

ASSESSMENT OF DIAGNOSTIC ACCURACY OF ORTHOPANTOMOGRAM IN DETERMINING THE ROOT MORPHOLOGY OF IMPACTED MANDIBULAR THIRD MOLARS

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ABSTRACT

Accurate assessment of root morphology is a key to surgical management of impacted teeth. The objective of this study was to determine the diagnostic accuracy of orthopantomogram in determining root morphology of impacted mandibular third molar tooth by taking the surgical findings as gold standard. Patients presenting in Department of Oral & Maxillofacial surgery, Punjab Dental Hospital / de'Montmorency College of Dentistry, Lahore for impacted mandibular third molar surgery and who consented to be part of the study were included in the study. It was a cross-sectional survey with a sample size of 300 and was carried out from December 2011 to December 2012. All patients were advised an orthopantomogram before the surgery. Pre-operative radiographs were assessed and findings noted. Surgeries were carried out as per standard protocol. Post-operative root morphology was assessed and noted. In case where tooth sectioning was done, crown and root fragments were re-approximated using sticky wax. The sensitivity and specificity values of orthopantomogram in determining the root morphology of impacted mandibular third molars were 33.3% and 92.5%.

It was concluded that orthopantomogram is less sensitive and more specific in assessing root curvatures of impacted mandibular third molars.

Key Words: Impaction, Diagnostic Accuracy, Orthopantomogram, Root curvatures.

INTRODUCTION

The incidence of impacted teeth is 90% with 33% having at least one impacted tooth.¹ An impacted tooth is one which fails to erupt in the dental arch within expected time due to lack of space because of hard and soft tissue obstructions.² One of the most frequently performed procedures in minor oral surgery is surgical extraction of impacted mandibular teeth which is frequently carried out on an out-patient as well as day-stay basis.³ Surgical extraction of mandibular third molars is a technique sensitive procedure. Detailed analysis of patient related factors and dental factors should be done in order to plan the surgical procedure.⁴ Complicated root morphology is one of the most important tooth related factor that if not properly assessed

before the procedure increase the operation time and henceforth postoperative recovery time.⁵ It is important to determine the number of roots, their position and whether they are fused or not.⁶ while planning the surgical extraction of impacted mandibular third molar surgery. Higher curvatures often mean more difficult extraction.^{7,8}

Clinical and radiographic evaluations are the two important tools for any surgical procedure. Orthopantomogram is part of routine preoperative investigations.^{1,9} It helps to visualize whole of the tooth, mandible, relationship of the tooth roots with IAN canal, dental root morphology, and bone quality.¹⁰ Timely diagnosis of curved roots helps the surgeon to devise a surgical plan with a lesser per operative duration and with better post-operative results.¹¹

METHODOLOGY

Patients of both genders with ages above 17 years requiring surgical extraction with complete root formation and closed apices presenting in the Department of Oral & Maxillofacial surgery, Punjab Dental Hospital/ de, Montmorency College of Dentistry, Lahore were included in the study. It was cross-sectional survey using non- probability, consecutive sampling with a

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sample size of 300 and was carried out for a period of one year from December 2011 to December 2012 all patients were informed about the study protocol and were advised an orthopantomogram before the surgery. For standardization, radiographic facilities of Punjab dental hospital were used only. The radiographs were assessed and magnification with a hand held lens was used, if necessary. All tracings of the third molar tooth from the radiograph on the cephalometric tracing film were done. Findings were specified in writing whether the roots were curved or not. After the administration of local anesthesia extraction of third molar was performed by standardized technique. The morphology of the root(s) was assessed and post-surgical findings were compared with the pre-operative assessment. Routine post-operative instructions and medications were prescribed to the patient.

All collected data was entered in SPSS version 16 and results analyzed accordingly. Data on quantitative variable (age of patient) was presented as mean with standard deviation whereas data on qualitative variable (gender of patient) was presented as frequency. The accuracy of orthopantomogram was determined by applying tests of validity (sensitivity and specificity, positive predictive value and negative predictive value).

RESULTS

A total number of 300 patients having impacted mandibular third molar teeth, fulfilling the inclusion criteria were included in the study. The mean age of these patients was 21.26, standard deviation 2.764. The age range of the patients is 17 to 30. Female patients formed the predominant gender of the study. Total number of female patients included in the sample was 165 (55%). Total number of male patients in the sample was 135 (45%). The mean age of female patients is 20.12 years, with an age range of 17-29 (SD. 1.84). The mean age of male patients is 22.66 years with an age range of 17-30 years (SD. 3.081).

In 300 impacted mandibular impacted teeth, roots of 69 (23%) teeth were found curved and 231 (77%) were not found curved on orthopantomogram. Of these 300 impacted mandibular third molar teeth, 60 were found true positive, 111 true negative, 09 false positive and

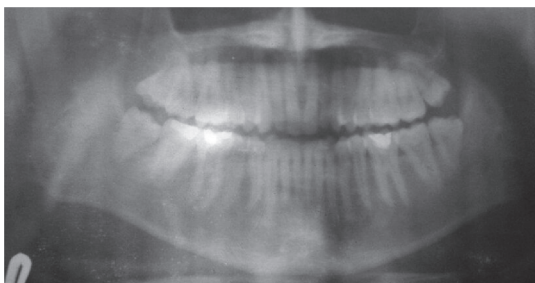


Fig 1: Pre-op orthopantomogram



Fig 2: Per-op view of surgical procedure



Fig 3: Pre-op third molar tracing

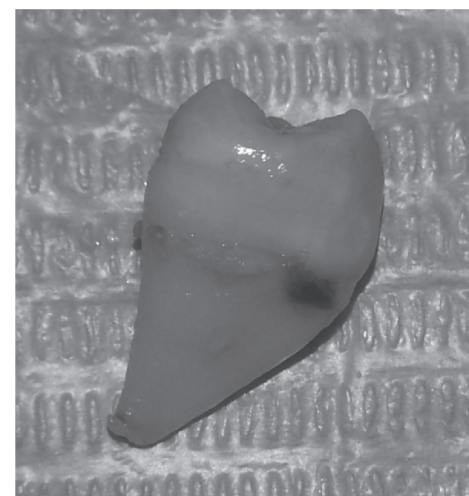


Fig 4: Actual tooth after surgical removal

120 false negative post-operatively. The sensitivity and specificity was calculated as 33.33% and 92.5% by applying test of validation.

DISCUSSION

In adult age, the commonest presenting odontogenic problem observed is impacted mandibular third molar.¹² Prediction of operative difficulty before the extraction of impacted mandibular third molar has always been the biggest desire of any surgeon performing the procedure. The teeth judged to be associated with a higher risk of per-operative complications can benefit from an accurately designed treatment plan.⁴ A compilation of both clinical and radiological information is necessary to make an intelligent plan of surgery. Among the morphological features associated with increased difficulty during the procedure curved roots predominate. Panoramic imaging is a growing part of clinical practice and is the most commonly performed radiograph for assessment of impacted third molar.¹³ Orthopantomogram aids in diagnosis of impaction and gives a detailed description of tooth and root morphology of the tooth, angulation and position, adjacent teeth, surrounding bone, and position of IAN canal.¹⁴

Total 300 patients were included in the study. The mean age of patients in the study was 21.26 years. Almendros-Marques et al¹⁵ reported mean age of 27.32 years with the age range from 16 to 64 years in their study. Chang et al¹⁶ reported mean age of 28.3 years with the age range from 14 to 75 years in their study whereas Ozec et al¹⁷ reported a mean age of 25.2 years. The increased numbers of patients in the study belonged to a younger age group with a median age of 21.26 as opposed to above quoted studies. The most probable explanation for this can be interdisciplinary referrals in our hospital. Most of the procedures performed were elective surgeries, patients referred mostly from orthodontics department.

Females formed the predominated gender in the data. Out of 300 patients females were 165 (55%) and males were 135 (45%). Alkhateeb et al¹⁸ also reported that 80% (80) of their patients were females while 20% (20) were males. Almendros et al¹⁹ found that 61% i.e. 91 patients out of 150 patients in their study were females and 39% i.e. 59 were males. Occurrence of impacted third molars is more frequent in females which may be due to the fact that females have smaller size of jaw that cannot accommodate these teeth and the remain buried in jaw bones.

The mean age of female patients included in the study is 20.12 years whereas that of male patients is 22.66 years. Females are always more concerned about the esthetics. Since most of the patients included in the study were referred from orthodontics department. This explains the younger mean age of female patients in comparison to male patients.

Saraswati et al²⁰ conducted a study on 100 impacted mandibular third molars. Out of them roots

of 8(8%) teeth were found curved on orthopantomogram, whereas roots of 92(92%) teeth were found curved post-operatively. Sensitivity and Specificity of orthopantomogram in assessing the root morphology of impacted mandibular third molar was found to be 88.09% and 100% respectively. On the other hand, Bell et al⁶ performed a study on 300 impacted mandibular third molar teeth and found out results contradicting Saraswati et al study. The Sensitivity and Specificity values obtained were 29% and 94% respectively.

In our study, sensitivity and specificity values were 33.33% and 92.5% respectively which are in concordance with the previous studies. Sensitivity and Specificity are mostly quoted terms in order to describe performance of a diagnostic test. Sensitivity is the ability of a diagnostic test to accurately identify patients with the disease. Specificity is the ability of the diagnostic test to accurately identify patients who do not have the disease.²¹

Orthopantomogram is a two dimensional image of a three dimensional object and the quality of the radiograph produced depends on the technique performed. The poor results may be attributable to lack of operator training performing the radiograph. The quality of the tomographic image is also influenced by a number of factors such as operator's, patient positioning and co-operation, exposure and processing.

The recommendations are that the patients head should be tilted downward so that ala-tragus line is 5 degrees down and forward.²² So that the tooth is positioned within the focal trough. The required radiation exposure to the x-ray film depends upon density of object, quality of x-ray beam, sensitivity of receptor film, and field of radiation.²³ Processing of film is another very important and technique sensitive procedure. Procedural errors while performing the radiograph do affect the resolution ability of orthopantomogram and hence may be misleading in diagnosing a curvature in the root(s). All the radiographs included in the study were performed in the radiology department of Punjab dental hospital, in order to control the confounding effect of quality of image on study.

The other reason for poor results may be related to limited inherent diagnostic accuracy of orthopantomogram. In orthopantomogram a slit beam scans the orofacial region and produces a tomographic slice. As a result the radiograph will show teeth and the supporting structures in this zone.⁶ The whole idea of using a combination of film and an x-ray source moving at equal speeds, but in opposite directions, around the patient is to produce a focal trough. The primary beam is projected upwards at an angle to project the shadow of base of skull and hard palate above the apices of teeth.⁶

The resolution of orthopantomogram is sharpest in the center that is 2.9 to 5 Ip/mm, reducing to 1.2 to 1.5Ip/mm at the periphery of the focal trough, which technically speaking is large enough to identify curved roots.²⁴ However, in cases of buccally or lingually curved roots of impacted lower wisdom tooth, the apices are no longer in the plane of maximum resolution. The range of widths of focal trough on the lingual side has been measured as 7 to 13 mm and on buccal side 10 to 23mm. Considering the fact that 92% of curvatures are greater than 3mm in length with a maximum of 10mm and 86% of curvatures are between 3 to 7 mm in length, thus a substantial amount of curvatures are placed at the periphery.⁶

Most of the root curvatures are in distal direction but only 40% of them are identified.⁶ The issue of variable resolution does not explain the inadequacy in diagnosing mesial and distal curvatures. Even the resolution within the center of the focal trough is not enough to detect curved roots of lesser widths.

Lither et al²⁵ stated that path of beam passing through the complex roots gives different projections. The curvature of roots is an unpredictable factor, often not visible on radiographs. The false positive and false negative radiographic appearance is more common with the root morphology. It is also stated that dilacerations are not accurately radiographed due to path of x-ray beam.²⁶ Wenzel further added that root bent inward rather than outward results in different radiographic and tooth in vitro appearance.²⁷

Radiographic magnification is an inevitable phenomenon. There is variation between the magnification values between different operating machines as well as between patients and location in jaws. Generally a magnification factor of 10-20% is expected in third molar region of mandible.²⁸ This also explains the lower accuracy of orthopantomogram in determining root curvatures in impacted mandibular third molars.

Another factor which might have affected the study is the position of entire third molar tooth in relation to line of arch and focal trough. Central zone and width of the focal trough corresponds to the average shape and form of dental arches. Impacted mandibular third molar rarely lie in the same contours as the rest of the dental arch. Most of them lie slight buccally or lingually to the central plane and at angles to the vertical plane of adjacent teeth. Studies have shown that unpredictable changes in the position and angulation may occur even after age 19 years, more in vertical and distoangular teeth than in mesioangular teeth.²⁹ This is the reason that most of the tooth do not lie in the zone of maximum resolution.

The limitation of this study is that the setting of the study was conducted in a tertiary care hospital. More-

over, the patients induced in the study were referred from orthodontics department requiring extraction of impacted mandibular third molar tooth. Hence the data included is not representative of the general population. Therefore, the results are not applicable to masses. More studies are required to assess the diagnostic accuracy of orthopantomogram in determining the root morphology of impacted mandibular third molar tooth on the study data obtained from general population.

CONCLUSION

Orthopantomogram is a less sensitive but more specific imaging modality for pre-operative assessment of root morphology. This means that there are more chances of missing root curvature that are liable to make surgical retrieval difficult when pre-operative assessment is made solely on orthopantomogram. Orthopantomogram is still the most widely used diagnostic imaging tool in assessment of impacted third molars owing to easy availability and less cost. However, its lower diagnostic accuracy necessitates the need to resort to more sensitive radiographic modalities like Cone beam CT (CBCT) which will result in a more optimum pre-operative treatment planning and a better outcome.

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CONTRIBUTION BY AUTHORS

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| 1 Shahid Ali: | Title selection, planned design, literature review, wrote introduction, results & conclusion. |
| 2 Rabia Geelani: | Data collection and helped in compilation of results. |
| 3 Syed Adnan Ali Shah: | Helped in references collection & final review. |