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Original Research

Predictive Value of Preoperative Radiography for Inferior Alveolar Nerve Paraesthesia Following Third Molar Extraction: A Prospective Study

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Abstract

Background: Impacted teeth usually remain symptom-free, but cause various symptoms and pathologies due to pain, swelling, bone loss, distal caries, periodontitis, infections, occlusion disturbances, pericoronitis, root resorption of adjacent teeth, periapical infections, cysts and tumors. Associated complications to the surgical removal of IMTM can be divided into intra-operative and postoperative. Am of this study is to assess the predictive value of preoperative radiological assessment of mandibular third molar impactions in relation to the inferior alveolar canal and postoperative complications.

Methodology: Independent variables evaluated in this study were depth of impaction, angulation of impacted mandibular third molars and Proximity to the mandibular canal of the impacted mandibular third molar. The postoperative assessment parameters were measured after 24 hours, 3rd and 7th day after extraction of the mandibular third molar.

Results: The maximum number of patients with the complaint of impacted mandibular third molar falls in the age group of 18-30 years, with no sex predilection. The most common angulation found was mesioangular (44.3%), with Level A (57.4%). The most common warning radiographic sign on OPG, according to Rood and Shehab classification, was interruption of the white line of the canal (29.6%). The correlation was found to be highly significant (p=0.000) between radiologist and surgeon according to Paderson's scale before surgical removal of impacted third molars.

Conclusion: The pre-operative assessment of mandibular third molar impactions in relation to the inferior alveolar canal was found to be predictive in assessing the postoperative complications after extraction.

Keywords: Impacted 3rd molar, Paraesthesia, Orthopantomography, Inferior alveolar nerve

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Introduction:

Impaction is derived from the Latin word 'IMPACT', which means an organ or structure has been prevented from presuming its normal position due to an abnormal mechanical condition.[1]

Impaction varies with age, race, sex, nature of the diet, genetics, and use of the masticatory apparatus.[2] Impacted mandibular molars are found in approximately 90% of the general population, in which 33% at least one impacted mandibular third molar.[3]

Impacted tooth usually remain symptom-free, but cause various symptoms and pathologies due to pain, swelling, bone loss, distal caries, periodontitis, infections, occlusion disturbances, pericoronitis, root resorption of adjacent teeth, periapical infections, cysts and tumors.[4]

There are multiple diagnostic tools and different imaging techniques to evaluate the pre-operative assessment of the impacted mandibular third molar and its relationship with the inferior alveolar canal.[5]

The surgical removal of the mandibular third molar (wisdom tooth) is a frequent treatment and routine practice in dental offices and hospitals for therapeutic, prophylactic and orthodontic reasons.[6, 7] But sometimes the surgical procedures are associated with unfortunate events that are influenced by diversified aspects related to the patient, the surgeon, and/or the procedure performed.[2] Associated complications to the surgical removal of IMTM can be outlined into intra-operative and post-operative.

Sedaghaftar et al stated that the overall risk of permanent paraesthesia is less than 1%. So, the correct diagnosis is very important.[7]

Objective:

The aim and objective of the study were to assess the predictive value of preoperative radiological assessment of mandibular third molar impactions in relation to the inferior alveolar canal and postoperative complications.

Materials and methodology:

A Cross-sectional study was carried out on patients who underwent radiographic investigation before mandibular third molar extraction in the Department of Oral and Medicine and Radiology, as well as the Department of Oral and Maxillofacial Surgery. The study was conducted as per the Declaration of Helsinki of 1964, which was revised in 2013, with the approval of the Institutional Ethical Committee, Project No: IEC-1603 dated13-01-2022. A total of 115 patients were selected for the study, which included 59 males and 56 females with complaints like pain, decayed tooth, food lodgment in the mandibular third molar region and were evaluated for the impaction of the mandibular third molar on the respective side. Written informed consent was obtained from all patients.

Inclusion criteria: 1. Patients with clinically and radiographically impacted mandibular third molars. 2. Age group of patients above 18 years. 3. Patients undergoing extraction of the mandibular third molar.

Exclusion criteria: 1. Patient with systemic diseases 2. Fractures of the Oro-facial region. 3. Patient suffering from bleeding disorders. 4. Immuno-compromised patients. 5. Drug abusers, alcohol consumers and heavy smokers. 6. Psychological and mental disorders. 7. Patients undergone radiotherapy.

After the examination, patients were subjected to digital panoramic radiography using digitalized panoramic machine. Panoramic machine (Orthophos X G 5 DS Ceph), with tube current i.e 3-16mA,

voltage of 60-90kv with more than 2.5mm total filtration, along with Digital CCD line and aluminium sensor focus, distance of sensor is 497mm.

Independent variables evaluated in this study were depth of impaction classified according to the Pell and Gregory classification (Figure 2) [2], and angulation of impacted mandibular third molars according to Winter's classification (Figure 1) [2]. Proximity to the mandibular canal was assessed by using Rood and Shehab's (Figure 3)[12] radiographic markers that indicate a close relationship between the impacted mandibular third molar and the mandibular canal.

The degree of difficulty, according to Pederson, takes into account both the angulation of the molar and its spatial position relative to the mandibular ramus and the occlusal plane.

The post – operative assessment parameters measured after 24 hours, 3rd and 7th day post – operatively were:

Pain: with the help of the Visual Analogue Scale (VAS).

Swelling: with the help of the method given by Schultze-Mosgau et al.

Trismus: Trismus was measured by the inter–incisal distance (in cm) suggested by Ustun et al. (2003. Healing: Checked clinically as Excellent, Good, Fair or Poor

Post-operative complications (if any): such as infection, bleeding, paresthesia and dry socket, checked clinically - if Present/Absent.

Statistical Analysis:
Statistical analysis was performed using the Shapiro-Wilk test, Pearson Correlation, Kruskal-Wallis One-way Anova test and chi square testto analyze the significance of the obtained data. The significance of all tests was predetermined at a probability value of 0.05 or less.

Results:

The mean age of the patients reported with impacted mandibular third molar was 27.7±7.96 years, with the maximum number of patients reported being from the age group 18-30 years (74.78%). There was no sex predilection. The most common angulation found was mesioangular (44.3%) [Table 1], with Level A (57.4%) [Table 2]. The most common warning radiographic sign on OPG, according to Rood and Shehab classification, was interruption of the white line of the canal (29.6%) [Table 3]. The correlation was found to be highly significant (p=0.000) between radiologist and surgeon according to Paderson's scale before surgical removal of impacted third molars [Table 4]. Table 5 shows that according to *Rood and Shehab classification*, on comparing the complications (trismus, infection, bleeding, paraesthesia, dry socket) at different follow-ups after 24 hours, 3 days, and 7 days, was done. The difference was found to be statistically not significant.

Table 1: Distribution according to *Winter's classification*

Winter's classification	Frequency	Valid Percent (%)
Mesioangular	51	44.3
Horizontal	27	23.5
Vertical	21	18.3

Distoangular	16	13.9
Total	115	100.0

Table 2: Distribution according to *Pell and Gregory classification*

Pell and Gregory classification	Frequency	Valid Percent (%)
Level A	66	57.4
Level B	41	35.7
Level C	8	7.0
Total	115	100.0

Table 3: Distribution according to *Rood and Shehab classification*

Rood and Shehab classification	Frequency	Valid Percent (%)
Narrowing of the inferior alveolar canal	26	22.6
Deflection of the root	16	13.9
Narrowing of the root	6	5.2
Dark and bifid apex of the root	6	5.2
Interruption of the white line of the canal	34	29.6
Darkening of the root	14	12.2
Diversion of the inferior alveolar canal	13	11.3
Total	115	100.0

Table 4: Correlation between radiologist and surgeon according to Pederson's scale

Pearson Correlation	Radiologist	Surgeon
Sig. (2-tailed)		.000
N	115	115
Correlation is significant at the 0.01 level (2-tailed).		

Table 5: Complications observed in the *Rood and Shehab classification*

		Trismus		Infection		Bleeding		Paraesthesia		Dry socket	
		Abse	Prese	Abse	Prese	Abse	Prese	Abse	Prese	Abse	Prese
Narrow of IA (n=2	24	21 (23	5 (2(	25 (21	1 (10	24 (23	2 (14.	24 (21	2 (40	26 (22	0 ((
	3	25 (22	1 (2(	25 (21	1 (10	26 (22	0 (0'	25 (23	1 (16.	26 (22	0 ((
	7	26 (22	0 (0	26 (22	0 (0	26 (22	0 (0'	26 (23	0 (0'	25 (24	1 (7.
Defl Roo (n=1	24	13 (14	3 (1(	16 (1-	0 (0	14 (13	2 (14.	14 (13	1 (20	16 (13	0 ((
	3	16 (14	0 (0	16 (1-	0 (0	16 (13	0 (0'	14 (17	2 (33.	16 (13	0 ((
	7	15 (13	1 (10	16 (13	0 (0	16 (13	0 (0'	16 (14	0 (0'	16 (14	0 (7.

Narro Roo (n=6	24	5 (5.(	1 (4	6 (5.3	0 (0	6 (5.9	0 (0	6 (5.5	0 (0	6 (5.2	0 ((
	3	6 (5.5	0 (0	6 (5.3	0 (0	6 (5.2	0 (0	6 (4.8	0 (0	6 (5.2	0 ((
	7	6 (5.3	0 (0	6 (5.2	0 (0	6 (5.2	0 (0	6 (5.5	0 (0	6 (5.9	0 ((
dark & Bifi Roo (n=6	24	6 (6.7	0 (0	6 (5.3	0 (0	6 (5.9	0 (0	6 (5.5	0 (0	6 (5.2	0 ((
	3	6 (5.5	0 (0	6 (5.3	0 (0	6 (5.2	0 (0	5 (6.3	1 (16.	6 (5.2	0 ((
	7	6 (5.3	0 (0	6 (5.2	0 (0	6 (5.2	0 (0	6 (5.5	0 (0	5 (4.9	1 (7.
Interup Of W of car (n=3	24	27 (3	7 (2	34 (29	0 (0	28 (27	6 (42.	33 (3	1 (20	34 (29	0 ((
	3	31 (28	3 (6	34 (29	0 (0	34 (29	0 (0	33 (28	1 (16.	34 (29	0 ((
	7	34 (29	0 (0	34 (29	0 (0	34 (29	0 (0	34 (31	0 (0	29 (28	5 (38
Dark Roo (n=1	24	9 (10	5 (2	14 (12	0 (0	12 (11	2 (14.	13 (11	1 (20	14 (12	0 ((
	3	13 (11	1 (2	14 (12	0 (0	14 (12	0 (0	13 (11	1 (16.	14 (12	0 ((
	7	14 (12	0 (0	14 (12	0 (0	14 (12	0 (0	11 (10	3 (50	10 (9.	4 (30
Div Of IAC (n=1	24	9 (10	4 (1	13 (11	0 (0	11 (10	2 (14.	13 (10	0 (0	13 (11	0 ((
	3	13 (11	0 (0	13 (11	0 (0	13 (11	0 (0	13 (7.	0 (0	13 (11	0 ((
	7	13 (11	0 (0	13 (11	0 (0	13 (11	0 (0	10 (9.	3 (50	12 (11	1 (7.

Discussion:

An impacted tooth is a tooth in the jaw with complete development and a fully formed root that is covered partially or completely by soft and/or hard tissues, beyond its physiological period of eruption. [27, 28] The reason behind the impaction of third molars is that it follows an abortive eruption path.[6]

Nakagawa Y. et al stated that 74% of patients with impacted mandibular third molars ranged between the age from 20 to 39 years.[15] In this current study, patients with impacted third molars ranged between 18-30 years, which is in accordance with studies conducted by Ryalat S. et al. [30]

Ryalat S. et al exclaimed that angulation of the third molar significantly changed between different age groups, but with no constant pattern. [30]

In the current study, no significant difference was observed regarding the gender of the patient with impacted mandibular third molar, which was in agreement with Padhye M.N. et al [21], and Al-Dajani M. et al also stated that sex should not be considered as a criterion to determine the incidence of impaction. [29]

Msagati F et al observed a higher frequency in females compared to males as a result of differences between growth patterns among them. As the growth of the jaws in males continues over the eruption time of third molars, which creates more space for the eruption of third molars, whereas in females, growth stops when third molars start to erupt. [4]

The most persistent reason for surgical removal of third molars is either dental caries (38.53%) itself or adjacent second molar or pericoronitis(29.36%). [27] The most essential preoperative diagnostic tool in dentistry is panoramic radiography. [20]

The most common type of angulation according to Winter's classification found was mesioangular impaction, which is in agreement with Passi D et al [1], who observed in 49.2% patients, Sandhu S et al [13], Gupta S et al[18], Hashemipour M A et al [22], Zaman M et al [26]. Males show mesioangular

angulation (33%) while females show vertical angulation(55.9%). [21] One theory explains the effect of an inclined plane due to the angle of contact between the third and second molars in the mandible. [10] On the contrary, Horizontal angulation (in 33 patients) was the most common type of angulation observed by Yilmaz S et al. [6]

The most common level of impaction of third molar according to Pell and Gregory classification is Level A which is in agreement with Hashemipour M A et al [22], Zaman M et al [26], Jaron A et al [27] On contrary, Level B was most common level of impaction observed by Passi D et al [1], Padhye m et al [21]. Level C was the most common level of impaction observed by Alfadil L et al [25]

The most common warning radiographic sign observed in this present study, according to Rood and Shehab classification, is Interruption of the white line of the inferior alveolar canal, which is in agreement with Nagaraj M., who observed a closer approximation between the mandibular canal and impacted mandibular third molar in 50% of cases. [17] Tantanapornkul et al reported that the only most significant sign was interruption of the inferior canal wall. [14] Nakagawa Y showed the absence of the white line on the OPG in 85.7% cases. [16] On the contrary, Valmaseda Castellon et al believed that the most significant sign was deflection of the mandibular canal. [12] Leung et al claimed that only 2 warning signs that are darkening of root and displacement of the inferior alveolar canal should be considered significant. [19]

In planning the surgical removal of impacted 3rd molars, preoperative assessment of the degree of surgical difficulty is fundamental. To evaluate the difficulty, the Pederson scale is widely accepted by dental surgeons. [11]

In the literature, 6.9% - 30.6% cases have been reported with complications after the extraction of the mandibular third molar. [24] The various complications are pain, trismus, surgical oedema, post-operative infections, alveolar osteitis, bleeding, damage to adjacent tooth, nerve injury, mandibular fracture and many more. [29] The rationale behind the increased complications observed in the older age group[>36 years] is the hardness and brittleness of bone, complete formation of roots of the mandibular third molar and the degree of surgical difficulty. [24]

Several investigators have already illustrated that the concurrent presence of a combination of two or more signs on the OPG can result in an increased risk of injury to the inferior alveolar nerve. [8]

The complications reach a maximum level after 2-3 days postoperatively but resolve by 7 days. [29] Post–operative pain of different degrees was one of the main complaints. Pain was either due to some infection or dry socket. In the current study, no statistically significant difference was observed [p=0.595]

After 1or 2 days of surgery, sometimes swelling is accompanied by trismus.[4] This occurs secondary to medial pterygoid muscle inflammation. [29]

Sweet & Butler found that females are more prone to dry socket (alveolar osteitis). Accompanying signs are blood clot disintegration and a necrotic layer covering the extraction site. [29]

Another complication is bleeding after surgery, which ranges from 1-6% in third molar surgery and is more common in old age due to vascular fragility, and the coagulation mechanism is less effective. [29]

Conclusion:

Extraction of the totally impacted third molar inevitably causes postoperative pain and discomfort. The pre-operative assessment of mandibular third molar impactions in relation to the inferior alveolar canal was found to be predictive in assessing the post-operative complications after extraction.

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