The outcome of postoperative paresthesia of inferior alveolar nerve after surgical removal of mandibular third molar using Orthopantomogram (OPG) versus Cone-beam CT

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ABSTRACT

Background: Periapical and Orthopantomogram (OPG) are the most commonly used radiographs for assessment of the relationship of lower 3rd molar roots with the inferior alveolar canal. Panoramic radiographs provide inadequate information of the buccolingual relationship between the roots of the 3rd molar & mandibular canal being two-dimensional (2D) in nature. To verify the relationship in three (3D) dimensions and to make a predictable treatment plan, traditional investigations may be supplemented by using CBCT. Cone-beam computerized tomography (CBCT) is an office-based radiography technique used to assess the three-dimensional relationship of lower 3rd molar roots with inferior alveolar nerve.

Patients and methods: This comparative-cross sectional study was conducted at the Department of Oral and Maxillofacial Surgery, Fatima Memorial Hospital (FMH), Lahore from 1st January 2019 till 30th June 2019. A total of 124 patients requiring removal of lower wisdom tooth were enrolled and then divided into two groups (62 in each) randomly. OPG was used for diagnosis of impacted lower 3rd molars in Group A patients while CBCT for diagnosis in Group B patients. A self-designed Performa was used to collect the data and final information was collected after 3 months of follow-up. Data analysis was performed using SPSS 20. A chi-square test was used to compare the postoperative paraesthesia between the OPG group and CBCT group patients. A p-value ≤ 0.05 was taken as significant.

Results: The occurrence of postoperative paresthesia between the two groups is significantly different; being a low percentage in the CBCT group at 2nd, 7th day and after 3 months follow-up visits with a p-value of 0.019, 0.019, and 0.005 respectively. On 3 months follow up, the distribution of paraesthesia between the two groups is significantly different; 20 patients (32.25%) in OPG group A and those of 7 (11.29%) in CBCT group B experienced paresthesia with a p-value of 0.005.

Conclusion: It is better to use CBCT to improve the postoperative paraesthesia for lower third molar surgical extraction.

Keywords:
    Third molar extraction; CBCT; OPG; Paresthesia; Inferior alveolar nerve; Wisdom tooth.

INTRODUCTION

Mandibular 3rd molars are the teeth that are impacted most often, and their removal is one of the most frequent surgical procedures in the oral cavity.[1-3] Surgical extraction or simple extraction of an impacted lower 3rd molar may be the cause of injury to the inferior alveolar nerve (IAN) if the tooth and its roots are in close approximation to this nerve.[4-7] Iatrogenic IAN injury is debilitating and a known complication resulting in postoperative paresthesia or dysesthesia which may present as a prolonged sensory deficit and/or altered sensation in the mandible, mental region, and/or lower lip on the ipsilateral side. This sensation could be temporary or permanent. Incidence of the neurosensory complications is variable, ranging from 0.2 to 1% for a permanent neurosensory deficit and 3.3 to 13% for a transient nerve injury. The chances of IAN injury may increase to 30% when lower 3rd molar roots are in a closer relationship with the mandibular canal radiographically.[7,8] To prevent any complication following 3rd molar surgery and to have proper treatment planning, an optimum diagnostic aid is needed.[5,8,9]

The radiographic signs suggestive of a close relationship between the roots of the lower 3rd molar & mandibular canal include superimposition of the 3rd molar roots over the mandibular canal, narrowing or deviation of this canal, interruption of the canal borders, darkening or narrowing of the molar roots or their deviation and the bifid apex.[9,10] Preoperatively

periapical and panoramic radiographs are used commonly for assessment of the relation between these two important structures. Panoramic radiographs provide inadequate information of the buccolingual relationship between the roots of the 3rd molar & mandibular canal, **cortication** of the canal, and detailed anatomy of the third molar being two-dimensional (2D) in nature. To verify the relationship in three (3D) dimensions, traditional investigations may be supplemented by using CBCT; which is an office-based radiographic modality to assess the three-dimensional (3D) relationship of the tooth with the inferior alveolar nerve. Advantages of this technique include; reduced radiation dose & higher spatial resolution. Literature shows it has been successfully used to evaluate the true nature of the relationship of the lower 3rd molar to the mandibular canal.[10-12]

The use of CBCT to assess impacted lower 3rd molars is justified because it is essential to evaluate whether it gives the clinician an enhanced detailing of anatomic relation of the lower 3rd molar and IAN canal than conventional radiographic modality. The objective of the study was to compare the frequency of postoperative paraesthesia in patients after surgical removal of mandibular third molar based on difficulty index evaluated by OPG versus CBCT. This may help to plan the removal of an impacted lower third molar with reduced possibility of inferior alveolar nerve injury.

PATIENTS AND METHODS

This was a comparative cross-sectional study conducted at the Department of Oral and Maxillofacial Surgery, Fatima Memorial Hospital, College of Medicine and Dentistry, Lahore from 1st January till 30th June 2019. Patients were selected as per the inclusion criteria from the Outpatient Department (OPD) of Oral & Maxillofacial Surgery, Fatima Memorial Hospital-Lahore. Informed consent was taken from all patients. The permission was taken from Institutional Review Board (#FMH-08-2017-IRB-292-M) to conduct the study. A pre-designed Proforma was utilized to enter **the patients' data.** Non-probability consecutive sampling was used with a sample size of 124 (62 in each group), calculated at a 5% level of significance and 80% power of the test and taking expected frequency of postoperative paraesthesia in OPG group 16.4% and CBCT group 3.2%.[11] Patients of both genders aged 18 to 45 years were included. Patients requiring removal of impacted mandibular third molars with a close relationship of about 2 to 4 mm with inferior alveolar

nerve on OPG and CBCT were included, with a difficulty index of greater than 4 (moderately difficult impacted 3rd molars) based on Pederson scale.[22] Medically compromised patients based on medical history (**American Society of Anesthesiologists' Classification II**) [23] including those with chronic obstructive pulmonary disease (COPD), Ischemic Heart disease (IHD) and uncontrolled diabetes mellitus were excluded. Pregnant and lactating females and those with fully erupted mandibular third molars were also excluded.

Patients with impacted lower 3rd molar were assigned to two groups; one with only OPG while the second group was based on CBCT. The difficulty index was scored according to Pederson Scale. The procedure was performed by the surgeon (final year Resident) and a standardized technique was used for the removal of the lower 3rd molar. Local anesthesia (LA) was given using a standardized inferior dental (ID) nerve block along with a long buccal nerve block using a 2% solution of Lidocaine Hydrochloride containing epinephrine 1:100,000 ratio. The bone around the impacted 3rd molar tooth was removed as and when appropriate by using a round bur in a straight surgical hand-piece under continuous irrigation with normal saline. The tooth-crown and its roots were then sectioned as and when required. When the tooth was completely removed surgically, its socket was irrigated copiously and then inspected for any piece of tooth or bone. Finally, the flap was secured with interrupted sutures using 3/0 silk sutures. A gauze pack of appropriate size was applied over the wound and the routine post-operative instructions were explained to the patient. The outcome variable in terms of paresthesia (abnormal sensation, described by the patient as typically tingling or pricking in nature) was noted on the 2nd, 7th postoperative day and after three months as per operational definitions for both groups. Data was entered in SPSS version 20, analyzed, and presented in the form of mean ± SD for age whereas qualitative data i.e. gender, paraesthesia were presented as frequency and percentages. A Chi-square test was used for comparing the postoperative paraesthesia between OPG group and CBCT group patients. A p-value $\leq$0.05 was considered significant.

RESULTS

A total of 124 patients were enrolled and divided into two groups; with sixty-two patients in each group; Group A: OPG and Group B: CBCT. There was a total of 43 (34.7%) males in both groups and 81 (65.3%)

Table 1. Comparison of post-operative inferior alveolar nerve paraesthesia between 2 groups (n = 124)

Groups	Postoperative paraesthesia			
	Follow up on 2nd & 7th day		Follow up after 3 months	
	Yes	No	Yes	No
Group A-OPG	25	37	20	42
Group B-CBCT	13	49	7	55
Total	38	86	27	97
p-value	0.019		0.005	

were females. There were 23 males (43.3%) and 39 females (56.7%) in group A. While in group B, 20 were males (40%) and 42 females (60%). Age-range of all patients was 22-39 years with a mean + SD of 29.73 ± 4.232 years. In both male and female patients, the average age was not significantly different at a 5% level of significance having a p-value of 0.445. In Group A; 25 patients (40.32%) had paraesthesia at 2nd day postoperative while in Group B, 13 (20.97%) patients reported paraesthesia. Both groups are significantly different with respect to 2nd day result of paraesthesia and with respect to gender with a p-value of 0.019. When we assessed paraesthesia on the 7th postoperative day, the results were the same as for the 2nd postoperative day. After 3 months follow up, the distribution of postoperative IAN paraesthesia between two groups is significantly different; 20 (32.26%) patients in the OPG group (A) had paresthesia while it was positive in those of 7 (11.29%) patients of CBCT Group (B) with p-value= 0.005 (Table 1).

DISCUSSION

Removal of the lower 3rd molar is one of the most commonly performed oral surgical procedures. Inferior Alveolar Nerve (IAN) injury is serious morbidity associated with the removal of the lower 3rd molar which affects the functionality of the oral cavity and the quality of life of patients.[13] The cited frequency of Inferior alveolar nerve paresthesia falls between 0.4% and 8.4%, whereas permanent nerve deficit risk is less than 1%. Injury to the Inferior Alveolar Nerve has been associated with deep-seated and horizontal impactions, inexperienced & novice surgeons, and a close relation of the roots of the lower 3rd molar with the inferior dental canal. To be able to predict Inferior Alveolar Nerve injury before surgery is a great advantage both for the patients and the operating surgeon. Thus, a radiographic assessment is paramount before embarking upon the surgery for identification of the close relationship of the roots of the impacted lower 3rd molar with that of the mandibular canal.[14] Current study is the comparison of postoperative paraesthesia related to surgical extraction removal of lower 3rd molar after difficulty index determined on OPG and CBCT. Post-

operative paraesthesia was assessed on 2nd day, 7th day and after three months results show OPG group has paraesthesia after three months in 20 patients (16.1%) which is greater than the CBCT group; having paraesthesia in 7 (5.6%) patients. A study was conducted to assess whether cone-beam computed tomography (CBCT) can improve the risk assessment for injury of the inferior alveolar nerve (IAN) compared to panoramic radiography.[15] Total 106 lower 3rd molars (59 on left-side and 47 right-sided) in 72 females and 34 male patients (mean age 29 years, range 19–56 years) were enrolled & treated in this study. 21 patients (19.8%) reported a neurosensory deficit of the Inferior Alveolar Nerve one week postoperatively. All patients had a monthly follow up. One patient (0.9%) reported a permanent sensory deficit (lasted >6 months).[15] The 16.1% (n=20) patients of the OPG group in the current study reported nerve deficit which is a finding quite close to this study's nerve deficit of 19.8% (n=21). Another study was conducted on a sample comprised of 135 patients (161 impacted teeth), to assess the diagnostic accuracy of cone-beam CT scan in comparison to panoramic radiographs to predict the exposure of neurovascular bundle during surgical removal of lower 3rd molar (p<0.5).[16] Results of this research proposed CBCT to be a superior diagnostic modality to predict the exposure of neurovascular bundle for evaluation of the relation of the lower 3rd molar root tip to the inferior alveolar canal as compared to OPG.[16] This correlates well with the outcome of the current study. One previous study compared the panoramic radiography with CBCT to predict risk assessment for nerve deficit in lower 3rd molar surgery. 2 patients (1.5%) in the CBCT group and 5 patients (3.8 %) in the panoramic (PAN) group reported Inferior Alveolar Nerve (IAN) deficit (p-value=0.45). This study inferred that though CBCT did not decrease postoperative complications, it revealed the number of 3rd molar roots & their apical divergence more reliably than panoramic radiographs.[17] Despite the small number of patients in our study, there was a significant difference between CBCT and OPG groups with regard to an inferior alveolar sensory deficit which is similar to the findings of the above study. In one of the

studies, authors discussed the use of cone-beam CT for the removal of lower 3rd molars to change the surgical approach compared with panoramic radiography.[18] They included forty subjects with 53 lower 3rd molars. When CBCTs were reviewed, significantly more patients had to re-classify to a lower risk for inferior alveolar nerve injury when compared with the panoramic radiograph assessments. This change in the assessment of risk also resulted in a change in the different surgical techniques (p-value<0.03). Authors concluded that cone-beam CT scan contributed to an optimal assessment of the risk of nerve injury, consequently became the reason for a more suited surgical planning as compared to panoramic radiography which correlates well with findings of the current study.[17] Moreover, CBCT has also been suggested for a meticulous assessment and identification of bifid mandibular canals before any surgical intervention to decrease or avoid postoperative sequelae.[19] Authors also favor the provision of cone-beam CT when clinicians find one or more signs of close proximity between the roots of the tooth and the mandibular canal in the two-dimensional (2D)imaging or if CBCT may change the treatment plan and in turn, the outcome of the procedure for the patients. Further research on high-evidence levels is suggested.[10, 20, 21]

CONCLUSION

The OPG and CBCT both diagnostic tools are effective but the CBCT gives more reliable results. Hence, clinicians may preferably choose CBCT over OPG for accurate diagnosis, whereby decreasing the chances of post-operative positive IAN paraesthesia.

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