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Original Research Article

Association of mandibular third molar impaction and radiological risk predictors using orthopantomogram in a tertiary dental care centre in Kerala- A retrospective analysis

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ABSTRACT

Background: To avoid unwanted complications during the extraction of impacted mandibular teeth pre-operative investigations are required to plan the best protocol for the situation. Although 3D imaging modalities provide clear picture, because of their reduced accessibility and high cost panoramic radiography is more preferred for planning third molar extraction.

Aim: To assess and associate the pattern of mandibular third molar impactions with the associated radiological risk predictors in relation to age and sex using Orthopantomogram in a Tertiary Dental Care Centre in Kerala.

Methodology: This is a retrospective cross-sectional study using the digital panoramic radiographic records of subjects with impacted mandibular third molar. Data collected will be analysed using Descriptive statistics and Chi square test. Associations and differences will be considered significant when the p value less than 0.05.

Results: Out of the 710 mandibular third molar impactions, 368 (51.8%) belong to females and 342 (48.2%) belong to males. The highest frequency of impactions (73.2%) belonged to the 20-24-year age group. The predominant pattern of impaction was mesioangular impactions. Among the radiological risk predictors darkening of root was having the highest frequency (40%); followed by interruption of white line of canal, (34.9%). The radiological signs when correlated with pattern of impaction, shows statistically significant results associated with darkening of root and deflection of root. There was statistically significant results when radiological signs were correlated with sex, in the case of narrowing of root even though darkening of the root accounted for the most common radiological risk predictor in both sexes.

Conclusion: Mesioangular impactions are the most common impaction in our study population. The largest number of impactions belonged to the 20-24 age group. The most frequent radiological risk predictor as per the study is darkening of the root.

1. Introduction

The mandibular third molars are the most frequent impacted tooth.[1] The relationship of these mandibular third

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molar roots to the variable position and anatomy of the mandibular canal containing the inferior alveolar nerve may causes different surgical challenges. These will result with unpredictable and undesirable surgical outcomes.[2] The inferior alveolar nerve enters the mandibular canal through the mandibular foramen on the medial surface of the ascending mandibular ramus.[3] The most appropriate radiographic techniques for viewing these impacted teeth is by using an Orthopantomogram (OPG). The Orthopantomogram scanners require less technical skill to operate and have low costs and with a relatively low radiation dosage comparable to Computed Tomography machines.[3] In Orthopantomogram an overall view of all-important anatomical structures with the relationship and proximity of the mandibular impacted third molar roots inferior alveolar canal viewing is possible.[4] The aim of this study was to assess the frequency of the relative relationship and proximity of the mandibular third molar roots to the inferior alveolar canal in relation to age and sex using Orthopantomogram in a Tertiary Dental Care Centre in Kerala.

2. Materials and Methods

This retrospective cross-sectional study was conducted in the Department of Oral Medicine and Radiology, Government Dental College, Alappuzha. The radiographic records of patients with impacted third molar were selected in a retrospective manner, from July 2019 till December 2019 for a period of 6 months. All panoramic radiographs were taken by ORTHOPHOS XG, by Denstply Sirona, USA, panoramic machine. A total of 375 digital panoramic radiographs of patients in the age group of 20–35 years were interpreted and assessed for the mandibular third molar impactions. The panoramic radiographs presenting with bilateral impacted mandibular third molars with root completion and presence of mandibular second molars were selected for the study. Those panoramic radiographs with congenital absence of mandibular third molars, mandibular third molars extracted previously, trauma/surgery to the mandibular site of study, developmental anomalies affecting the jaws and radiographic evidence of pathologies of the impacted mandibular third molar teeth of mandible which could obscure the visualization of the periapical region or IAC were excluded from the study. The type of impaction of mandibular third molars was assessed by Winter's method[5] as mesioangular, distoangular, vertical or horizontal impactions. Rood and Shehab's criteria[6] will be used to assess the presence of each of in root of mandibular third molar and Inferior Alveolar Canal changes. The data was analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics and Chi square test were done.

3. Results

Table 1:

Age group	Frequency	Percent
20-24 years	520	73.2
25-29 years	158	22.3
30-34 years	32	4.5
Total	710	100.0

Table 2:

Gender	Frequency	Percent
Male	342	48.2
Female	368	51.8
Total	710	100.0

Table 3:

Radiological signs	Frequency	Percent
Darkening of root	284	40.0
Deflection of root	43	6.1
Narrowing of root	8	1.1
Dark and bifid apex root	7	1.0
Interruption of white line of canal	248	34.9
Diversion of canal	22	3.1
Narrowing of canal	9	1.3
None	89	12.5
Total	710	100.0

Table 4:

Types of Impactions	Frequency	Percent
Vertical	267	37.6
Mesioangular	324	45.6
Distoangular	17	2.4
Horizontal	102	14.4
Total	710	100.0

Table 5:

Impaction	Male	Female	p value
Vertical	111(41.6)	156(58.4)	0.006*
Mesioangular	158(48.8)	166(51.2)	0.771
Distoangular	5(29.4)	12(70.6)	0.117
Horizontal	68(66.7)	34(33.3)	0.00*

From the 375 panoramic radiographs evaluated for our study, 710 mandibular third molar impactions were found. Out of the 710 mandibular third molar impactions, 368 (51.8%) belong to females and 342 (48.2%) belong to males. The age group selected for the population was 20-35 years. The highest frequency of impactions, 520 (73.2%) belonged to the 20-24 year age group.

Table 6:

Impaction	20-24	25-29	30-34	p value
Vertical	190(71.2)	63(23.6)	14(5.2)	0.573
Mesioangular	255(78.7)	61(18.8)	8(2.5)	0.004*
Distoangular	11(64.7)	4(23.5)	2(11.8)	0.329
Horizontal	64(62.7)	30(29.4)	8(7.8)	0.024*

Table 7:

Radiological relationship	Vertical	Mesioangular	Distoangular	Horizontal	Total	p value
Darkening of root	92(32.4)	158(55.6)	6(2.1)	28(9.9)	284	0.00*
Deflection of root	11(25.6)	20(46.5)	0(0)	12(27.9)	43	0.03*
Narrowing of root	5(62.5)	2(25)	1(12.5)	0(0)	8	0.082
Dark and Bifid apex of root	3(42.9)	3(42.9)	0(0)	1(14.3)	7	0.972
Interruption of white line of canal	108(43.5)	99(39.9)	7(2.8)	34(13.7)	248	0.082
Diversion of canal	8(36.4)	14(63.6)	0(0)	0(0)	22	0.143
Narrowing of canal	1(11.1)	7(77.8)	0(0)	1(11.1)	9	0.256

Table 8:

Radiological relationship	20-24 years	25-29 years	30-34 years	Total	p value
Darkening of root	216(76.1)	61(21.5)	7(2.5)	284	0.081
Deflection of root	31(72.1)	8(18.6)	4(9.3)	43	0.270
Narrowing of root	8(100)	0(0)	0(0)	8	0.228
Dark and Bifid apex of root	7(100)	0(0)	0(0)	7	0.275
Interruption of white line of canal	172(69.4)	62(25)	14(5.6)	248	0.205
Diversion of canal	16(72.7)	6(27.3)	0(0)	22	0.527
Narrowing of canal	6(66.7)	2(22.2)	1(11.1)	9	0.626

Table 9:

Radiological relationship	Male	Female	Total	p value
Darkening of root	143(50.4)	141(49.6)	284	0.342
Deflection of root	19(44.2)	24(55.8)	43	0.590
Narrowing of root	1(12.5)	7(87.5)	8	0.042*
Dark and Bifid apex of root	1(14.3)	6(85.7)	7	0.071
Interruption of white line of canal	122(49.2)	126(50.8)	248	0.689
Diversion of canal	7(31.8)	15(68.2)	22	0.119
Narrowing of canal	4(44.4)	5(55.6)	9	0.822

The evaluation of the pattern of impaction as per Winter's classification showed, there was predominance of mesioangular impactions, 324 (45.6%), followed by vertical, 267 (37.6%). Least predominant impaction among the radiographs was found with distoangular impactions, 17(2.4%). Among the radiological signs as per Rood and Shehab criteria, darkening of root was having the highest frequency, 284 (40%), followed by interruption of white line of canal, 248 (34.9%). Least frequent among the radiological signs were narrowing of root, 8 (1.1%) and dark and bifid apex root, 7 (1%).

When the pattern of impaction was correlated with age and sex, it was found that in the case of age, mesioangular impactions (p value-0.004) and horizontal impactions (p value-0.024) showed statistically significant results. Correlation with sex, showed statistically significant values associated with vertical (p value-0.006) and horizontal impactions (p value-0.00). The radiological signs when correlated with pattern of impaction, shows statistically significant results associated with darkening of root (p value -0) and deflection of root (p value-.03). On correlation with age, even though there were no statistically significant results, darkening of root and interruption of white line were having relatively high values especially in the 20-24 age group. There were statistically significant results when radiological signs were correlated with sex, in the case of

narrowing of root (p value-.042) even though darkening of the root accounted for the most common radiological risk predictor in both sexes.

4. Discussion

Those individual teeth which remain unerupted due to a lack of eruptive forces, heredity, lack of space either due to small jaws or large teeth, or incomplete mandibular growth are addressed as embedded teeth.[7] Among the various impactions, mandibular third molar impaction is more symptomatic and quite disturbing.[8] This in turn is associated with difficulty of extraction and various associated complications such as pain, swelling, inferior alveolar nerve damage, alveolitis, incomplete root removal, bleeding, delayed healing, postoperative infection and bony spicules. Associated with the mandibular third molars removal, inferior alveolar canal injury has been reported with a frequency ranging from 0.6% to5.3%.[9] Up to some extent such complications can be anticipated prior to surgery by using radiographs, which can help surgeon to take steps to avoid the likelihood of their occurrence.[10]

Studies have shown that as 2D imaging modalities like panoramic radiography is capable of predicting the relationship between the third molar and the mandibular canal as accurate as CBCT.[11,12] Moreover the radiation dose of a panoramic radiograph is lower than that from four periapical views.[13] Although 3D imaging modalities provide clear picture, but because of their reduced accessibility and high cost and the aforesaid features of panoramic radiography, the latter is more preferred for planning third molar extraction.[11–14]

The age group selected for the study was 20-35 years. The highest frequency of impactions, belonged to the 20-24 year age group. This is in accordance with the studies by Hazza et al[15] and Costa et al.[16] In our study there was a relative female predisposition, in accordance with the studies by Jerjes et al,[17] Knutsson et al,[18] Szalma et al[19] Quek SL et al[20] and Kim et al[21] observed a female preponderance. This may be because of the prior stoppage of physical growth in females contributing to a smaller jaw size compared to males; where the jaw growth continues during the third molar eruption provides more space for the tooth.[20,22] In the present study, the most common angulation type of impacted mandibular third molar was mesioangular (45.6%). Few studies were in agreement with the similar findings.[8,18,20,23–26] The are a few factors contributing for the same including their late development and maturation, path of eruption, and lack of space in mandible at later age.[27] The radiographic risk predictors were evaluated based on Rood and Shehab criteria.[6] There has been an estimated specificity ranging from 96 to 98% for radiographic signs, as predictor of nerve injury.[10] There were a few studies which depicted radiographic signs associated with nerve damage.[4,25,28,29] Even though the radiographic sign associated with nerve damage in the majority of the studies was the diversion of the canal;[30] our study went in accordance with those studies[6,11,25,28,31–34] where darkening of the roots accounts the most in frequency.

The studies by Rood et al., Kipp et al., Nevus et al. suggested darkening of the root, interruption of the white line of the mandibular canal and deflection of the mandibular canal are alarming concerns of inferior alveolar nerve damage.[6,34,35]

The darkening of the roots can be because of the thinning of the cortical plates[36] or due to the loss of dentine caused by grooving of the root by the canal.[31]

In our study when the radiological risk predictors were correlated with the type of impaction, age, sex and side, the following results were seen. When correlated with age, the highest number of radiological risk factors were found in the 20-24 age group and the lowest number were found in the 30-34 age group. In the 20-24 age group, darkening of the roots were the most followed by interruption of white line. In the other two age groups, interruption of white line accounts for the most; the least was found with narrowing of root, diversion of canal, dark and bifid apex in various groups. Except for the darkening of roots; which has got a slight male predominance all radiological risk predictors showed a female preponderance. When correlated with the type of impaction, darkening of root has been found predominant among mesioangular and horizontal types of impactions. These results were statistically significant. Interruption of white line was the most common radiological risk predictor associated with vertical and distoangular impactions.

5. Conclusion

The study concluded that mesioangular impactions are the most common impaction in our study population. The largest number of impactions belonged to the 20-24 age group. The most frequent radiological risk predictor as per the study is darkening of the root, followed by interruption of white line. Though the sensitivity and specificity of Panoramic radiograph is low when compared with other 3D imaging modalities the former is capable of predicting the relationship between the third molar and the mandibular canal accurately.

6. Source of Funding

None.

7. Conflict of Interest

None.

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