

## Evaluation of Passive Surgical Removal of Close Related Wisdom Tooth to Inferior Alveolar Nerve

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### Abstract

**Background** Inferior alveolar nerve injury is the most serious complication of impacted lower third molar surgery. **Objectives** This study aims to optimize surgical procedure to safely remove wisdom tooth in contact or near the inferior alveolar canal and estimate the incidence of nerve injury in such cases. **Methods and Methods** this prospective controlled clinical study was implemented in Specialized Dental Center from February 2018 to May 2019. The sample was composed of 100 patients divided into two groups according to the distance of root apex from the inferior alveolar canal (the predictive variable), For the study group, the root apex is in contact or  $\leq 1$ mm from the inferior alveolar canal (buccal, lingual, or above the canal or canal between roots). For the control group the distance  $> 1$ mm. The primary outcome variable was inferior alveolar nerve injury after surgery. Another study variable was nerve recovery. Descriptive and bivariate statistics were computed and the P-value was set at .05. **Results** The study group involves 40 patients (18 males, 22 females) with a mean age of 23.5. The Control group involves 60 patients (26 males, 34 females) with a mean age of 24.5. There was a non-significant association between the distance of root apex to the inferior alveolar canal and paresthesia at p-value  $< .05$  as revealed by fisher's exact test (p=.061). **Conclusion** The results of this study suggest that surgical removal of wisdom teeth with a close relation to the inferior alveolar canal is a safe procedure when specific precautions and techniques are performed.

**Keywords: Inferior alveolar canal; impaction; surgery; wisdom tooth**

### Introduction

Third molar removal is the most common surgery performed in the oral and maxillofacial field, and it can be associated with some complications. Inferior alveolar nerve (IAN) injury is the most serious

complication of impacted lower third molar surgery (Deliverska and Petkova, 2016). The incidence of nerve injury is 0.4-6% as reported by (Gu et al, 2018) and higher incidence (11%) when the inferior alveolar canal (IAC) is in intimate contact with

root apex (Smith, 2013). The injury can be temporary and recovers within 4-8 weeks or can be permanent with less than 1% permanent numbness (Kim et al, 2012; Xu et al, 2013; Sarikov and Juodzbalys, 2014). The main risk factor of nerve injury is the distance of the apices of the roots to IAC (Marciani, 2012; Guerrero, 2012; Renton, 2013). Age of patient, the shape of roots, impaction depth, and surgeon experience are other factors (Deliverska and Petkova, 2016). Radiographical examination with an orthopantomogram (OPG) can provide information about the increased risk of nerve injury by revealing specific positive predictive signs (Sedaghatfar et al, 2005). In particular, Rood and Shehab, 1990, reported that three of seven classic radiographic signs are significantly related to IAN injury, which is the diversion of the canal, darkening of the root and interruption of the white line of the upper border of IAC, but OPG remains deficient as it is the two-dimensional image and the buccolingual position of the tooth cannot be anticipated, in addition to image superimposition, therefore, it is not reliable image to predict nerve injury (Smith, 2013; Hasegawa et al, 2013; Komerik et al, 2014; Gu et al, 2018). Cone beam computerized tomograms (CBCT) imaging provides cross-sectional (buccolingual), axial, sagittal, coronal, panoramic views and three-dimensional image so it is more accurate than OPG and more reliable imaging technique to determine the actual positional relation between root apex and IAC (Neves et al, 2012; Shujaat et al, 2014; Gu et al, 2018). Mandibular third molar with a close relation to the nerve canal can be treated by coronectomy, orthodontic disimpaction, or sagittal split osteotomy (Ahmed et al, 2011; Martin et al, 2015; Cervera-Espert et al, 2016). But despite this, coronectomy and orthodontic disimpaction have complications and limitations. Coronectomy still carries the

risk of nerve injury and need case selection with long and staged surgical procedure, Orthodontic intervention needs multidisciplinary approach and has limitations such as complex surgical procedure, high cost, and long follow up period (Ahmed et al, 2011). This study aims to optimize the surgical procedure for removal of wisdom tooth in contact or near the IAC, estimate the incidence of nerve injury, and determine the association between nerve injury and distance of root apex to the canal.

### **Patients and methods**

This prospective clinical controlled study was approved by Al-Shaab Specialized Dental Center institutional review board (2018/55), and conducted in Al-Shaab Specialized Dental Center from February 2018 to May 2019. A total of 100 patients were included and divided into two groups according to the distance of root apex from IAC, 40 patients were in the study group, and 60 patients were in the control group.

### **Inclusion criteria**

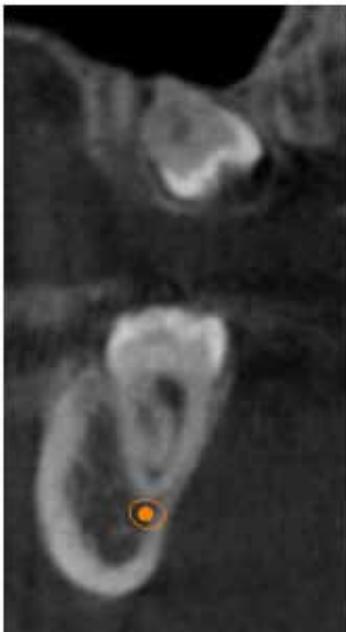
Any patient with symptomatic lower wisdom tooth or surgical removal indicated for orthodontic treatment. For the study group, the root apex is in contact or  $\leq$  1mm from the IAC (the root can be buccal, lingual, above the canal or the canal passes between roots). For the control group the distance  $>$  1mm.

### **Exclusion criteria**

1. Wisdom teeth associated with cyst or tumor.
2. Irradiated mandible.
3. Revision lower wisdom tooth surgery.
4. Diabetic patient.
5. Root apex within the canal, or surround it by more than 90°.
6. Patients who refused the surgery due to the expected risks.

### Preoperative assessment

Each patient was examined clinically and radiographically. When there was a close relation of root apex to the canal in the OPG or another predictive radiographical sign such as diversion of the IAC, root apex darkening, and deflected root apices, CBCT was ordered for precise positional assessment and estimation for the difficulty of the procedure. The parameters that examined by CBCT were the distance between root apex and IAC, depth, angulation of the tooth, and the number of roots, figure (1).



**Figure (1): Coronal CBCT slice interpretations of the distance between root apex and IAC.**

### Surgical procedure

Under local anesthesia (Lignospan Special/Septodont, France®) a full-thickness two-sided mucoperiosteal flap was reflected. Whatever the classification of impacted wisdom tooth, passive removal of the tooth is attempted by wide buccal and distal osteotomy all around the crown, sectioning of the crown and/or roots if needed (depending on tooth angulation, root number, and configuration) figure (2), exclude luxation of the tooth by the figure-of-eight move-

ment to avoid a wide range of root movement near the canal. Consideration of the root alignment with the canal during its removal is mandatory to avoid any impingement on the canal. Irrigation with normal saline was done to remove any bone spicules. Suturing with 3/0 silk suture. Postoperative medications: diclofenac acid tablet 1\*3.



**Figure (2): Operative field after tooth removal, the black arrow pointed peripheral osteotomy.**

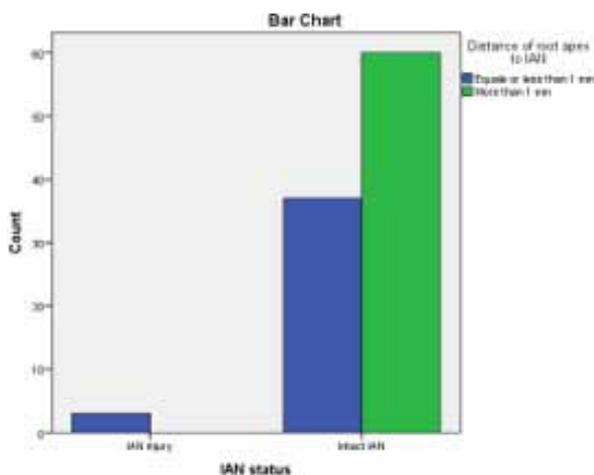
### Follow up and outcome measurement

The primary outcome which is nerve injury manifests as paresthesia (spontaneous, subjective, and not painful altered sensation) of lower lip and chin was evaluated depending on the subjective sensation of the patient. Patients follow up was done from the second day after surgery, if there is numbness in the lower lip and chin then Prednisolone 5 mg 2\*4 for 10 days tapering (Gatot and Tovi 1986) and neurorubin forte tablet 1\*1, Suture removal was done at day 7 postoperatively. Further, follow up after 1, 2, 3, and 6 months depending on the persistence of paresthesia. Statistical analysis was done using IBM SPSS statistics for windows, version 24.0 presented as a percentage, and mean when appropriate. Fisher's exact test was to measure the association between nerve injury and

distance of root apex from the IAC. Value with  $p < .05$  was considered statistically significant.

## Results

A total of 100 patients were included in this study. The study group involves 40 patients (18 males and 22 females) with a mean age of 23.5. The Control group involves 60 patients (26 males, 34 females) with a mean age of 24.5. Transient paresthesia was observed in three patients (0.07%) from the study group, which is nonsignificant as revealed by fisher's exact test ( $p=0.061$ ) figure (3). Full recovery was obtained in all cases (100%), after 1 week for two patients (0.05%), and after 1 month for the third one (0.02%). In the control group, no paresthesia was observed in all patients.



**Figure (3): Relation between distance and IAN injury, which is not significant at  $p$ -value  $< .05$ .**

## Discussion

Surgical removal of the third molar with a close relation to IAC is a safe procedure when a specific surgical technique is done. The risk of nerve injury can be minimized by passive surgical removal that protects the bony wall of the canal from pressure or a direct injury. In this study; no paresthesia

was reported in the control group (i.e when the distance between IAC and root apex  $> 1$ mm), this agrees with (Bell, 2004) who reported that no paresthesia encountered in any of 300 patients who underwent surgical removal of lower wisdom tooth. On another hand, several studies reported the incidence of IAN injury after surgical removal of lower third molar and the incidence was 0-8.4 (Cheung et al, 2010). This may be explained by the fact that in this study the distance between root apex and IAC was  $> 1$  mm but the distance was not recorded in all studies so the result was not for a specific distance. Most mandibular third molars are not in intimate contact with IAC so the surgery can be considered as a safe procedure and no injury should be anticipated (Bell et al, 2003). Also in this study preoperative radiographical evaluation by OPG was done and critically evaluate the distance between IAC and root apex, the number, and configuration of roots, so that any questionable tooth with positive prediction single was more evaluated by CBCT that gave a chance for more accurate surgical procedure and as a consequence less Intra and postoperative complications. Flanagan, 2012, reported that there is 49% risk of nerve exposure when there is clear contact of the apex of the mandibular third molar with the IAC on CBCT and he suspected that this will be associated with 23% risk for the postoperative altered sensation of those cases where there was CBCT apex–canal contact and 37% risk for postoperative altered sensation when nerve exposure clinically happens. It is important to evaluate the distance between root apex and IAC by CBCT that allows for 3D view and spatial configuration of the tooth that enables the surgeon to decide the amount of bone removal, the need for tooth sectioning, to determine the path of removal, to precisely measure the distance between root apex and IAC, and to evaluate encasement of

the IAC by the root. Smith, 2013, reported a clinical study on 1,000 patients, extracting 1,589 impacted lower third molar teeth and found that the lowest incidences were seen (0.8%) and (0.9%) when the nerve was either distant or close respectively depending on OPG, and the highest incidence was (11%) when the nerve was categorized as intimate «the tips of the roots are considered to be intimate to the IAC when 1 of the following 3 criteria are found: a. Diversion of the ID canal, b. Darkening of the root, c. Deflected root apices». In all previously mentioned studies, the focus was on the distance between root apex and IAC and they documented the higher incidence of injury in cases of close relation to the canal but in this study, it was found that despite the close relation and contact with IAC; nerve injury can be reduced to a minimum degree. In this study, for the study group transient paresthesia was observed in (0.07%) of cases which is nonsignificant at  $p$ -value  $<0.05$ , this may be explained by the fact that surgical technique should aim to reduce pressure on the canal as much as possible, modify the path of removal and the fulcrum point that is affected by the shape of roots and its relation to the canal by adapting wide surgical exposure, bone removal and tooth sectioning to allow withdrawal of roots away from the IAC in that direction that does not impinge on the canal without ignoring the experience of the surgeon that of quite an importance in such cases. Transient paresthesia that occurred in the study group is not significant statistically as well as clinically as full recovery of all cases was obtained after one month maximally, this is in agreement with (Deliver-ska and Petkova, 2016) that reported that 96% of IAN injuries recover within 4 - 8 weeks after surgery. While (Smith, 2013) reported that permanent nerve deficit was 0.4% when there is intimate contact with the canal. Paresthesia may be due to post-

operative edema at the surgical site that causes pressure on the nerve and with prescription of steroidal anti-inflammatory resolution of edema and recovery was obtained in all cases. Another cause for transient paresthesia may be hematoma formation due to surgical intervention that compresses the nerve (Hasegawa et al, 2013). In both situations, whether surgical edema or hematoma occurs, the resultant compression on the nerve will cause neuropraxia (focal demyelination) that affects impulse conduction velocity (Menorca et al, 2013). According to Seddon classification of peripheral nerve injury, IAN injury is classified as neurapraxia, axonotmesis, and neurotmesis (Seddon et al, 1943). Paresthesia was transient and fully recovered as no neurogenesis encountered by a surgical instrument, elevated root, or direct nerve injury by sharp bone specula of IAC wall (Sarikov and Juodzbalys, 2014). It is postulated that if the nerve remains within the IAC and not displaced into the socket or from the roof of the canal, it will regenerate even if it is injured (Renton, 2013).

### Limitation of the study

Small sample size due to patient refused to accept the expected risk of nerve injury especially in the asymptomatic tooth or tooth extraction for orthodontic treatment.

### Conclusion

The risk of IAN injury with close distance between the root and the IAC is not high and it is mostly of neuropraxia in nature.

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