



RESEARCH ARTICLE

ASSESSMENT OF PROXIMITY OF ROOTS OF MANDIBULAR THIRD MOLAR TO THE INFERIOR ALVEOLAR CANAL IN IMPACTED TEETH BY RADIOVISIOGRAPHY

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ABSTRACT

Aim: To assess the proximity of roots of mandibular third molar to the inferior alveolar canal in impacted teeth by radiovisiotherapy”

Background: Prior knowledge of the proximity of the roots of the mandibular third molars to the inferior alveolar nerve canal minimizes injury to the nerve. Previous studies have shown Intra Oral Periapical Radiograph (IOPA), Dental Panoramic Tomograph, and Cone Beam Computed Tomography (CBCT) as tool for assessment of risk of injury to the canal. The aim of our study was to assess proximity of roots of mandibular third molar to the inferior alveolar canal using radiovisiotherapy (RVG).

Methods: The total study sample enrolled 50 impacted mandibular third molars among 50 patients. Patients requiring surgical removal of impacted mandibular third molars are selected. Preoperative radiovisiotherapy was taken and the findings are correlated with findings during surgery.

Study design: Descriptive interventional study.

Result: Out of 50 patients 15(30%) were males and 35(70%) were females. All the nine radiographic signs were evaluated individually and their association with the Nerve identified at operation/ root grooved was studied. There was an root of tooth just touching upper white line was observed in 1 out of 11 Nerve identified at operation (root grooved) close cases and was the most statistically significant sign noted. $p = 0.0038 (<0.05)$. Also darkening of the root was observed with $p=0.0277 (<0.05)$. Out of total 50 cases Type 2(8%) was most common in males; in females Type 2 (14%) and Type 4 (14%) were more common.

Conclusion: In our study Type 2 (Root of tooth just touching upper white line) was most commonly observed. Risks of nerve damage during operation were more significant in Type 2 and Type 4.

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INTRODUCTION

Impaction is a pathological condition which is defined as “lack of eruption of a tooth in the oral cavity within the time and physiological limits of normal eruption process”. (Maverna and Gracco, 2007) Surgical extraction of impacted third molars is one of the most common oral and maxillofacial surgical procedures performed and may have a number of associated complications. (Koong et al., 2006) One of the most common complications that may occur following the extraction of mandibular third molars is injury to the inferior alveolar nerve canal (IANC) which may result in dysaesthesia or impairment of sensory perception. (Kipp et al., 1980; Cade, 1992) Prior knowledge of the proximity of the roots of the mandibular third molars to the IANC may minimize such complications. (Shujaat et al., 2014) Various pre- operative radiographs techniques are used to evaluate the relationship between the

mandibular third molar and the IANC. They are intra-oral radiographs, orthopantomogram (OPG), tomographs, scanographs, Computed Tomography (CT), cone beam computed tomography (CBCT) scans and Digital Radiovisiotherapy (RVG). RVG is a form of X-ray imaging, where digital X-ray sensors are used instead of traditional photographic film. RVG has advantages that include time efficiency through by passing chemical processing and the ability to digitally transfer and enhance images. Less radiation can be used to produce an image than that of Cone Beam Tomography (CBCT).

Methods

The approval of the Medical ethics committee was obtained. (Ref. No. :KIMSDU/ICMR/STS/2015)

Inclusion Criteria

Impacted mandibular third molars which were indicated for surgical extraction was included in this study.

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Exclusion Criteria

The patients with systemic problems such as bleeding disorders, cardiovascular diseases, and uncontrolled diabetes mellitus were excluded.

Total 50 patients who required removal of one or more impacted mandibular third molar teeth were included in the study. Intraoral periapical radiograph are taken with RVG censor (Kodak) and Radiographic machine (Eclat Electro Medicals EDX- 10D) were used. After taking radiograph the relationship of third molars with inferior alveolar canal is enable using criteria given by many authors, (Howe and Poyton, 1960; Main, 1938; Stockdale, 1959; Waggener, 1959; Seward, 1963; MacGregor, 1976; Killey and Kay, 1975) and investigated Rood and Noraldeen Shehab. Each mandibular third molar tooth was classified according to its relation to the inferior alveolar neurovascular bundle.

These were:

- Darkening of the root (Howe and Poyton, Main). (Howe and Poyton, 1960; Main, 1938)
- Deflection of the roots (Stockdale, Waggener). (Howe and Poyton, 1960; Main, 1938)
- Narrowing of the root (Seward). (Waggener, 1959)
- Dark and bifid apex of the root (Seward). (Waggener, 1959)
- Interruption of white lines of the canal (Howe and Poyton, Seward). (Howe and Poyton, 1960; Waggener, 1959)
- Diversion of the inferior alveolar canal (Seward, MacGregor). (Waggener, 1959; Seward, 1963)
- Narrowing of the inferior alveolar canal (Seward, Macgregor, Killey and Kay). (Seward, 1963; MacGregor, 1976; Killey and Kay, 1975) (Figs. 1-7).

For the sake of completeness we added three radiological descriptions. These were:

- Root of tooth more than 1mm distant from the neurovascular bundle.
- Root of tooth just touching the upper outline of the neurovascular bundle.
- Root of tooth superimposed on the neurovascular bundle.

After taking digital radiograph that is radiovisiography (RVG), patients were subjected for surgical removal of impacted teeth. The surgical technique was standardized. Asepsis and isolation was maintained. Local anesthesia was given. Mucoperiosteal flap was reflected after an incision. Required bone was removed. Sectioning of tooth was done. Tooth was elevated from the socket carefully without damaging the nerve and the tooth was extracted. After the removal of tooth the position, depth, and any grooving of the root by the neurovascular bundle were measured. Control of bleeding followed by closure of flap and suturing was done. Analgesics and antibiotics were prescribed for 5 days and Post operative instructions were given to patients and the patients were recalled after 1 week to examine whether any postoperative symptoms were seen or not.

Statistical Analysis

Descriptive statistics was calculated by using mean and as standard deviation (S.D). Comparison was done by using

Fisher's exact test with sensitivity, specificity, predictive powers etc. The statistical analysis was done by using SPSS (Statistical package for social sciences) 20.0.

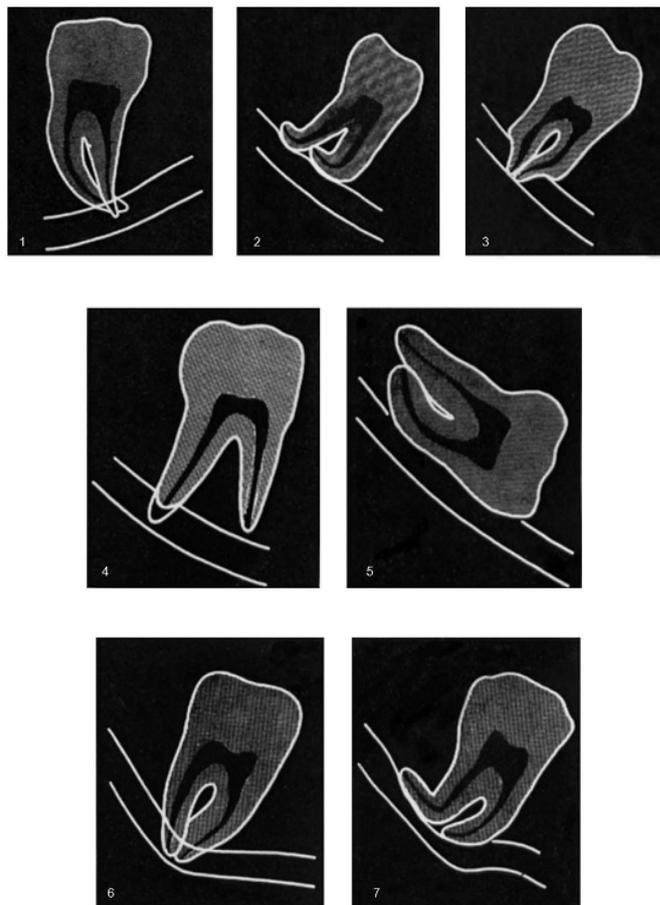


Figure 1. Darkening of root **Figure 2. Deflection of root**
Figure 3. Narrowing of root. **Figure 4. Dark and bifid apex of root.** **Figure 5. Interruption of white line of canal.**
Figure 6. Diversion of canal. **Figure 7. Narrowing of canal**

RESULTS

The total study sample enrolled 50 impacted mandibular third molars among 50 patients. Out of 50 (100%) mandibular third molar patients 15(30%) were males and maximum 35(70%) were females. The average age of study group was 22.72 years (SD 1.61). Here the average age of male patients was 23.67 (SD 1.29) whereas average age of female patients was 21.67 (SD 1.67). The male to female ratio was 1:2.3. Among the 50 impacted mandibular third molars, 38 (66 %) were present on the left side and on the other hand 17(34%) present on right side. [Table No.1]

Radiographic Risk Signs and Correlation with Nerve identified at operation/ root grooved

Radiographic risk predictor signs shows out of 50(100%) mandibular third molars maximum 11(22%) were root of tooth touching upper white line (Positive Patients) whereas no signs observed in 39(78%) with nerve identified at operation 1(2%). Fisher's exact test was used, then p-value was 0.0038 with 22% sensitivity 98% specificity 91% PPV & 55% NPV also odds ratio was 13.821 with CI (1.709-111.07). On the other hand as per darkening of the root 10(20%) positive patients whereas no darkening was 40(80%) with nerve

identified at operation 2(4%). Fisher's exact test was used, then p-value was 0.0277 with 20% sensitivity 96% specificity 83% PPV & 54% NPV also odds ratio was 6.000 with CI (1.241-28.999). All other signs did not follow significant association between radiographic signs and nerve identified at operation.

females Type 2 (14%) and Type 4 (14%) were more common followed by Type 3(10%) and Type 5(10%). [Table 3]

Table 1. Descriptive statistics summary of impacted mandibular third molars

Discriptive statistics	
Total no. of Samples	50
No. of Males	15 (30%)
No. of Females	35 (70%)
Overall Average Age (in years)	22.72 (SD 1.61)
Average Male Age (in years)	23.67 (SD 1.29)
Average Female Age (in years)	21.67 (SD 1.67)
Mandibular third molar region	
Left	38(66%)
Right	17(34%)

Table 2. Individual radiographic risk signs & comparison with nerve identified at operation/root grooved

Sign	Radiographic findings N=50	Nerve identified at operation/ root grooved N=50	P value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	OR (CI)
Root of tooth >1 mm from neurovascular bundle	4(8%)	0(%)	0.1175	8	100	100	52	9.74(0.518-186.65)
Root of tooth just touching upper white line	11(22%)	1(2%)	0.0038	22	98	91	55	13.821(1.709-111.07)
Root of tooth superimposed on outline of neurovascular bundle including interruption of white line	8(16%)	2(4%)	0.0916	16	96	80	53	4.571(0.9120-22.739)
Darkening of root	10(20%)	2(4%)	0.0277	20	96	83	54	6.000(1.241-28.999)
Deflection of root	6(12%)	1(2%)	0.1117	12	98	85	52	6.682(0.7734-57.726)
Narrowing of root	4(8%)	0(%)	0.1175	8	100	100	52	9.774(0.5118-186.65)
Dark and bifid apex	3(6%)	0(%)	0.2424	6	100	100	51	7.442(0.3741-148.03)
Diversion of canal	3(6%)	0(%)	0.2424	6	100	100	51	7.442(0.3741-148.03)
Narrowing of canal	1(2%)	0(%)	1.000	2	100	100	50	3.061(0.1216-77.010)

*Statistically significant when ($p < 0.05$) PPV positive predictive value, NPV negative predictive value, OR (CI) odd's ratio (confidence interval)

Table 3. Incidence of proximity of root of tooth to inferior alveolar canal

Sex	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7	Type 8	Type 9	Total
Male	1	4	3	3	1	0	3	0	0	15
In Percentage %	2%	8%	6%	6%	2%	0	6%	0	0	30%
Female	3	7	5	7	5	4	0	3	1	35
In Percentage %	6%	14%	10%	14%	10%	8%	0	6%	2%	70%

Correlation of Individual Signs with the nerve identified at operation

All the nine radiographic signs were evaluated individually and their association with the Nerve identified at operation/ root grooved was studied. There was an root of tooth just touching upper white line was observed in 1 out of 11 Nerve identified at operation (root grooved) close cases and was the most statistically significant sign noted. $p = 0.0038$ (< 0.05). Also darkening of the root was observed with $p = 0.0277$ (< 0.05), Showing in [Table 2].

Incidence of proximity of root of tooth to inferior alveolar canal

Out of total 50 cases Type 2(8%) was most common in males followed by Type 3(6%), Type 4 (6%) and Type 7 (6%). In

DISCUSSION

Most mandibular third molar teeth are not intimately related to the inferior alveolar nerve, (Bell *et al.*, 2003; Wenzel *et al.*, 1998) and may be removed safely without causing injury to the nerve. It is, however, important that when an intimate relation exists so that the nerve may be injured, the patient be told, so for that informed consent is given before operation. Before operation the patient must be warned about the complications of removal of tooth. The risk should be quantified. Rood and Noraldeen Shehab have already quantified that risk on the basis of radiological observations using a combination of periapical radiographs and Dental Panoramic Tomograph. (Rood *et al.*, 1990) In our study Radiovisiography were used to quantify the risks. Although even if the operator is aware of or suspects an intimate relation between the root and nerve preoperatively, the

incidence of nerve injury will not necessarily be reduced despite careful or modified surgical technique. As results showed p value less than 0.05 is seen in darkening of root (Type 4) and root of tooth just touching white line (Type 2) indicative of significant risk sign. Rood and Noraldeen Shehab showed that the second most reliable sign indicative of the danger of damage to the inferior alveolar nerve was darkening of the root. (Wenzel *et al.*, 1998) Similarly G.W. Bell showed that after deflection of the root, darkening of the root was the radiographic sign most commonly associated with intimate contact between the tooth and nerve. (Bell, 2004) Study conducted by Pallavi Sinha, Anuradha Pai showed that Darkening of the root was present in maximum no. of subject while narrowing and diversion of the canal was present in the least number of patient. (Pallavi Sinha and Anuradha Pai, 2015) The results of our study showed that after root of tooth just touching upper white line (Type 2), darkening of the root (Type 4) was the radiographic sign most commonly associated with intimate contact between the tooth and nerve, which was in consistent with previous studies. (Bell, 2004; Pallavi Sinha and Anuradha Pai, 2015) Rood and Noraldeen Shehab found that the third most reliable sign indicative of nerve injury was interruption of the radiopaque outline of the inferior alveolar canal as it crossed the tooth. (Rood *et al.*, 1990) In the present study Root of tooth superimposed on outline of neurovascular bundle including interruption of white line was third most reliable sign which is supportive to Rood Noraldeen Shehab study. (Rood *et al.*, 1990) Studies conducted by Bell and Deshpande showed that the Root of tooth superimposed on outline of neurovascular bundle including interruption of white line was most reliable sign indicative of nerve injury, (Prasannasrinivas Deshpande *et al.*, 2013; Bell, 2004) where the results of our study were contradictory to their studies. Study conducted by B koong, MJ Pharoah, M Bulsara, Tennant showed that maximum surgeons were considering narrowing of canal as a risk predictor sign whereas in this present study narrowing of the canal is found in least number (6%) of patients with no sign of risk. (Koong *et al.*, 2006) Study conducted by Pallavi S, Anuradha P showed that darkening of roots was more common in males and females. (Main, 1938) In the present study root of tooth just touching upper white line (Type 2) was more common in males, whereas root of tooth just touching upper white line (Type 2) and darkening of roots (Type 4) was more common in females.

The Radiovisiography will be recommended as the radiographic investigation of choice in the preoperative assessment of mandibular third molar teeth. It is useful to assess the position, depth, and type of impaction, as well as the texture of the investing bone. In this study we compare the preoperative radiological observations with the findings at operation and the clinical outcome.

Conclusion

In our study Type 2 (Root of tooth just touching upper white line) was most commonly observed. Risks of nerve damage during operation were more significant in Type 2 (Root of tooth just touching upper white line) and Type 4 (Darkening of root).

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Conflicts of interest: There are no conflicts of interest.

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