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Review Article

Radiographic assessment of impacted mandibular third molars

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ABSTRACT

The surgical remedy of problems related to lower jaw 3^{rd} molars is related to common surgical risks like contamination, haemorrhage, pain and swelling. Certain unique risks are related with such surgery, specifically inferior alveolar and lingual nerve harm as these are adjacent vital structures. Risk assessment calls for an entire understanding of dental factors that can impact the care of these characteristic structures. Preoperative radiographic assessment warrants to provide data about the tooth itself, its encompassing bone, the neighbouring dentition, and related anatomical structural systems. Parameters that ought to be assessed are level of impaction, root formulations, angulation of the enamel, number of roots, root morphology, related pathology and, most importantly, the relation some of the crown/roots and the mandibular canal. An appropriate imaging method for 3^{rd} molars ought to display the complete 3rd molar and the mandibular canal below it. In this mini review, we elaborate on the generally used radiographic assessment methods of mandibular 3rd molars.

1. Introduction

The presence of an impacted mandibular 3rd molar as a developmental anomaly is widely recognized all over the world. It is included within the World Health Organization definitions of the International Classification of Diseases (ICD-10).[1] It is well known that customarily the surgical extraction of a diseased or symptomatic 3rd molar will alleviate ache and other different symptoms associated with it. This enhances the oral health and fitness and daily life characteristics of the sufferers.[2,3] The surgical extraction of mandibular 3rd molars is the maximum executed oral and maxillofacial surgical procedure all over the world. Radiography has always been used for a long time as a part of the preoperative evaluation before the extraction of the 3rd molar.

The need for radiographic evaluation of 3rd molars prior to the surgical operation is well-established. Performing a pre-operative radiograph will aid in finding out the easiest and least traumatic method for extraction of the mandibular 3rd molar. Thus, radiography before 3^{rd} molar removal is an exercise which allows the health care provider to set up a formidable surgical remedy plan. Surgical extraction of the 3rd molars can also additionally traumatize the inferior alveolar nerve (IAN). The modern literature suggests that post-operative transient lack of IAN sensation associated

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with 3rd molar extraction degrees from 0.4% to 22%, whilst long lasting persistent harm to the IAN occurs in approximately 1% of the instances.[4,5] Injury to the inferior alveolar canal which occurs during the execution of 3rd molar surgical operation relies upon numerous anatomical elements, like its vicinity and close association to the 3^{rd} molar, angulation and orientation of impacted tooth, bone mass and density, age of the affected person, and surgical capability or expertise of the surgeon. Apart from harm to IAN, different other problems which may arise after the 3rd molar surgery include infection, contamination, delayed healing, and jaw fracture. These diverse problems can result in malpractice issues for oral surgeons.[6–8] To lessen these complications, pre-operative radiographic exam is crucial to assess the orientation of impaction, deflection of the root, vicinity of the canal, courting of the canal to the roots, and thickness of the cortical plates.[8]

1.1. Panoramic radiography

Currently, the panoramic radiograph is the preferable radiographic approach to pre-operatively assess the impacted mandibular 3rd molars. The predicted sensitivity for panoramic radiographic as a predictor of post-operative IAN damage varies from 24% to 38%, and the specificity varies from 96% to 98%. In this way, panoramic radiography enables a preliminary assessment of any issues associated with impacted mandibular 3rd molar.[9–11] It is a known reality that for taking a peri-apical radiograph, positioning the receptor or sensor within the mouth is uncomfortable for the affected person. This is one of the frequently encountered problems which leads to inadequate radiographs. Panoramic imaging has therefore been recommended by few to be the primary-preference approach for pre-operative evaluation of 3rd molars. Several research have evaluated the diagnostic accuracy of the panoramic radiographic findings in figuring out vulnerability to IAN harm after extraction of the 3rd molars.

The panoramic radiography also has a known downside that it is eventually based on two-dimensional (2D) radiographs. Unfortunately, conventional x-rays, periapical and panoramic radiographs to exemplify, can simply offer restrained anatomical data and facts in relation to approximation of IAN to the 3rd molars, including and their association to the IAN canals.[8,11] A comparison of the computed tomographic scan and panoramic radiography before mandibular third molar extraction surgery was done by Luo et al.[12] They aptly demonstrated that preoperative panoramic radiography, Computed Tomography (CT) scan, age, and the expertise of the health care provider can influence commonly expected postoperative sequelae after extraction of a mandibular 3rd molar. Panoramic radiography by itself is not sufficient to predict hypoesthesia of lips and/or chin. They encouraged the usage of CT scans to predict IAN damage after the surgical operation.[12] Diagnostic credibility of cone beam computed tomography and panoramic radiography in predicting mandibular nerve damage during 3rd molar surgical operation has been evaluated by Hasani et al.[13] In their research, the sensitivity of panoramic radiography was reported to be 67.8%. The most common radiographic factors with the best sensitivity were interruption of the mandibular canal border and abrupt canal narrowing. The Pell and Gregory classification, 3^{rd}molar angulations, or 3-dimensional canal-apex relationships are appreciably related to clinically shown IAN problems. Panoramic radiography can also additionally omit approximately a third of instances of the close association of the tooth and IAN. However, a properly done panoramic radiograph analysis is rather beneficial. It may possibly provide actual anatomical data, and must be executed seriously.[13] Surgeons, however, must be aware about the restrictions of the radiographic markers of panoramic radiography and must not forget to undertake any additional designated imaging investigations in particular instances of 3^{rd} molar surgery.

2. Cone Beam CT

Cone Beam CT (CBCT) three-dimensional (3D) offer advanced and extra designated facts as compared with traditional 2D radiographs. In yesteryears, improvement of the cone beam computed tomography device has caused a growth in its scientific use in dentistry and its specialties. It gives a much-decreased dose of radiation to the patient, has a low cost as compared to conventional CT, gives a higher quantity reconstruction and high-precision bone details.[5,8] With CBCT, the impacted 3^{rd} molar may be visible in numerous views (coronal, sagittal, axial or horizontal), which is obviously lacking in the panoramic view. This makes it feasible to attain the correct vicinity of the impacted 3^{rd} molar, and its relation to the adjoining IAN. CBCT makes it feasible to outline the form of impaction, the follicle size, the axial inclination of the 3^{rd} molar, the relative buccal and palatal positions, the quality and quantity of bone encompassing the enamel and its approximation and relation to adjoining 2^{nd} molar and anatomical systems.[8,11,14]

The use of CBCT gives a detailed information of the anatomic association of 3rd molar roots and the inferior alveolar canal (IAC). However, only skilled and experienced surgeons coping with impacted 3rd molars with proof of proximity to the IAC on OPG may be able to determine the best remedy modality without CBCT.[15] Since CBCT can show the 3^{rd} molar in all anatomical planes, and the examiner is capable of scrolling via the sub-millimetre slices, it safely can be assumed that extra designated facts are obtainable in CBCT than in 2D imaging. While an over-projection of the mandibular canal through the roots of the 3rd molars is visible within the conventional 2D

radiographs, the CBCT can display the precise association of the 3rd molar and the mandibular canal in all 3 sections.[15,16] If no bony separation is demonstrated between the 3rd molar and the mandibular canal within the CBCT views, this could be interpreted as the 3^{rd} molar and the nerve are actually in contact with each other. Moreover, it's more feasible to evaluate root curvatures within the buccolingual plane on a CBCT.[16,17]

3. Intraoral Periapical Radiograph and its relation to panoramic radiography

An intraoral periapical radiograph was earlier believed to be an adequate pre-operative assessment before surgical intervention of mandibular 3rd molars if the complete enamel and the mandibular canal are displayed within the radiograph. If there's an over-projection among the roots of the 3rd molar roots and the canal, additional examinations may be done and the tube shift approach within the vertical plane.[18]It is useful in interpreting if the 3rd molar is placed buccally or lingually to the mandibular canal. Moreover, an axial/occlusal radiograph alongside with the tube shift radiographs aids in analysing buccolingual inclination of the 3rd molar, and has been routinely advised. In general, the sharpness of the intraoral periapical radiograph is better than that of the panoramic radiograph, and the magnification element while the usage of the paralleling approach is round 1.05 without any distortion.[19,20] There can also be additional issues with positioning the intraoral receptor in the patient's mouth. Particularly, solid-state sensors can be uncomfortable to the affected person, as they are visibly a great deal thicker than periapical films. In maximum instances, a cord connects the sensor with the computer. If the affected patient perceives extra pain while such receptors are used, it is understandable that many variety of retakes may also be warranted, and that it simply may not be possible to show the whole mandibular 3rd molar in a single intraoral radiograph. Some researchers have compared periapical imaging with solid-state sensors, phosphor plate structures and films for pre-operative evaluation of a mandibular 3rd molarand concluded that as much as 38% radiographs with solid-state sensors have been inadequately consistent with standards for an acceptable radiograph. After a retake by usage of traditional film, 22% have still been nonetheless inadequate.[18,19]

Owing to the problems in positioning the intraoral receptor for periapical exposures, many surgeons advocate that panoramic radiography can be the approach of preference as stated earlier for pre-operative assessment of mandibular 3rd molars. A panoramic radiography exam is easily executable without much problems and done with very little pain to the affected person as compared to intraoral radiography. Moreover, it delivers a drastically reduced radiation-dose to the patient. The panoramic radiograph also gives a view of all the four 3rd molars in a single radiograph, quite similar to sixteen intraoral periapical exposures. Latest systems may even offer segmented radiographs exposing the molar place(s) in question. Thus, panoramic radiography will frequently be the primary-preference approach for assessment of mandibular 3rd molars where such devices are accessible.[14,17,20]

In a panoramic radiograph, first of all it has to be interpreted whether or not there is an over-projection of the roots of the 3^{rd} molar and the mandibular canal. Secondly, while an over-projection is determined, previously, several findings within the panoramic radiograph have been known to be suggestive of a close association or actual touch among the roots of the 3rd molar and the IAN within the mandibular canal.[21] However, they appear now no longer to be similarly reliable. In a latest review, it was concluded that 3 of the findings (interruption of the radiopaque borders of the canal, diversion of the canal and darkening of the roots) had been very inaccurate in predicting approximation. It became evident in some studies that the absence of these findings couldn't absolutely certify that no close association exits between the rots and the IAN. Thus, if the roots over-project the mandibular canal within the panoramic radiograph, and if one or more of the findings are present, an addition radiographic exam can be advised.[4,17,22]

3.1. Stereoscanography

Stereoscanography (SCAN) has been recognized as a radiographic modality since the 1990s. The SCAN includes 4 radiographs acquired in a single exam, which show the 3rd molar area placed in one single orthogonal and one distoeccentric projection, and two projections cranial to these. In each guideline, the tube shift is approximately four degrees angle.[19] In SCAN, the relation among the roots of the 3rd molar and the mandibular canal may be decided through the usage of the tube shift approach or viewing with stereopsis. Only some devices within the market offer the opportunity for SCAN, and the approach has now no longer gianed attention.[23–25]

4. The Posteroanterior (PA) Projection of the Cranium

The posteroanterior (PA) projection of the cranium can also additionally provide vital information in figuring out the connection among the roots of the 3rd molar and the mandibular canal. Further, it also provides an idea to the angulation of the 3rd molar roots within the buccolingual plane. The buccolingual relation among the mandibular 3rd molar and the mandibular canal can also additionally be interpreted.[26,27]This projection needs that a cephalostat or any other form of unit for exam of the cranium is available within the clinic. Moreover, there's frequently an overlapping of anatomical structures in the jaw within the mandibular molar area, which can also additionally obstruct a clean view of the 3rd molar. The traditional

tomographic approach may provide an insight on facts within the buccolingual relationship among the 3^{rd} molar root and the mandibular canal.[28]

5. Conclusion

Guidelines for the usage of CBCT scanning for pre-operative radiographic examination of mandibular 3rd molars prior to surgical intervention have advised that CBCT may be utilized in instances wherein the traditional radiographs show a close interrelation among the 3rd molar and the IAN or IAC. A thorough radiographic exam of mandibular 3rd molars is supposed to aid the health care provider in organising an appropriate surgical remedy plan. For years panoramic imaging has been the primary preference approach. However, where an over projection is determined among the 3rd molar and the mandibular canal and while particular symptoms and symptoms advocate a close association among the molar and the canal, CBCT can be indicated.

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None.

7. Conflict of Interest

The authors declare no conflict of interest.

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