Original Article

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Dentistry Section

Significance of Radiological Variables Studied on Orthopantamogram to Predict Post-Operative Inferior Alveolar Nerve Paresthesia after Third Molar Extraction

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ABSTRACT

Context: Removal of impacted third molar is a procedure that is often associated with post-operative complications. The rate of complications is somewhat high because of its proximity to the vital structures. Inferior alveolar nerve paresthesia is one of the common complications of impacted their molar surgery. This is due to intimate relationship between roots of mandibular third molar and inferior alveolar canal. To access the proximity of inferior alveolar canal to third molar many diagnostic methods are suggested but in conventional radiography orthopantamogram is considered as the best. There are many findings on-orthopantamogram that are suggestive of close proximity of nerve to the canal. In this study authors reviewed seven radiographic findings related to proximity of roots to the inferior alveolar nerve as seen on orthopantamogram and try to find a relationship between these radiographic variables and presence of post-operative paresthesia.

Study Design: The study containd 100 impacted third molars need to be removed. Presence of radiographic findings on orthopantamogram were noted and analyzed, to find a relationship with occurrence of post-operative inferior alveolar nerve paresthesia.

Materials and Methods: This study comprises of 100 impacted third molar teeth indicated for extraction. Cases were randomly selected from the patients, needs to undergo extraction of impacted mandibular third molar. After extraction cases were evaluated for occurrence of inferior alveolar nerve paresthesia.

Stastical Analyisis: Data was transferred to SPss 21 software for frequency calculation, and two tailed p-values were obtained betweens these variables and post-operative paresthesia, by applying Fischer's exact test (GRAPH PAD SOFTWARE).

Results: Out of seven, four radiological findings that are grooving of roots, hooked roots, bifid roots and obliteration of white line are significantly related to post-operative paresthesia while bending of canal, narrow canal and darkening of tooth roots over the canal are not significantly associated with post-operative morbidity of facial nerve.

Keywords: Impacted, OPG, Dilacerations, Roots, Obliteration

INTRODUCTION

Removal of mandibular impacted third molars are routine surgical procedure performed by maxillofacial surgeons in dental clinics as well as hospital setups. As all surgical procedures, removal of mandibular third molars are also associated with some complications [1], inferior alveolar nerve injury is one of the less common complication and it also involves some important medico legal issues [2]. The reported frequency of inferior alveolar nerve injury associated with M3 removal ranges from 0.6% to 5.3% but the risk of permanent IAN injury is less than 1% [3-7].

To prevent complications a useful diagnostic tool is needed that can determine the relationship between inferior alveolar nerve and third molar. Panoramic radiography is suggested as the technique of choice to evaluate impacted third molars as well as to estimate the pre-operative risk for inferior alveolar nerve injury associated with third molar surgery [8]. Smith AC et al., [9] also described panoramic radiography as optimal method for radiological assessment for mandibular third molar teeth prior to their removal. Cone Beam Computed Tomography (CBCT), Denta Scane, computed tomography are some other diagnostic modalities also available to locate inferior alveolar nerve and canal, but availability in small towns and cost factor also play an important role to make a choice. In modern dental practice both digital and manual panoramic radiograph machines are easily available even in small towns. Apart from conventional intra oral periapical radiographs, orthopantamogram gives better view to the operator for accessing additional features like mandibular height, relation between second and third molar, and better view of density of bone. Magnification of images could be a issue of interest in conventional orthopantamogram but it does not affect the presence of radiological variables as described in this study. Digital orthopantamogram is another option however some authors reported that there is no significant difference between accuracy of digital and conventional orthopantamogram for predicting inferior alveolar nerve paresthesia [10].

There are many radiological variables seen on orthopantamogram to assess the proximity of inferior alveolar nerve to the roots of third molars but among all findings these seven radiological variables described by research workers are of important value [11].

1. Darkening of roots where it crosses inferior alveolar canal.
2. Deflected or hooked roots around inferior alveolar canal.
3. Narrowing of roots due to grooving by the nerve.
4. Interruption or obliteration of either of white cortical lines of inferior alveolar canal.
5. Bifid root apex representing intimacy of the apical periodontal membrane.
6. Diversion or bending of root canal in the region of root apices.
7. Narrowing of inferior alveolar canal.

Of these seven radiographic findings Rood And Nooraldeen Shehab [8] identified three radiological variables (no.1, no.4 and no.6) significantly associated with inferior nerve injury. In a similar study Michel Sedaghatfar, Meredith A. August [12] found that four

radiological variables (no.1, no.3, no.4, no.6) are important variable to predict injury to IAN while removing third molar. The purpose of this study was to measure the association between radiographic findings noted on panoramic imaging and occurrence of post-operative inferior alveolar nerve parasthesia.

PATIENTS AND METHODS

The study comprise of 100 patients, randomly selected from the patients reported to the Dental OPD of Sri Ram Murti Smarak Medical college, India from March 2010 to June 2013 for the extraction of at least one impacted mandibular third molar. Patients included in this study were medically fit and with a valid reason for extraction of mandibular third molar. Patient with both mandibular third molar to be removed, considered as two cases and were separately assessed Patients with chronic systemic neurological disease, patient under psychiatric treatment and patients with severe local infection were not included in the study. Before extraction all patients were asymptomatic or made asymptomatic by the use of standard antibiotic and analgesics protocol. Surgical procedure was performed by the same surgeon under inferior alveolar and long buccal nerve block by using 1.8 ml 2% lignocain with 1;200000 adrenalin added to it. All extractions were done by open method and wound was closed by 3'0 silk suture. All patients were recalled after one day to evaluate inferior alveolar nerve injury by pin prick method. Cases were defined as patients with documented IAN injury, manifested by complaints of persistent sensory deficit or dysesthesia after third molar removal. Controls were defined as patient who had third molar extracted but with no post-operative sensation related complaints. Both cases and controls were examined one day after the procedure for neurosensory functions. The case and controls were randomly selected from the population of patients and operated by same oral surgeon.

RESULTS

The study incorporated a total number of 100 impacted teeth needs to be operated. A total of 29 female and 71 males were included in the study with the mean age of 29.7 years. Individuals were screened on the basis of seven variables on the orthopantamogram. These seven variables are Darkening of roots (n=32), Bifid root apex (n=14), Narrowing of root canal (n = 39), Bending of canal (n=18), grooving of roots (n=18), Hooked roots (n=35), Obliteration of white line (n=67) [Table/Fig-1]. Total cases reported with post-operative parasthesia were (n=8). After statistical analysis significant relationship were found between post-operative parasthesia and Hooked Roots (p=.0025), Bifid root Apex (p=.0126), Grooving of roots (p=.0003) and obliteration of white line (p=.0498) however Bending of canal(p=.6323) Narrowing of Canal (p=0.0533) and Darkening of roots(p=1.000) showed no statistically significant relationship with occurring of post-operative paresthesia.

S. NO.	Variables	Number of Cases with Presence of Positive Finding	Number of Cases with Absence of Positive Finding	Post-Operative Paresthesia n=8)	p-Value Fisher's exact test
1	Grooving of Canal	18	82	6	0.0003
2	Hooked Roots	35	65	7	0.0025
3	Bifid Roots	14	86	4	0.0126
4	Obliteration of White Line	67	33	8	0.0498
5	Bending of Canal	18	82	2	0.6323
6	Narrowing of Canal	39	61	6	0.0533
7	Darkening of Tooth Roots	32	68	2	1.0000

[Table/Fig-1]: Showing level of significance of each radiographic finding with development of post operative paresthesia

DISCUSSION

Extraction of mandibular third molar is often associated with the post-operative events like post-operative infections, trismus, paresthesia , dry socket etc [1]. Earlier studies showed that post-operative nerve paresthesia is third most common complication after alveolar osteitis and pre operative infections with an approximate incidence of .057% to 5.3% [7]. Radiographs are the most common diagnostic tool to predict the difficulty of extraction of tooth and to assess the mode of extraction [13]. Risk of inferior alveolar nerve injury is associated with anatomic relationship between nerve and the tooth; Smith AC et al.,[9] determined in their study that panoramic radiography is the slandered radiological examination to evaluate the anatomic relationship of third molar and inferior alveolar nerve. Guerrero ME et al., [14,15] found that even cone beam computed tomography was not superior to panoramic radiography in predicting post-operative sensory disturbances. Szalma J, et al., [10] in their study concluded that there is no significant advantage of digital panoramic radiography over conventional one. In the literature many radiological variables are described to describe relationship of canal to the roots of mandibular third molar. In this study we took all seven radiological variables and find their relevancy in terms of post-operative parasthesia.

This study described, out of seven radiological findings related to roots of mandibular third molar and inferior alveolar canal, four radiological variables, grooving of roots, hooked roots, bifid roots and obliteration of white line, are significantly related to development of inferior alveolar nerve paresthesia, after removing the impacted mandibular third molar, while three radiological variables, bending of canal, narrowing of canal and darkening of tooth roots over the canal are not significantly associated, with development of post-operative complication related to inferior alveolar nerve.

Grooving of roots is found to be most significant variable associated with post-operative paresthesia in this study. The reason behind, maybe due to the intimate relationship of canal and growing mandible with the developing tooth in teen age causing pressure on the roots that results into grooving of canal. In some individuals this intimate relation of tooth and canal continues resulting in trauma to the inferior alveolar nerve during extraction of impacted third molar.

The second most significant association in our study is hooked roots. Deflected or hooked roots were also considered as risk factor by Kim Jw [16]. Hooked roots are difficult to extract and much bone cutting required for extraction of these teeth more bone cutting and may cause trauma to inferior alveolar nerve which can lead to post-operative paresthesia.

Obliteration of white line and bifid roots are also found to be significantly associated with post-operative paresthesia of inferior alveolar nerve. This shows that presence of these variables denotes proximity of inferior alveolar canal to the tooth roots. Obliteration of white line as a valuable prediction factor of post-operative paresthesia was showed in the study of Blaeser [11], While Kim Jw [16] favors bifid apex as much significant finding.

However in the study bending of canal ,narrowing of canal and darkening of roots showed a relationship that is less than significant this is in contrast of study of many authors [16,11,17]. The opinion of authors for less significant variables was that the bending and narrowing of canal results due to differential growth of developing mandible and emerging tooth. Due to these differential forces canal may be bended or narrowed this do not prove anyways the approximation of canal to the inferior alveolar nerve. Impacted teeth that are easy to extract may have bended or narrowed canal and in many cases studied, author found that, there were significant distance between inferior alveolar nerve and roots of third molar even when the canals were bended or narrowed. Dark band across the roots may be due to buccal or lingual position of

canal so in three dimensional view there may be a considerable distance between canal and tooth roots buccally or lingually so according to authors orthopantamogram being a two dimensional study could not predict the actual position of canal if it was shown as dark band and thus it is not found significantly associated with post-operative paresthesia.

This study establish orthopantamogram as an important primary diagnostic tool to predict development of post-operative parasthesia. It is a less biased diagnostic tool than IOPAR because head position is fixed and less chances of presence of operator bias. Presence or absence of these specific findings on OPG provides some very informative data to predict the relationship of inferior alveolar canal to the roots of mandibular third molars. But on the other side orthopantamogram only provides two dimensional data so actual distance of nerve to the roots of third molar could not be calculated that is also suggested by Hasegawa T et al., [18] in his study, when the panoramic image is suggestive of a close relationship between the impacted tooth and the inferior alveolar nerve computed tomography should be recommended as a means of conducting further investigations.

CONCLUSION

This study suggested orthopantamogram as an important diagnostic tool in conventional radiography. Radiographic findings related to mandibular third molar and inferior alveolar canal such as grooving of roots, hooked roots, bifid roots and obliteration of white line could have significant predictive value in predicting inferior alveolar nerve paresthesia after extraction of mandibular third molar. But if there is any dilemma in diagnosis one can choose higher investigation of his choice.

REFERENCES

[1] Bouloux GF, Steed MB, Perciaccante VJ. Complications of third molar surgery. *Oral Maxillofac Surg Clin North Am*. 2007;19(1):117-28,

[2] Ruga E,Gallesio C, Boffano P. Mandibular alveolar neurovascular bundle injury associated with impacted third molar surgery. *J Craniofacial Surgery*. 2010;21(4):1175-7.

[3] G.L. Howe and H.G. Poyton. Prevention of damage to the inferior alveolar nerve during extraction of mandibular third molars. *Br Dent J*. 1960;(109):355.

[4] DA Hochwald, WH Davis and JM Mortinoff.; Modified distolingual splitting technique for removal of impacted mandibular third molars Incidence of postoperative sequelae. *Oral Surg Oral Med Oral Pathol*. 1983;(56): 9.

[5] CC Alling, Dysesthesia of the lingual and inferior alveolar nerves following third molar surgery, *J Oral Maxillofacial Surg*. 1986; (44):454.

[6] DT Wofford and RI Miller, Prospective study of dysesthesia following odontectomy of impacted mandibular third molars, *J Oral Maxillofacial Surg*. 1987;(45):15.

[7] RA Bruce, GC Frederickson and GS Small. Age of patients and morbidity associated with mandibular third molar surgery. *J Am Dent Assoc*. 1980;(101): 240.

[8] Rood JP, Nooraldeen Shehab BAA: The radiological prediction of inferior alveolar nerve injury during third molar surgery. *Br J Oral Maxillofac Surg*.1990; 28:20.

[9] Smith AC, Barry SE, Chiong AY, et al. Inferior alveolar nerve damage following removal of mandibular third molar teeth. A prospective study using panoramic radiography. *Aust Dent*. 1997 42:149.

[10] Szalma J, Lempel E, Jeges S, Olasz L. Darkening of third molar roots: panoramic radiographic associations with inferior alveolar nerve exposure. *J Oral Maxillofac Surg*. 2011;69(6):1544-9.

[11] Blaeser BF, August MA, Donoff RB, Kaban LB, Dodson TB. Panoramic radiographic risk factors for inferior alveolar nerve injury after third molar extraction. *J Oral Maxillofac Surg*. 2003;61(4):417-21.

[12] Michael Sedaghatfar BS, Meredith A. August DMD, and Thomas B. Dodson, MPH Panoramic radiographic findings as predictors of inferior alveolar nerve exposure following third molar extraction. *Journal of Oral and Maxillofacial Surgery*. 2005;63(1): 3-7.

[13] CS Miller, PV Nummikoski and DA Barnett, et al. Cross-sectional tomography. A diagnostic technique for determining the bucco-lingual relationship of impacted mandibular third molars and the inferior alveolar neurovascular bundle. *Oral Surg Oral Med Oral Pathol*. 1990;(70): 791.

[14] Guerrero ME, Nackaerts O, Beinsberger J, Horner K, Schoenaers J, Jacobs R. Inferior alveolar nerve sensory disturbance after impacted mandibular third molar evaluation using cone beam computed tomography and panoramic radiography: a pilot study. *J Oral Maxillofac Surg*. 2012;70(10):2264-70.

[15] Guerrero ME, Botetano R, Beltran J, Horner K, Jacobs R. Can preoperative imaging help to predict postoperative outcome after wisdom tooth removal? A randomized controlled trial using panoramic radiography versus cone-beam CT. *Clin Oral Investig*. 2014;18(1):335-42.

[16] Kim JW, Cha IH, Kim SJ, Kim MR. Which risk factors are associated with neurosensory deficits of inferior alveolar nerve after mandibular third molar extraction? *J Oral Maxillofac Surg*. 2012;70(11):2508-14.

[17] Leung YY, Cheung LK. Correlation of radiographic signs, inferior dental nerve exposure, and deficit in third molar surgery. *J Oral Maxillofac Surg*. 2011;69(7):1873-9.

[18] Hasegawa T, Ri S, Shigeta T, Akashi M, Imai Y, Kakei Y, et al. Risk factors associated with inferior alveolar nerve injury after extraction of the mandibular third molar--a comparative study of preoperative images by panoramic radiography and computed tomography. *Int J Oral Maxillofac Surg*. 2013;42(7):843-51.

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