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ASSESSMENT OF RELATIONSHIP OF MANDIBULAR THIRD MOLAR ROOT TO INFERIOR ALVEOLAR NERVE CANAL USING PHOTOSTIMULABLE PHOSPHOR PLATE

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ABSTRACT:

The extraction of impacted mandibular third molars has long been associated with the dreaded and rarely, grave and irreversible complications. The oral and maxillofacial surgeons' dogma strongly links most complications with the proximity of inferior alveolar canal and the impacted teeth, the relationship of which is still a topic of debate among surgeons. In this randomized, prospective case study, involving 114 patients, we have attempted to evaluate the relationship between impacted mandibular third molar root and the inferior alveolar canal with intra oral periapical radiographs using photostimulable phosphor plates and the incidence of inferior alveolar nerve injury following removal of impacted mandibular third molar. Preoperative assessment based on Rood and Shehab Criteria revealed 38.6% cases with an interruption of white line, 25.4% had darkening of root and 11.4% cases with diversion of the canal and 7% of cases revealed an inferior alveolar nerve deficit corresponding with the radiographic signs of "darkening of the third molar root" and "interruption of white line" by the third molar root. In comparison with the other imaging modalities Photo Stimulable Phosphor plate consumes less time with higher image resolution and magnification to gain better knowledge of the inferior alveolar canal and root relationship

Key words: Impaction - Mandibular molar- Photostimulable plate – radiographic signs - Inferior alveolar nerve

INTRODUCTION:

Impacted teeth can be defined as those teeth that are prevented from reaching its normal eruption by adjacent tooth, overlying bone, or soft tissue, or other impediments. The impacted mandibular third molar removal is the most common surgical procedure in oral and maxillofacial surgery and it is widely acknowledged to be useful due to its prevention of future problems. [3] The major complications associated with the surgical removal are the neurosensory deficits post-operatively with an incidence of 0.26 to 8.4 % of inferior alveolar nerve. [2,16] The degree and the incidence of nerve injury is multi-factorial which includes surgeon's experience, age and sex of the patient and most importantly the anatomical relationship between the mandibular

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canal and impacted mandibular third molar root. According to Rood and Shehab[36] there are seven radio graphical signs which suggest a close relationship between mandibular third molar and inferior alveolar canal, four of these signs are seen in the root of the tooth and three signs are seen on the inferior alveolar canal.

For precise identification of the proximity of mandibular canal and third molar root pre-operatively and to avoid complications and upgrade the surgical planning , various intra oral and extra oral radiographs like Orthopantomogram (OPG), intraoral periapical radiograph (IOPA), computed tomography (CT), cone beam computer tomography (CBCT), Photo Stimulable Phosphor plate (PSP) images are available, with Photo Stimulable Phosphor plates being latest technology incorporated by oral and maxillofacial surgeons worldwide. [3,9]

The purpose of this study is to evaluate the relationship between mandibular third molars and the inferior alveolar canal with intra oral periapical radiographs using a photostimulable phosphor plate and the incidence of inferior alveolar nerve injury following removal of impacted mandibular third molar

MATERIALS AND METHODS:

114 patients, who reported to the department of Oral and Maxillofacial Surgery, Meenakshi Ammal Dental College, for the Transalveolar extraction of impacted mandibular third molars, were selected for this study based on the inclusion criteria of presence of one or two Rood and Shehab Criteria. An Impacted mandibular third molar with periapical infection and cysts, no involvement of third molar root to inferior alveolar canal or radiographs with more than two radiographic signs were excluded. Radiographs of included patients were taken using Photostimulable Phosphor plate (fig I, II, III) IOPAR with paralleling cone technique and assessed for Rood and Shehab criteria.

Preoperative assessment: The details of the patients and third molar status were recorded according to a standardized protocol, including age and gender, impaction pattern, and the presence of 1 or more of the 7 radiographic signs listed below (fig IV).

A) Darkening of the root

B) Deflected root

C) Narrowing of the root

D) Dark and bifid root

E) Interruption of the white line

F) Diversion of the inferior alveolar canal

G) Narrowing of the inferior alveolar canal.

A Standard operative technique for transalveolar extraction of mandibular third molar was performed.

Postoperative assessment: All the patients were examined post operatively

on the 7th day at the time of suture removal for the presence of any injury to the inferior alveolar nerve. The patients were questioned on paresthesia /anesthesia in the operated side of the lip and chin region. Neurosensory tests like static light touch (fig V), two point discrimination test (figVI) and pin prick test (fig VII) were performed for confirmation. Patients with neurosensory changes were followed up for a period of 6 months. If recovery was not complete after 6 months, the injury was considered permanent or delayed.

RESULTS:

114 patients (68 (59.6 %) male and 46 (40.35%) female) who reported to Meenakshi Ammal Dental College, Department of Oral and Maxillofacial Surgery with an age range of 18-35 years were included in the study (Fig- VIII). (TABLE – 1) Out of the 114 cases 44 (38.6%) cases presented with interruption of white line as radiographic marker. 29 (25.4%) had darkening of root, 13 (11.4%) cases presented with diversion of the canal, 7 (6.1%) cases presented with narrowing of the canal, 5 (4.4%) cases had Diversion of root, 4 (3.5%) cases presented with dark bifid apex, 3 (2.6%) cases had narrowing of root and 9 patients (7.9%) had 2 radiographic signs- darkening of the root and interruption of the white line (fig-IX).

The radiographic signs “darkening of the third molar root” and “interruption of white line by the third molar root” had an inferior alveolar nerve deficit in 4 (3.5%) and 3 (2.6%) cases respectively after impaction surgery and showed statistically significant P value (TABLE 3). Out of the 4 cases with darkening of root, 1 case (0.87%) had an inferior alveolar defect for a period of more than 6 months and the rest 3 cases (2.63%) had a temporary nerve deficit and recovered within a period of 3 months. All the 3 cases seen with interruption of the white line with temporary nerve deficit recovered within a period of 3 months.

Out of the 9 radiographs with 2 radiographical signs 1 case (0.87%) had a neurosensory deficit, which was temporary (TABLE 2). Out of the 114 cases, 8 cases revealed an inferior alveolar nerve deficit, of which 7 cases showed grade 1 nerve injury (neuropraxia), while the 1 case showed grade III nerve injury (axonotmesis) (fig-X). Pinprick test with two point discrimination of the lower lip were negative in these patients with absence of response to light touch.

DISCUSSION:

Photo-Stimulable Phosphor (PSP) imaging is a digital technique for intra-oral radiography, which commercially came into use in the late 1980s. Although many studies have assessed extra-oral radiographic methods for assessment of mandibular third molars before removal, no study seems to have analyzed the use of digital intraoral radiography [15], which makes this study the first of its kind. In addition, the intraoral image is sharper than the panoramic image which is used by many

oral surgeons, and even though the focal trough is relatively wide in the molar regions of the panoramic image, the roots of the mandibular third molar may be blurred if beyond the layer of sharpness. [16]

In our study the incidence of darkening of root was seen in 25.4 % cases, whereas interruption of white line was seen in 38.6 % cases with the total population of 114 patients, when compared to the incidence of 6.04 % & 4.61 % with 800 patients seen by Rood et al.

Catellon et al in their prospective study tried to determine the incidence of inferior alveolar nerve (IAN) damage after surgical removal of lower third molars, identify causes, and to construct a predictive model to assess the risk of inferior alveolar nerve injury and concluded that Patient age, ostectomy of the bone distal to the third molar, the radiologic relationship between the roots of the third molar and the mandibular canal, and deflection of the mandibular canal increased the risk of inferior alveolar nerve damage. Older patients were at a higher risk of suffering permanent injuries.

Carrio et al in a literature review of preoperative radiographic signs in orthopantomography (OPG) and computed tomography (CT) related to the risk of inferior alveolar nerve damage during the surgical extraction of lower third molar,found that radiographic signs in the OPG that indicate a close proximity between the lower third molar and the inferior alveolar canal are considered a risk factor for nerve damage. These signs were depicted as darkening and the deflection of the root, and diversion and interruption in the white line of the canal. In the majority of reviewing studies, the routine use of computed tomography is not justified, and is only recommended when radiographic signs appear in the orthopantomography that demonstrate a direct anatomical relationship between the lower third molar and the canal. In the computed tomography, the absence of cortical bone in the canal implies a contact between the root of the lower third molar and the canal, and is related to the presence of some radiographic signs in the orthopantomography. Some studies demonstrate that despite the absence of cortical bone, the risk of lesion or exposure of the nerve during the extraction of lower third molar was low.

In our study, out of the 114 patients, 5 patients complained paresthesia of lower lip on the operated side and 3 patients had paresthesia on the skin of the mental region at the time of suture removal.

These nerve injuries were assessed using neurological tests, which can be divided into 2 basic categories mechanoceptive and nociceptive testing based on the specific receptors stimulated through cutaneous contact. Mechanoceptive testing can be further divided into Two-point discrimination test (TPD), static light touch test and brush directional

stroke test. Nociceptive testing is subdivided into pinprick test and thermal discrimination test.

In our study, we have used two-point discrimination test, static light touch test and pin prick test for patients with signs of inferior alveolar nerve deficit, according to the protocol given by A. R. Loescher and K. G. Smith. Patients who participated in the study were unable to discriminate between two points on the operated side initially till the third month postoperatively.

A classification of neurological injuries based on mechanism of injury has been described by Sunderland.[35] These include compression injury (neuropraxia), severe compression, stretch injury (axonotmesis), complete section of a nerve trunk (neurotmesis), and other injuries (perineural inflammation). The damaged nerve will react by going through stages of Wallerian degeneration and an attempt of axon regeneration, but the altered sensation is likely to remain permanent if there is no change after one to two years. In contrast, some authors claim that persistently symptomatic patients are classified as having a permanent nerve injury if there has been no change after 3 months[1].The Permanent altered sensation is more likely to occur where the nerve was severed (neurotmesis) or crushed as a result of sectioning with a rotary instrument or crushing of the nerve as a result of displacement of root tips into the inferior alveolar canal [35]. According to Robert et al [5] inferior alveolar nerve injury was found in 4 out of 1000 patients, in our study, we had a nerve injury in 8 patients out of 114 patients, which was higher compared to Robert et al study. Out of the 8 patients, 7 patients had neuroprexia and 1 case had axontmesis, none of the patients had neurotmesis as per Sunderland classification. And according to Seddon classification, it was grade 1 injury in 7 patients and grade III injury in 1 patient.

The patients who had neurosensory deficit were managed medically with capsule Renerve plus once daily for 3 weeks and reviewed periodically for sensory changes, which was done in accordance with Gintaraset al [14] Of the 8 cases which showed a sensory nerve deficit, 7 cases showed a complete recovery at the end of 3 months, whereas 1 case had a prolonged prophesy for a period of more than 6 months.

CONCLUSION:

This is a pioneering study done using Photo-Stimulable Phosphor plate periapical radiograph to evaluate the relationship between impacted mandibular third molar root apex to the inferior alveolar canal. Significant statistical and clinical co- relation was observed between radiographic signs like darkening of root, interruption of white line and nerve injury. 7.01 % of inferior alveolar nerve injury present in our study are similar to the previous studies done using conventional intra oral periapical radiograph, orthopantomogram (OPG), cone beam

computer tomography (CBCT) and computer tomography (CT). In comparison with the other imaging modalities Photo-Stimulable Phosphor plates are cost effective and less time consuming. It revealed higher image resolution and magnification which helped us to gain better knowledge of the inferior alveolar canal and root relation enabling us to carry out the surgical procedure with greater safety.

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TABLES:

TABLE -1:Incidence of seven radio graphical signs

RADIOGRAPHIC SIGNS	SIGN APPEARENCE	PERCENT OF POPULATION (TOTAL 114 CASES)
Darkening of root	29	25.4
Interruption of white line	44	38.6
Diversion of canal	13	11.4
Narrowing of canal	7	6.1
Diversion of root	5	4.4
Dark & bifid apex	4	3.5
Narrowing of root	3	2.6
Darkening & interruption of line	9	7.9

TABLE - 2: Incidence of paresthesia seen

RADIOGRAPHIC SIGN	PARESTHESIA SEEN	PERCENT OF POPULATION (TOTAL 114CASES)
Darkening of root	4	3.5
Interruption of white line	3	2.63
Diversion of canal	0	NA
Narrowing of canal	0	NA
Diversion of root	0	NA
Dark & bifid apex	0	NA
Narrowing of root	0	NA
Darkening of root & interruption of white line	1	0.87

TABLE - 3:

Darkening of root	Interruption of whiteline	Darkening&Interruption of white line
15.207[a] 1 .000	32.818[b] 1 .000	5.444[a] 1 .020

FIGURES:

fig I : Photostimulable plate

fig II: Photostimulable cover

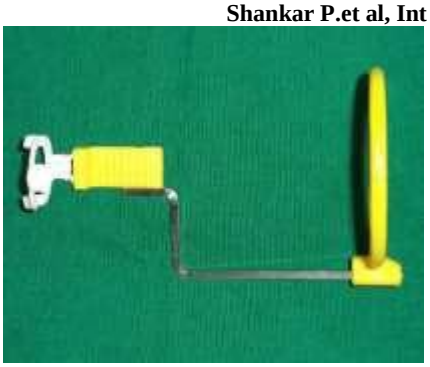

fig III: Photostimulable plate holder

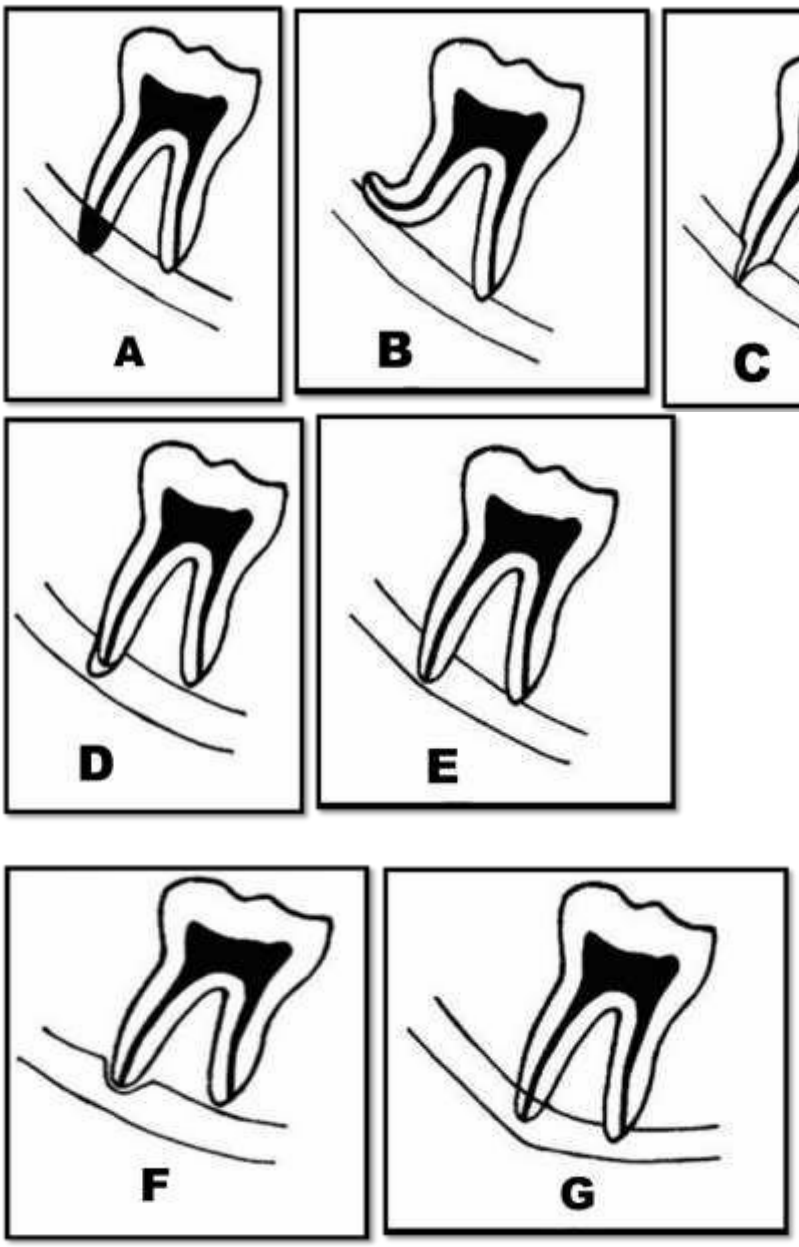

fig IV:

A) Darkening of the root B) Deflected root C) Narrowing of the root D) Dark and Bifid root E) Interruption of the white line F) Diversion of the inferior alveolar canal G) Narrowing of the inferior alveolar canal

fig V: Light Touch Assessment (lt)

fig VII: Pinprick Test (pp)

fig VI: Two - Point Discrimination test (tpd)

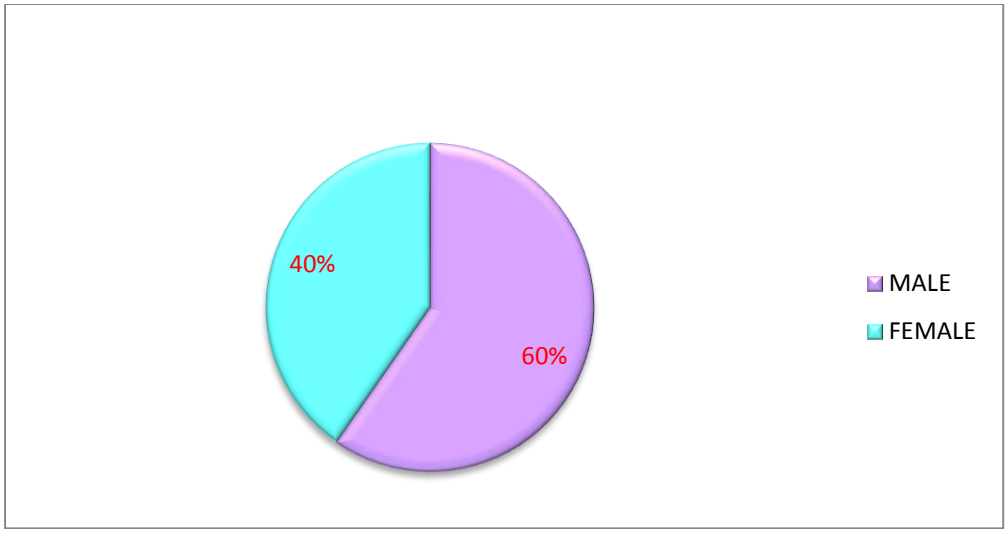

fig : VIII

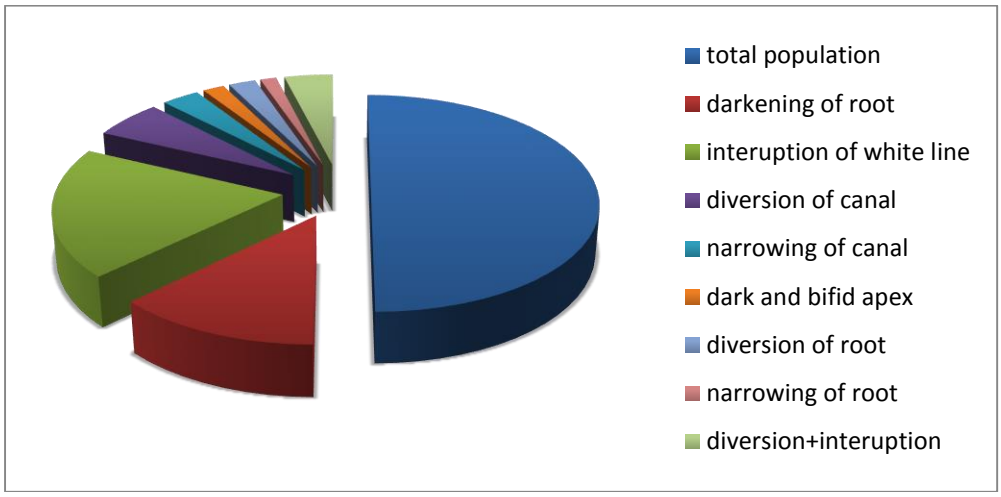

Fig IX: Radiographic signs present in total population

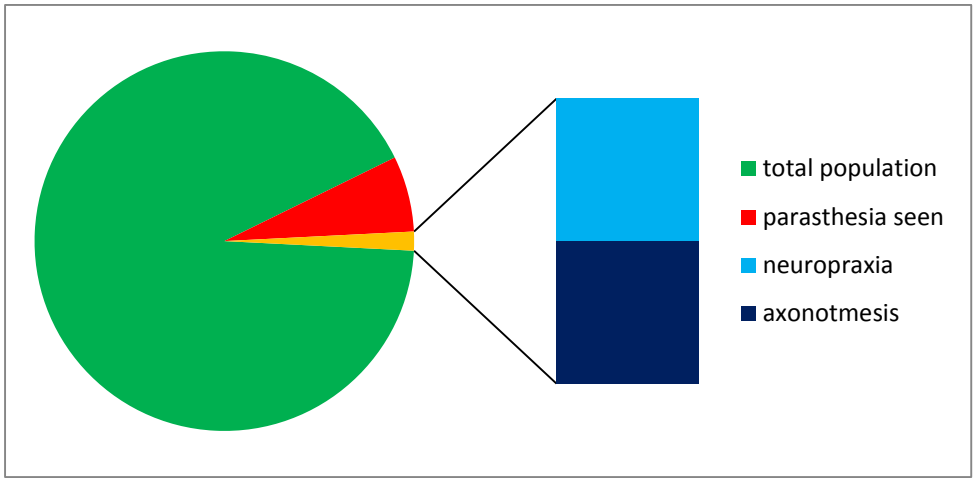

Fig X: Neurosensory Deficit