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Proximity of Impacted Mandibular Third Molars to the Inferior Alveolar Canal with Its Radiographic Predictors: A Digital Panoramic Study

Dr. Tanvi Bonala[1], Dr. Ashwini Desai[2], Dr.Mahesh Chavan[3], Dr.Niranjan Desai[4], Dr.Madhura Jathar[5] Dr.Kedarnath Kalyanpur[6]

[1]2nd year Post Graduate Student, Department of Conservative Dentistry & Endodontics, KLE Society's Institute of Dental Sciences, Dental School,Bangalore Karnataka - 22
[2]Assistant Professor, Department of Oral Medicine & Radiology, Sinhgad Dental College & Hospital,Vadgaon(BK), Off Sinhgad Road, Pune -41
[3]Professor & Head, Department of Oral Medicine & Radiology, Sinhgad Dental College & Hospital, Vadgaon(BK), Off Sinhgad Road, Pune -41
[4]Professor, Department of Conservative & Endodontics, Sinhgad Dental College & Hospital,, Vadgaon(BK), Off Sinhgad Road, Pune -41
[5]Asso.Professor, Department of Oral Medicine & Radiology, Sinhgad Dental College & Hospital,Vadgaon(BK), Off Sinhgad Road, Pune -41
[6]Asso.Professor, Department of Oral Medicine & Radiology, Sinhgad Dental College & Hospital, Vadgaon(BK), Off Sinhgad Road, Pune -41

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***Corresponding Author**
Dr. Ashwini Desai,
Assistant Professor, Department of Oral Medicine & Radiology, Sinhgad Dental College & Hospital, Vadgaon(BK), Off Sinhgad Road, Pune -41

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A B S T R A C T

Aim: To assess the radiographic proximity of impacted mandibular third molars to the inferior dental canal(IDC) with its radiographic predictors on digital panoramic radiographs and to evaluate pattern of impacted third molars.

Materials & Methods: Preoperative 50 orthopantomograms (OPGs) were examined. The radiographic relationship of the root apex of mandibular third molars and the IDC was assessed and categorized according to the following criteria: adjacent, superimposed, perforation, grooving, notching, or none. The type of impaction, age, and sex of the patient were also noted.

Results: The prevalence of **adjacen**t position of IDC with respect to third molar was most common i.e. 60% followed with superimposed (24%). Least common was grooving position (2%). This difference in proportion is statistically significant ($p < 0.05$). **Adjacent** position was seen more in males (60%) than females (40%). Superimposed was seen more among females (66.7%) as compared to males (33.3%). However there was no significant association between gender and position of IDC ($p = .337$). The prevalence of **vertical** pattern of impaction was most common (52%) followed with horizontal (32%) and least common was mesio-angular (16%). This difference was statistically significant ($p = .008$).Vertical pattern of impaction was prevalent more in male (61.5%) in comparison to female (38.5%). Horizontal pattern was seen more in female (68.8%) than in male (31.3%). However there was no significant association between gender and pattern of impaction ($p=0.69$).

Conclusion: The IDC are mostly bilaterally symmetrical, and the position of the IDC varies with respect to the apices of the roots of the impacted mandibular third molars with the majority being adjacent followed by superimposed. The most common impaction is vertical type. The variation should be appreciated, particularly by the oral surgeon when undertaking surgical removal of the impacted mandibular third molars.

Keywords: Impacted third molar, inferior dental canal, IDC, orthopantomogram, radiographic predictors.

INTRODUCTION

The word Impaction is originated from the Latin word 'IMPACT'. A tooth which is completely or partially unerupted, is positioned against another tooth, bone or soft tissue so that it's further eruption is unlikely and described according to its

anatomic position. A tooth which fails to develop/erupt in a given time in the oral cavity and may give rise to cysts or neoplasm.

The removal of impacted mandibular third molars is one of the most common surgical procedures performed and can be complicated by inferior alveolar nerve damage. Injury to the inferior alveolar nerve has been related to deeply impacted teeth and to roots in close approximation to the inferior dental canal (IDC) [1-4]

Thus, accurate assessment of the position of the inferior alveolar nerve in relation to the impacted third molar might reduce injuries to this nerve. Anatomically, the nerve lies in the IDC which is enclosed within a tube of dense bone. The tube is seen on radiographs as two parallel radiopaque lines; one representing the roof of the canal and the other the canal floor.[5,6]

The mandibular canal is fairly close to the apices of the second molar in 50% of the radiographs. In 40%, canal is away from the root apices, and in only 10% of the radiographs the root apices appeared to penetrate the canal. In root canal therapy of the second molar one should be cautious of over extending the reamer or the root canal filling materials because there is a possible risk of inferior alveolar nerve injury.[7,8]In human anatomy, the **mandibular canal** is a canal within the mandible that contains the inferior alveolar nerve, inferior alveolar artery, and inferior alveolar vein. It runs obliquely downward and forward in the ramus, and then horizontally forward in the body, where it is placed under the alveoli and communicates with them by small openings.

The most common tooth to be impacted is the mandibular third molars (third molars- also called wisdom tooth). 'Pain', Pericoronitis and 'Food lodgement ' is the most common complaint of a patient with partially erupted third molar.[9,10]

Pre-operative radiographs which are most commonly used are panoramic radiographs. Though newer imaging modalities exhibit higher qualities because of the reduced accessibility and high cost they have not been used often.

Investigations studied the distance of impacted mandibular third molars from the inferior alveolar canal and different signs on the panoramic images which are believed to indicate the close proximity of mandibular third molars to the inferior alveolar canal.

The aim of this present study is to evaluate the Proximity of Impacted Mandibular Third Molars to the Inferior Alveolar Canal and determine the reliable Radiographic Predictors signs on digital panoramic radiographs and also to evaluate the pattern of impacted third molars.

MATERIALS & METHODS

It is a retrospective study conducted in the Department of Oral Medicine & Radiology Department at Sinhgad Dental College & Hospital, Pune after the clearance of Institutional Ethical Committee. The study include using 52 (OPGs) of males and females both of age above 18 years. Ideal OPGs of completely dentate patients were selected for the study. 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 were excluded from the study. Digital Radiographs were taken by Planmeca Proline – EX/XC digital machine with exposure parameters (80 kVp, 12 mA, 14 sec).

Preoperative (OPGs) were examined and the proximity of the IDC to the roots of impacted mandibular third molars was categorized into the following groups:[1,8]

Superimposition
Adjacent
Perforation
Grooving
Notching
None

The categories are notching, grooving, and perforation were regrouped together and called the true relationship between the IDC and the root apices. The type of impaction, age, and sex of the patient were also noted.

The radiographic relationship of the root apex of mandibular third molars and the IDC was assessed and categorized according to the following criteria:[1,8]

Superimposed: The canal was superimposed over part of the roots which appeared less radiopaque than the remaining radiological image of the roots [1][Figure 1]

Adjacent: The superior border of the canal was either touching the roots apices or within 2 mm below them.[Figure 2]

Notching: Radiolucent band at the apex of the roots, a break in the continuity of the upper radio dense border and narrowing at the expense of the top of the canal .

Grooving: Radiolucent band across the root above the apex, interruption of both superior and inferior borders of the canal and narrowing of the canal space .

Perforation: Radiolucent band crossing the root above the apex, loss of both superior and inferior borders of the canal at the area where they cross the roots, and constriction of the canal maximal in the middle of the root .

None: A relationship between the canal and the root apices could not be decisively assessed.

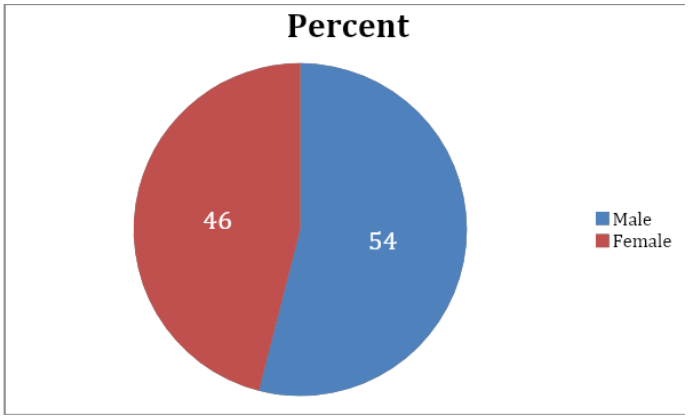
Figure 1: The OPG depicts Mesioangular Impaction and the Radiographic predictor being superimposed

Figure 2: The OPG depicts Vertical classification and radiographic prediction ⇦ Adjacent ⇨

The second parameter considered is Winter's classification. It is based on the inclination of the impacted third molar tooth to the long axis of the second molar.[2,11]

RESULTS

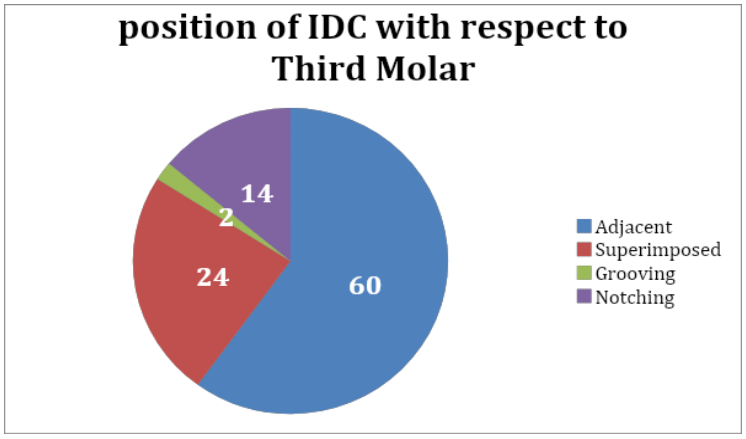
The OPGs examined were retrieved from the Oral medicine and Radiology department records. As many as 50 OPGs were used for the study. The study subjects consists of 27 males (54%) and 23 females (46%) (Graph 1) with ages ranging from 18 years - 40 years, with the majority being within the age group of 20 years -25 years(mean age - 27 years) . This difference was not statistically significant (p =.671)



Graph 1: Male to female ratio

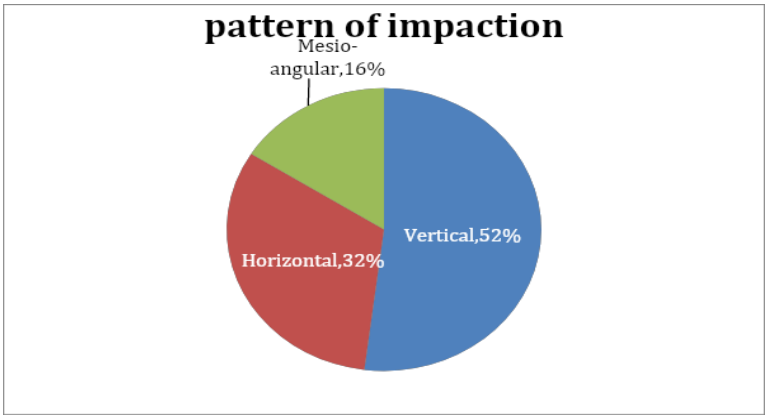
Our study consisted of two parameters -

1. The prevalence of **adjacen**t position of IDC with respect to third molar was most common i.e. 60% followed with superimposed (24%) (Graph 2) Least common was grooving position (2%). This difference in proportion is statistically significant ($p < 0.05$).



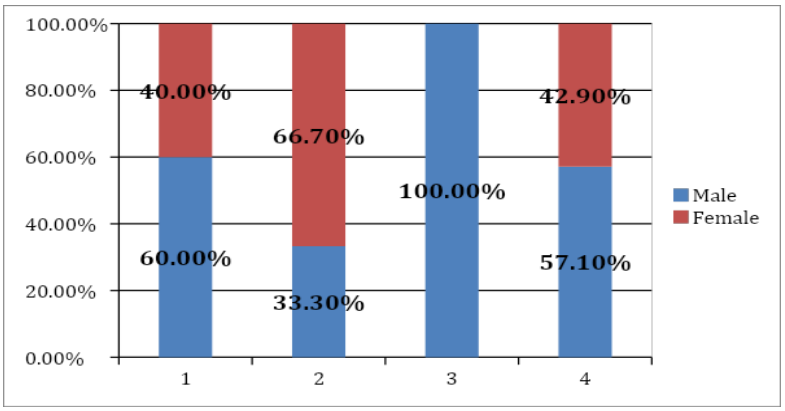
Graph 2: Position of IDC with respect to third molars

2. The prevalence of **vertical** pattern of impaction was most common (52%) followed with horizontal (32%) and least common was mesio-angular (16%)(Graph 3). This difference was statistically significant ($p = .008$)



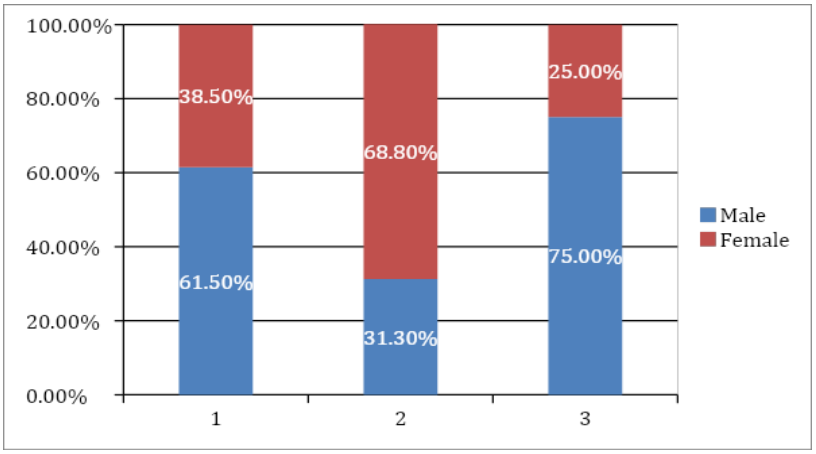
Graph 3: Pattern of Impaction

Adjacent position was seen more in males (60%) than females (40%). Superimposed was seen more among females (66.7%) as compared to males (33.3%) (Graph 4). However there was no significant association between gender and position of IDC ($p = .337$)



Graph 4: Radiographic predictors associated with gender

Vertical pattern of impaction was prevalent more in male (61.5%) in comparison to female (38.5%). Horizontal pattern was seen more in female (68.8%) than in male (31.3%) (Graph 5).However there was no significant association between gender and pattern of impaction (p = .069).



Graph 5: Pattern of impaction associated with gender

DISCUSSION

Tooth impaction is a pathological situation where a tooth fails to attain its normal functional position. Impacted third molars are commonly encountered in routine dental practice.. Any pathological changes either in the bone or the adjacent tooth bud can cause obstruction in the pathway of the eruption of the third molar. The impaction rate is higher for third molars when compared with other teeth. Impacted teeth may remain asymptomatic or may be associated with various pathologies such as caries, pericoronitis, cysts, tumors, and also root resorption of the adjacent tooth.

The third molar teeth are the last to erupt with a relatively high chance of becoming impacted. Hence, the surgical extraction of these impacted teeth has become the most common dento alveolar surgeries. While performing the surgical extraction procedure the proximity of the inferior dental canal is of concern. Various radiographic predictors have been categorized to take prior care and avoid injury to the inferior alveolar nerve. Trismus and pain is the most common complication of the damage to inferior nerve. Most of the impacted mandibular third molars (61.76 %) extended beyond the superior border of the inferior alveolar nerve in accordance with Miloro and DaBell [12]. These results suggest that impacted mandibular third molars lie in close proximity to the inferior alveolar canal.

In the study done by Deshpande P[1], mesioangular impactions are more closely placed to inferior alveolar canal and interruption of the white line is the most reliable risk predictor sign on the panoramic radiographs, whereas in our study, vertical impaction was most commonly seen and **adjacen**t is the significant radiographic predictor.

In the study done by Abdalla M.Hazza[5] the results showed 15.7% of the total cases were in true relationship with the IDC, in our study **adjacent** is the significant radiographic predictor with a total % of 60.

In the study done by Miloro M, Unerupted mandibular third molar teeth are closer to the inferior alveolar canal than are erupted teeth[7]. Mesioangular mandibular third molar impactions are most closely positioned to the inferior alveolar canal in our study vertical impaction was most commonly seen and adjacent is the significant radiographic predictor

In the study done by Elkhateeb SM[8],Panoramic findings of interruption of inferior alveolar canal wall, isolated or combined with one of these signs (darkening of third molar roots, narrowing of canal, and diversion of canal); darkening of the roots; and narrowing of canal were significantly correlated with direct contact between the inferior alveolar canal and impacted third molars where as in our study **adjacent** is the significant radiographic predictor with a total % of 60, where darkening of the roots and narrowing of canal was seen.

In the study done by Jerjes W, Surgical difficulty of impacted third molars may be assessed radiographically through seven factors, including spatial relationship, depth of impaction, ramus relationship/space available, type of impaction, number and shape of roots, shape of the tip of the root, and relation of the root to the inferior alveolar nerve where as in our study two parameters were considered while assessing the relationship between IDC and third molar. Those were the type of impaction and a possible radiographic predictors.[13]

In Shujaat et al.[14] study horizontally angulated impactions were the most common in, which has a less varied range of ethnic groups in contrast with our study where vertical type was the most common (52%),followed by horizontal(32%). Similarly, Momin et al. reported horizontal (42%), angular (37%), and vertical (21%) angulated impactions.[15]

CONCLUSION

The mandibular canals are mostly bilaterally symmetrical, and the position of the IDC varies with respect to the apices of the roots of the impacted mandibular third molars with the majority being adjacent followed by superimposed. The most common impaction is vertical type. The variation should be appreciated, particularly by the oral surgeon when undertaking surgical removal of the impacted mandibular third molars. The presence of radiographic risk predictor signs specifically *'interruption of the white line'* on panoramic radiographs as observed in our study will alert the dental surgeon regarding close proximity of the impacted mandibular third molars to the inferior alveolar canal.[1,16] Different modes of treating symptomatic impacted mandibular third molars such as pericoronal ostectomy, coronectomy or orthodontic extractions could be employed in such situations.[17,18]

Limitation of the study: In some cases, panoramic radiographs are sufficient for preoperative evaluation of the anatomical relation of the IAN and third molars; however, this imaging modality does not provide any information regarding the buccolingual dimension.[19,20] Assessment of the buccolingual dimension is very important for cases in which there is a close anatomical proximity between the IAN and third molar, as the risk of IAN injury is significantly elevated when compared to other locations.[21,22] In such cases, cone beam computed tomography (CBCT) is recommended for accurate examination of the buccolingual dimensions.

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