern-surgically favorable/surgically unfavorable

neurosensory deficits of the IAN after mandibular third molar extraction[30] [Figure 2]. IAN may be involved after third molar removal from 0.5% to 5%. Lingual nerve involvement shows incidence of 0.2%–2% of lower third molar removals[31] [Figure 10].

Thoma, as quoted by Obimakinde, classified the curvature of the roots of the impacted mandibular molars into three categories.[32]

a. Straight roots (separated or fused)
b. Curved roots in a distal position
c. Roots curved mesially.

The number of roots may be two or multiple. The impacted tooth can also present with fused roots.

The classification of impacted third molar should be systemic and meticulous. It should cover all the parameters related to impacted teeth, that is, position, depth, relative incidence, difficulty level, and possible complications. Hence, an attempt is here y made to propose a new classification system of mandibular impacted third molar hoping it will benefit for students and researchers to update their knowledge and understanding.

Deepak Passi (2018) classification of impacted mandibular third molar [Table 10].

The newer proposed classification describes almost all the clinical and radiological parameters such as angulation, degree and incidence of impacted teeth, relationship with anterior border of mandible, relation with alveolar crest and second molar (depth), nerve relation and injury risk with both lingual and IAN. It also describes the degree of difficulty of removal, pathology associated with impacted third molar and complications. The main limitation of this classification is that it is applies to mandibular third molar only, not maxillary teeth and bit lengthy to write.

CONCLUSION

This was the most recent and perhaps first ever studies to evaluate the prevalence and pattern of mandibular third molar impactions in Delhi–NCR region of India. In our study, only 26.04% of the population had impacted mandibular third molar condition which is comparatively less when compared to other studies from different countries and regions. From our study, it can be concluded that recurrent pericoronitis and caries are two most common causes of impacted teeth removal. Mesioangular type of impaction was most common type of impactions. Impacted level B and Class II ramus relationship
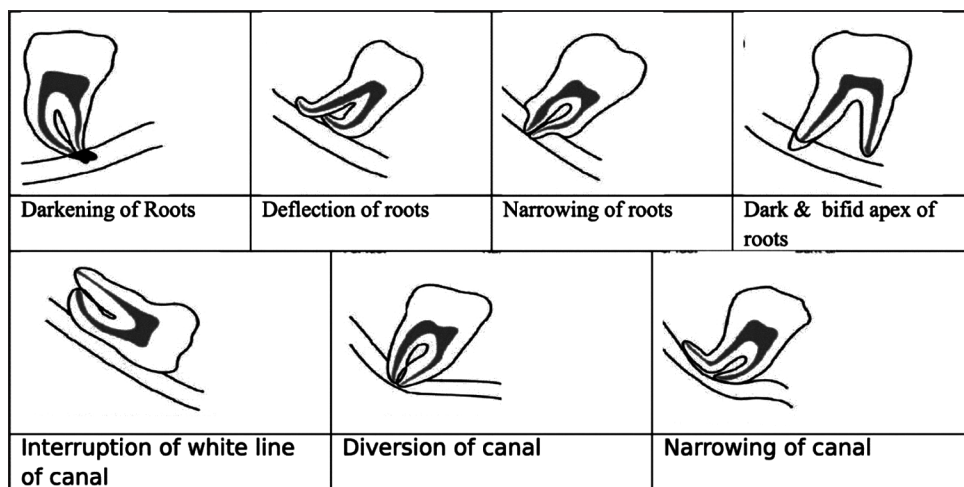
Figure 10: Classification of third molar in relation to inferior alveolar nerve

Table 10: Passi D (2018) classification of impacted mandibular third molar

Mandibular third molar	Components			
Spatial position (S) Incidence (%) and Degree (°)	Mesioangular (49%) (31°-60°)	Vertical (24%) (61°-90°	Horizontal (20%) (0°-30°)	Distoangular (5%) (91°-120°) (Transverse- 2%)
Relationship with anterior border of ramus of mandible (R)	Class I: Sufficient space is present in the dental arch to accommodate the mesiodistal diameter of the crown and it completely anterior to the anterior border of the mandibular ramus	Class II: Sufficient space is not present in the dental arch to accommodate the mesiodistal diameter of the crown. About 1/3 of is covered by ramus	Class III: Tooth is partially impacted in the ramus and more than one half is covered by the ramus	Class IV: The tooth is located completely within the mandibular ramus
Relation to the second molar and alveolar crest (M)	Position A: Occlusal surface of the impacted tooth is in level with the occlusal plane of the second molar. Tooth is completely erupted	Position B: Occlusal surface of impacted tooth is between the occlusal plane and the cervical line of the second molar. Partially impacted, but widest part of the crown is above the bone	Position C: Occlusal surface of the impacted tooth is below the cervical line of the second molar. Widest part of the crown is below the bone	Position D: Occlusal surface of the impacted tooth is below the half of the root length. Completely embedded in the bone
Degree of difficulty (D)	Easy/simple Extraction requiring forceps/elevators	Slightly difficult Extraction requiring osteotomy	Moderately difficult Requiring osteotomy and coronal section	Very difficult/complicated. Extraction (roots section)
Bucco-lingual location of third molar (lingual nerve injury risk)-L	Location B	Impacted tooth is closer to buccal wall		
	Location B-L	Impacted tooth is in the middle between lingual and buccal walls		
	Location L	Impacted tooth is closer to lingual wall		
Relation to the mandibular canal (IAN injury risk)-I	I_0	Mandibular canal runs apically/buccally/lingually with respect to the tooth but without touching it. The distance IAN/tooth is >3 mm		
	I_1	Mandibular canal runs apically/buccally/lingually touching the root		
	I_2	Root of the impacted tooth contacting or penetrating the mandibular canal		
	I_3	Mandibular canal runs between fused roots or roots surrounding the mandibular canal		
Associated pathology (P)	Type 1	No associated pathology		
	Type 2	Associated with pericoronitis, caries, pocket formation, root resorption, crowding of anterior dentition		
	Type 3	Associated with inflammatory radiographic changes like periapical granuloma, furcation involvement, osteomyelitis, space infection		
	Type 4	Associated with pathology like odontogenic cysts and tumors		
Compications (C)	1°	Persistent pain, bleeding, swelling, infection, wound dehiscence, periodontal pocket distal to second molar, trismus		
	2°	Alveolar osteitis (dry socket), damage to adjacent teeth, dentoalveolar fracture, displacement of tooth, ecchymosis of submandibular and sternum region		
	3°	Peresthesia of lingual and IAN, TM joint injury and dislocation, fracture angle of mandible		

TM: Temporomandibular, IAN: Inferior alveolar nerve

are most frequent parameters. Limitations of our study are that it was cross-sectional study without randomization. It covered only a limited region of Delhi–NCR region and also has short sample size; hence, more detailed randomized studies have to be emphasized. However, our proposed classification will benefit the young researchers to upgrade their knowledge.

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Conflicts of interest

There are no conflicts of interest.

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