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## Incidence of Injuries in Inferior Alveolar Nerve After Surgical Removal of Mandibular Third Molar. Prospective Study

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### Abstract

**Background and objective:** Inferior dental alveolar nerve injury is a recognized complication of mandibular third molar surgery, potentially resulting in sensory disturbances such as paresthesia and numbness in the lower lip and chin. Our study is aimed of to evaluate the incidence of IAN injury following surgical removal of third molar and to assess its management and outcomes.

**Material and Method;** Our study was involved surgical extraction of lower wisdom tooth for hundred patients. Preoperative assessments radiographically & clinically were accomplished. Around six months postoperative follow up period for any changes in neurosensory feeling for patients, with recording duration and management of I. A. N. injury.

**Results;** Factors of endanger represented in near proximity and deep impaction that making the roots in or around the mandibular canal, were resulted in permanent harm or damage persist after six months in four percent ((4%)) among the total number of 100 patients involved in the study. Transient effect or symptom of postoperative nerve harm/injury was clear in eight percent ((8%)) of patients among 100 case, were the symptom was solved and disappear within 3 months.

**Conclusion;** Surgery of the lower wisdom tooth stay accompanied with nerve harm or injury of inferior alveolar nerve. Effects could be temporary ((transient)) or permanent deficit which involve small ratio among patients. The essential keys for decreasing the incidence of nerve deficit/injury beside enhancing sequelae, were achieved by focusing on early/premature intervention, preoperative radiograph, and congruent surgical procedure.



**Keywords:** Inferior alveolar nerve injury, third molar surgery, Mandibular nerve, Paresthesia, Risk factors.

## Introduction

The inferior dental alveolar nerve, a branch of the mandibular division of the trigeminal nerve, plays important role in providing sensory innervation to the lower teeth, lower lip and chin region (1). Due to its anatomical course through the mandibular canal, the inferior dental alveolar nerve is highly susceptible to injury during various oral and maxillofacial surgical procedures, particularly the extraction of impacted mandibular third molars and the management of mandibular fracture (2). Injury to this nerve can result in significant neurosensory disturbances such as numbness, paresthesia, dysesthesia, or even chronic neuropathic pain, which can severely impact a patient daily functioning and psychological well-being (3). One of the most common causes of iatrogenic inferior dental alveolar nerve injury is the surgical extraction of mandibular third molars, especially when the roots of the tooth are in close proximity to or encroaching upon the mandibular canal (4). Risk factors contributing to nerve injury include deep impaction, difficult surgical access, operator experience and anatomical variations (5). Reported incidences vary from 0.4% to 8%, depending on the population, surgical technique and criteria used to define nerve injury (6). While most of these injuries are transient and resolve spontaneously within weeks to months, a minority may become permanent, leading to long-term morbidity (7). In case of mandibular trauma, especially fractures involving the mandibular body or angle the inferior dental alveolar nerve (IAN) can be directly injured by the fracture line or secondarily affected during surgical fixation (8). The likelihood of neurosensory deficit such case is influenced by the fracture type, displacement and timing of treatment. Nerve recovery is critically improved by correct diagnosis and adequate surgical planning (9). Diagnosis and management of nerve injuries are assessed by the main single component which is the function of neurosensory nerve. Assessment the progression and extent of the sensory nerve recovery by combination of objective and subjective techniques like; tow-point discrimination, pinprick testing, light touch discrimination, and electrophysiological studies (10). Figure out the timeline and manner of nerve healing assist the operator making his decision and supply prognostic data for the patient (11). Growing the request for the esthetic and functional remedy after complex surgical procedures become a preference in oral maxillofacial surgery, which is achieved by preventing, identifying, and managing the nerve harm (12). The aim of my study is to reconnoitering the occurring of the injuries for inferior

alveolar nerve during surgical removal of the lower wisdom tooth.

## Materials and Methods

The study was accomplished in the oral maxillofacial surgery department/College of Dentistry/University of Anbar since October-2021, to May-2025. Institutional Ethical Review Board approved the study. Before the surgical procedure, all the patients were completed the consent form. A total of 100 patients (52 females and 48 males) aged between 18 to 40 years who required surgical extraction of mandibular third molars were included. Patients were selected based on the following: Inclusion criteria; Patients requiring surgical removal of impacted mandibular third molars; Good general health & Availability for follow up. Extraction criteria: Systemic diseases affecting nerve function (e.g., diabetes mellitus), History of trauma or previous surgery in the mandibular region and Non-cooperative patients. Preoperative Assessment: Clinical examination and digital panoramic radiographs ( orthopantograms) were taken for all patients to evaluate the position and impacted type of the third molar in relation to the inferior alveolar canal. Classification systems used included: Pell and Gregory Classification, Winter's classification and Risk indicators such as proximity of the root to the mandibular canal, angulation, and depth of impaction were recorded. **Surgical Procedure:** All surgeries were performed under local anesthesia by operator with more than 5 years of experience. A standardized Surgical technique was used: Mucoperiosteal flap reflection, Buccal bone removal using surgical handpiece. Tooth sectioning where necessary, Copious irrigation with normal saline, Wound closure with 3/0 silk sutures and Postoperative instructions, antibiotics, and analgesics were prescribed for 5-7 days. Assessment of inferior alveolar nerve (IAN) injury: Patients were monitored for IAN injury at: 1 week, 1 month, and 6 months postoperative. **Objective assessment included:** Two-point discrimination test and Light touch and pinprick sensitivity using cotton wool and blunt probe. **Subjective symptoms included:** Numbness, Tingling and Burning or altered sensation in the lower lip and chin area. **Injury outcome were categorized as:** Transient injury; Full recovery within 3-6 months. Permanent injury; Symptoms persisted beyond 6 months. **Statistical Analysis:** Data were analyzed using SPSS software version [version 20]. Descriptive statistics were used to report frequencies and percentages. Chi-square test and logistic regression were applied to identify significant associations between risk factors and nerve injury. A p-value of <0.05 was considered statistically significant.



## Results

Out of the 100 patients who underwent mandibular third molar surgery, inferior dental alveolar nerve injury occurred in 12% of cases, with 8% classified as transient and 4% as permanent injuries as in table 1. Analysis of risk factors revealed a statistically significant association between IAN injury and several clinical parameters. Deep impaction was present in 83.3% of injured cases compared to 47.7% of non-injured cases ( $P=0.01$ ), while close proximity of the tooth root to the mandibular canal was observed in 91.7% of injured patients versus 37.5% in the non-injured patients ( $P=0.002$ ). Surgical difficulty was also significantly associated with nerve injury (75% vs. 31.8%,  $p=0.01$ ), whereas mesioangular impaction did not show a significant correlation ( $p=0.19$ ) (Table 2). Regarding recovery outcomes, 25% of affected patients experienced full resolution of symptoms within one month, and 41.7% recovered within three months. However, even after six months period, 33.3% exhibit

no sign of revival ((Table-3)), explaining an essential ratio of cases having long-term nerve harm/damage. Identification the independent endanger factors related to wounding I. A. N. following surgical procedure of lower wisdom tooth was conducted by logistic regression analysis. The result showed that close proximity of the tooth root to the mandibular canal was the potential marker of nerve injury, with an odds ratio (OR) of 16.1 (95% CI: 2.9-88.3;  $p=0.002$ ) indicating a significantly increased risk. Deep impaction also was an important endanger factor, with an OR of 5.4 (95% CI: 1.3-22.4;  $p=0.018$ ). Similarly, high surgical difficulty was associated with greater odds of IAN injury (OR = 6.5; 95% CI: 1.6-25.7;  $p=0.010$ ). In contrast, mesioangular impaction was not significantly associated with nerve injury (OR = 2.1; 95% CI: 0.7-6.5;  $p=0.190$ ) as in table (4). These findings suggest that anatomical and surgical factors, particularly root proximity and impaction depth, play a critical role in the risk of postoperative IAN injury.

**Table 1: Incidence and Outcome of Inferior alveolar nerve injury**

Outcome of IAN Injury	Number of patients (n=100)	Percentage %
No IAN Injury	88	88 %
Transient IAN Injury	8	8 %
Permanent IAN Injury	4	4 %
Total	100	100 %

**Table 2: Association between risk factors and inferior alveolar nerve injury**

Risk factors	IAN injury (N = 12)	No IAN injury (N = 88)	p-value
Deep impaction	10 (83.3 %)	42 (47.7 %)	0.018*
Close to root proximity to canal	11 (91.7 %)	33 (37.5 %)	0.002**
Mesio angular impaction	7 (58.3 %)	35 (39.8 %)	0.19***
Surgical difficulty	9 (75 %)	28 (31.8 %)	0.01

\* Significant at  $P < 0.05$  \*\* High Significant at  $P < 0.01$  \*\*\* No significant at  $P > 0.05$

**Table 3: Recovery timeline in patients with LAN injury (N=12)**

Recovery time	Number of patients	Percentage (%)
Within one month	3	25%
Within three	5	41.7%
No recovery at six months	4	33.3%

**Table 4: Logistic Regression for Predictors of Inferior dental alveolar nerve injury**

Risk factor	Odds Ratio (OR)	95% Confidence Interval (CI)	P-value
Deep impaction	5.4	1.3-22.4	0.01*
Close root proximity	16.1	2.9- 88.3	0.002**
Mesioangular impaction	2.1	0.7-6.5	0.19***
High surgical difficulty	6.5	1.6-25.7	0.01

\* Significant at  $P < 0.05$  \*\* High Significant at  $P < 0.01$  \*\*\* No significant at  $P > 0.05$

## Discussion

After complex surgical procedure of the lower wisdom tooth, damage to I. A. N. could happen. My study scrutinized occurrence, endanger factors, and healing end results of IAN injury. Postoperatively, a 12% of patients have symptoms of IAN damage. This percentage is harmonious with recorded results from previously literature, that range from 1 % to 20 %, relating on the diagnostic technique, patients' number, and complexity of procedure (13). Within the first three months, eight percent ((8%)) were completely recovered, whereas persistent nerve damage even after six months period seen in four percent ((4%)) of patients. In spite of the self-limiting healing of temporary nerve injury, still the small but significant number of patients will have a permanent nerve deficit, that confirm the requirement for preoperative consent form and appropriate patient counselling (14,15,16). A considerable relation of some endanger factors with I.A.N damage were found, like deep impacted tooth, as much as deep impaction as much nerve damage will occur ((83.3 % against 47.7 %  $P = 0.018$ )). I.A.N injury ((incidence 0.35 – 8.4 %)) was predicted by radiological marks of root-nerve close proximity was noted by a systemic review ((14 large studies, 2009

– 2014)) (17). Close root proximity to the mandibular canal showed the strongest association (91.7% vs 37.5%;  $p = 0.002$ ), highlighting the critical importance of root position in surgical planning. Panoramic/ CBCT imaging evidence confirms that root superimposition on the canal significantly increases risk (18). Myers also identified surgical difficulty, multi-rooted teeth, and nerve-root proximity as multivariate predictors (19). High surgical difficulty also had a statistically significant relationship (75% vs 31.8%;  $p = 0.01$ ), which is expected, as difficult surgeries involve more manipulation and risk to the nerve. Postoperative data showing depth of impaction (a difficulty surrogate) is linked to higher nerve injury risk (15). Mesioangular impaction, although more common in the IAN injury group (58.3% vs 39.8%), did not reach statistical significance ( $p = 0.19$ ), suggesting a possible trend but not a strong independent risk factor. Although more common in the IAN injured group (58% vs 40%), it lacked significance ( $p = 0.19$ ). Other findings include: Permanent IAN injuries were associated with mesioangular orientation in one Australian audit (11,599 teeth), particularly in >25-year-old (20). Similarly, horizontal impactions often feature higher injury rates (~1.7% vs 1.1% for vertical impaction) (21). 25% three patients recovered within 1 month, 41.7% (5 patients)



had recovery within 3 months, 33.3% (4 patients) showed no recovery at 6 months, indicating permanent injury. Temporary nerve damages are representing the majority in comparison to permanent nerve deficit, but still the number of permanent nerve defect is significance ((1 in 3)). A big retrospective cohort((n=4.995extraction)) show~ 50% complete healing within six months, major retrieval within the three months (22). A prospective survey ((n=4.338)) display~67% complete I.A.N retrieval with six months (15). Recovery differentiation; nerve healing follows the based range, 33% with no healing or nerve retrieval was because of the complexity of the surgical procedures not for the cases number. Within odds ratio ((OR)) of 16.1 ((95% CI;2.9-88.3; p=0.002)), the potent predictor was the close proximity of root-nerve area, this indicating that a patient has this criterion is 16 times more susceptible for nerve injury in contrast to patients without this feature. More difficulty in surgical procedure was a powerful endanger factor ((OR; 6.5; p=0.01)), reaffirming the finding in Table 2. The significant reason for nerve defect represented by deep impacted tooth ((OR;5.4; p-0.01)) which need a potential and cautious assessment before surgical procedure. Statistically, non-significant predictor p=0.19 with OR-2.1 in case of mesioangular impaction, lining with univariate analysis. Odds rate around ((OR=16.1; p = 0.002)), difficulty of surgery ((OR=6.5; p 0.01)), deep impacted tooth ((OR 5.4; p = 0.01)), and the mesial angulation ((NS)). Difficulty of the surgical technique, multiple root anatomy, and root-nerve interference, are considered as a major marker also mentioned by Pippi & De Luca in regression analysis ((22)). Prospective task relay on CBCT confirmed root-nerve relation, beside more severity scores, and extended surgical procedure, all indicating high I.A.N injuries odds (23). Our markers independently stand with previously multivariate researches, specially emphasize the pivotal action of proximity of the inferior canal and the surgical difficulty.

## Conclusion

Injury of the inferior dental nerve by risk factors individually and as independent predictors, which include close proximation of the roots of the wisdom teeth to mandibular canal, deep impacted tooth, and high difficulty of the surgical procedure. Preoperative radiological and clinical examinations beside completing the consent form is seem to be mandatory in such cases that expect postoperative complications, specifically if expecting permanent I.A.N injury in case of un-recovery, this was strengthen by regression study.

Before starting the surgery, patient education and explanation of the complications that could happen, is crucial and very important

in such cases. Also, the requirement for precise surgical procedure could decrease the complication related to I.A.N.

## Recommendation

- 1 Radiographic films including OPG & CBCT are very significant to estimate the hazard of I.A.N injury
- 2 Concerning probable nerve complications, consent form should include all the specifics explained for the patients.
- 3 In highly endanger cases, other techniques in dentistry ((surgically or non-surgically)) before the extraction may be considered.
- 4 Progressing in healing or nerve retrieval results, can be improved by early management.

## Declaration

**Conflict of interest;** There are no conflicts of interest to announce

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**Ethical approval:** This study was carried out according to the commission of medical ethics in Ministry of Higher Education and Scientific Research

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