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Research Article

Incidence of Injuries to the Inferior Alveolar and Lingual Nerves in the Oral Surgery Department on the CCTD IBN ROCHD-Casablanca

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Abstract

Introduction: Injuries to the inferior alveolar nerve (IAN) and lingual nerve (LN) are relatively common complications during oral surgery procedures. These injuries can result in temporary or permanent sensory disturbances in the regions innervated by these nerves, significantly affecting patients 'quality of life'.

Objective: The aim of our study is to investigate the incidence rate of IAN and LN lesions in the oral surgery department of the CCTD Ibn Rochd in Casablanca.

Materials and Methods: We conducted a descriptive cross-sectional study of patients who underwent surgical procedures on the mandibular arch, at the oral surgery department of the CCTD Ibn Rochd in Casablanca from November 15, 2022 to February 15, 2023. Statistical analysis was performed using SPSS software.

Results: Our population is made up of 60 patients, 65% of whom are women, 41.6% aged between 21 and 29, and 80% in good general condition. In terms of surgical procedures, 3MM extraction accounted for 91.6% of all procedures performed, cyst enucleation (5%), implant placement (1.7%) and benign tumor surgery (1.7%). 66.7% of these procedures were performed by a doctor specializing in oral surgery. Panoramic radiography was carried out in 100% of cases, while cone beam was performed in 15%. Regarding nerve lesions, no LN lesions were found in our study. Injury to the IAN was observed in 2 patients, one female and one male, following cyst enucleation. The common symptom between these two patients was numbness of the labiomental region on the operated side. The incidence of IAN lesions was 3.3% in our study. A statistically significant correlation ($P < 0.001$) was observed between the presence of IAN lesions and the age of the patients, as well as with the surgeon performing the procedure.

Conclusion: A thorough understanding of the incidence of IAN and LN lesions in oral surgery is essential to improving the quality of patient care. By accurately identifying the prevalence, nature and risk factors of these lesions, practitioners can design more effective screening strategies and more appropriate treatment plans. This approach leads to optimal therapeutic results and an overall improvement in the quality of care.

Keywords: *Postoperative Sensitivity; Inferior Alveolar Nerve; Lingual Nerve; Iatrogenic Nerve Injuries*

Introduction

the inferior alveolar nerve (IAN) and the lingual nerve (LN) are two major sensory branches of the third division of the trigeminal nerve (mandibular nerve) [1]. The IAN provides sensory innervation to the mandibular teeth, the buccal gingiva, the lower lip, and the chin, whereas the LN supplies sensation to the anterior two-thirds of the tongue and the lingual gingiva of the mandible [1]. Owing to their anatomical course, these nerves are particularly susceptible to injury during various oral surgical procedures, including mandibular third molar extraction, dental implant placement, surgical excision in the mandibular region, management of mandibular fractures, and endodontic surgery [1,2].

Although relatively uncommon, iatrogenic injury to these structures may have significant psychological, functional, and medicolegal consequences [1,2]. The mechanisms and nature of these injuries are commonly described using two main classification systems [3,4].

The first is based on the microanatomy of the affected nerve. The oldest and most widely used is Seddon's classification, introduced in 1943, which distinguishes three levels of severity [2-4]:

- **Neurapraxia:** A reversible conduction block without axonal disruption. The anatomical integrity of the nerve, including both the axon and its connective tissue sheaths, is preserved. This type of injury is typically caused by mild trauma, such as compression or contusion, resulting in focal demyelination. Recovery is complete and usually occurs within hours to weeks without surgical intervention [2-4].

- **Axonotmesis:** Results from moderate trauma, such as nerve stretching or crushing. It is characterized by axonal disruption, whereas the connective tissue sheaths may remain intact. Axonal regeneration is possible; however, functional recovery is often incomplete and variable, extending over several months or even years [2-4].

- **Neurotmesis:** The most severe form of nerve injury. It involves complete transection of the nerve with distal degeneration and disruption of the internal neural architecture, including the perineurium and endoneurium. Causes include severe contusion, excessive traction, laceration, local toxicity, or inadvertent surgical transection. Spontaneous recovery is not expected, and surgical repair is generally required to achieve functional recovery [2-4].

The second classification is based on the patient's clinical sensory manifestations and comprises four main categories:

- **Anesthesia:** Complete absence of detection or perception of any tactile, thermal, or painful stimulus [2-4].
- **Paresthesia:** An alteration in sensation characterized by abnormal, usually non-unpleasant sensations such as tingling. It may occur spontaneously or be elicited by a stimulus [2-5].
- **Hypoesthesia**: A reduced sensory response to a stimulus [2-4].
- **Dysesthesia:** An abnormal and unpleasant sensation, either spontaneous or stimulus-evoked, typically presenting as burning, tingling, or numbness, often accompanied by pain. This category includes hyperalgesia (an exaggerated pain response to a noxious stimulus) and allodynia (pain elicited by a normally non-painful stimulus) [2-4].

According to the literature, the incidence of these injuries varies depending on the type of surgical procedure, the operative technique used, the surgeon's experience, the complexity of the treated cases, and the diagnostic methods employed. However, no study has yet been conducted in the Moroccan university hospital setting, limiting the ability to accurately assess the incidence of these complications and their impact on patients' quality of life.

Aim of the Study

The aim of this study was to evaluate the incidence of inferior alveolar nerve and lingual nerve injuries in the Department of Oral Surgery at the CCTD Ibn Rochd, Casablanca, and to identify the associated risk factors.

Materials and Methods

A descriptive cross-sectional epidemiological study was conducted over a four-month period (from November 15, 2022, to February 15, 2023) in the Department of Oral Surgery at the Casablanca Dental Treatment and Consultation Center (CCTD). The study aimed to determine the incidence of inferior alveolar nerve (IAN) and lingual nerve (LN) injuries.

The study included all patients who underwent a surgical procedure involving the mandibular arch, including surgical extraction of mandibular third molars (3MM), cyst enucleation, dental implant placement, or surgery for benign oral tumors, and who provided written informed consent to participate. Patients who refused to participate were excluded from the study, as were those who, at the initial assessment, presented with symptoms suggestive of an NAI or NL lesion that had occurred outside our study period or at another location.

Data were collected from patients' medical records and a standardized data collection form divided into three sections. The first section recorded the patients' sociodemographic characteristics.

The second section included information related to the surgical procedure, including the type of surgery, the operator, the radiographic examination performed, and the radiographic relationship between the surgical site and the IAN. The third section focused on the occurrence of IAN or LN injuries.

The collected data were entered into Microsoft Excel spreadsheets and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS) software at the Epidemiology and Biostatistics Laboratory of the Faculty of Dental Medicine, Casablanca.

Results

A total of 60 patients were included in the study, of whom 35% were male and 65% were female. Patients ranged in age from 18 to 67 years, with a mean age of 33 years.

Regarding socioeconomic status, 35% of the patients were classified as having a low socioeconomic status, 58.3% a middle socioeconomic status, and 6.7% a high socioeconomic status. Overall, 80% of the patients were in good general health, whereas 20% had an underlying systemic disease (Table 1).

<table>
<tr><th>Sample</th><th>Sex</th><th>Age</th><th>Socioeconomic status</th><th>General health</th></tr>
<tr><td rowspan="8">60 patients
(100%)</td><td rowspan="3">Female: 39
(65%)</td><td>18-20: 4 (6,7%)</td><td rowspan="3">Low: 21 (35%)</td><td>Good general health: 48 (80%)</td></tr>
<tr><td>21-29: 25 (41,6%)</td><td>Type 2 diabetes: 2 (3,3%)</td></tr>
<tr><td>30-39: 20 (33,3%)</td><td>Hypertension: 2 (3,3%)</td></tr>
<tr><td rowspan="5">Male: 21
(35%)</td><td>40-49: 4 (6,7%)</td><td rowspan="2">Middle: 35 (58,3%)</td><td>Asthma: 5 (8,3%)</td></tr>
<tr><td>50-59: 3 (5%)</td><td>Epilepsy: 1 (1,7%)</td></tr>
<tr><td rowspan="3">≥60: 4 (6,7%)</td><td rowspan="3">High: 4 (6,7%)</td><td>Osteoporosis: 1 (1,7%)</td></tr>
<tr><td>History of cancer: 1 (1,7%)</td></tr>
</table>

Table 1: *Sociodemographic characteristics.*

The distribution of the surgical procedures performed was as follows: 91.6% were surgical extractions of 3MM, 1.7% were dental implant placements, 5% were cyst enucleations, and 1.7% were surgeries for benign oral tumors.

These procedures were performed by different operators: 1.7% by professors of Higher Education, 5% by associate professors, 1.7% by assistant professors, 66.7% by specialist practitioners, and 25% by resident doctors.

The relationship between the surgical site and the IAN was assessed using panoramic radiography alone in 75% of patients and panoramic radiography supplemented with CBCT in 15% of patients (Table 2).

Sample	Surgical procedures	Operator	Radiographic examination	Relationship with IAN
60 patients (100%)	Surgical extraction of 3MM: 55 (91,6%)	PHE: 1 (1,7%)	Panoramic radiograph: 60 (100%)	Distant from IAN: 23 (38,3%)
	Dental implant placement: 1 (1,7%)	Associate Professor: 7 (5%)		Superimposition with IAN: 29 (48,3%)
		Assistant Professor: 1 (1,7%)		Darkening/blurred roots: 13 (21,7%)
	Cyst enucleation: 3 (5%)	Specialist practitioner: 40 (66,7%)	CBCT: 9 (15%)	Narrowing/interruption of IAN canal: 8 (13,3%)
	Benign tumor surgery: 1 (1,7%)	Resident doctor: 15 (25%)		Close relationship confirmed by CBCT: 8 (13,3%)

Table 2: *Surgical characteristics.*

Regarding nerve injuries, no lingual nerve (LN) injury was observed, and all patients regained normal tongue sensation after surgery. In contrast, inferior alveolar nerve (IAN) injury was identified in two patients (one female and one male) following cyst enucleation, corresponding to an incidence of 3.3%. Both patients experienced numbness associated with tingling sensations involving the lower lip and chin on the operated side, which developed on the day following surgery (Table 3).

Sample	Characteristics of IAN Injuries							
	Number	Age	General health	Socioeconomic status	Surgical procedures	Operator	Radiographic examination	Symptoms
60 patients (100%)	2 (1 female, 1 male) (3.3%)	18-20: 0 (0%)	Good general health: 1 (1.7%)	Low: 2 (3,3%)	Surgical extraction of 3MM: 0 (0%)	PHE: 0 (0%)	Panoramic radiograph (0%)	Numbness + tingling: 1 (1.7%)
		21-29: 0 (0%)	Type 2 diabetes: 1 (1.7%)			Associate Professor: 0 (0%)		
		30-39: 0 (0%)	Hypertension: 0 (0%)	Middle: 0 (0%)	Dental implant placement: 0 (0%)	Assistant Professor: 1 (1.7%)		Numbness + pins and needles: 1 (1.7%)
		40-49: 0 (0%)	Asthma: 0 (0%)			Specialist practitioner: 0 (0%)	Panoramic radiograph + CBCT: 2 (3,3%)	Burning, electric shock, cold, heat, stretching, contraction, itching: 0 (0%)
		50-59: 0 (0%)	Epilepsy: 0 (0%)		Cyst enucleation: 2 (3,3%)			
		≥60: 2 (3,3%)	Osteoporosis: 0 (0%)	High: (0%)	Benign tumor surgery: 0 (0%)	Resident doctor: 1 (1.7%)		
			History of cancer: 0 (0%)					

Table 3: *Characteristics of IAN injuries.*

Discussion

In our study of 60 patients who underwent surgical procedures involving the mandibular arch, no lingual nerve (LN) injuries were observed. In contrast, two patients (3.3%) sustained inferior alveolar nerve (IAN) injuries, both occurring following cyst enucleation.

The main challenges encountered during this study included poor compliance of some patients with postoperative follow-up and the difficulty experienced by patients with IAN injuries in accurately describing their symptoms. Furthermore, the relatively small sample size (60 patients) limits the generalizability of our findings. In addition, some clinicians routinely prescribed a combination of B-complex vitamins and postoperative corticosteroid therapy following 3MM extraction when a close relationship with the IAN was identified, which may have masked the transient symptoms of iatrogenic nerve injury. Despite these limitations, our study provides a relevant estimate of the incidence of iatrogenic nerve injuries in our department.

Several studies have reported variable incidences of nerve injuries following oral surgical procedures. In Germany, Herbert Deppe., *et al*. investigated the incidence of trigeminal nerve branch injuries in 1559 patients who underwent various mandibular surgical procedures, including surgical extraction of 3MM, bone biopsies, dental implant placement, and endodontic surgery. The overall incidence of nerve injuries was 2.69%, including 2.31% involving the IAN and 0.38% involving the LN [6].

In Belgium, Jimoh Olubanwo., *et al*. evaluated trigeminal nerve branch injuries in 7602 patients attending the Department of Oral and Maxillofacial Surgery. They reported an overall incidence of 0.74%, including 0.64% IAN injuries and 0.07% LN injuries [7].

Another Belgian study conducted by Klazen Y., *et al*. reported an overall incidence of iatrogenic nerve injuries of 0.6% among 8,845 patients treated in the Department of Oral and Maxillofacial Surgery. Of these injuries, 0.32% involved the IAN and 0.24% involved the lingual nerve [8]. Therefore, the findings of our study fall within the range of incidences reported in the literature, with a slightly higher incidence of IAN injuries (3.3%) and no cases of LN injury (0%), despite the relatively small sample size of 60 patients.

The variability in the reported incidence rates may reflect the influence of several factors on the occurrence of nerve injuries. Our study demonstrated a statistically significant association between patient age and IAN injury ($P < 0.001$), with both cases occurring in patients older than 60 years. This finding is consistent with that reported by Hee Jin Kim., *et al*. who, in a study investigating the risk factors for IAN injury following surgical extraction of 3MM, also found a significant association between patient age and the occurrence of these injuries [9]. The increased risk associated with advancing age may be explained by physiological changes, including a reduced capacity for nerve regeneration, decreased bone elasticity, increased root density, and a higher prevalence of hypercementosis [9]. In contrast, Herbert Deppe., *et al*. found no significant association between patient age and the occurrence of nerve injuries [6].

The type of surgical procedure was identified as a determining factor in the occurrence of nerve injuries in our study. Both cases of nerve injury occurred following cyst enucleation, a procedure that accounted for only 5% of all surgical interventions performed. In contrast, no nerve injuries were observed following surgical extraction of 3MM, despite these procedures representing 91.6% of all interventions, nor after dental implant placement. These findings differ from those reported by Matias Garcia-Blanco., *et al*. who identified lower molar extraction (47%) and dental implant placement (20%) as the leading causes of nerve injuries, whereas cyst enucleation accounted for only 7% of cases [10].

A cross-sectional study conducted by Nelli Agbulut**,** based on an online survey of 1477 Turkish general dentists and specialists, also evaluated the incidence of IAN and LN injuries associated with various oral and maxillofacial surgical procedures. Implant surgery (72%), surgical extraction of 3MM (65%), and local anesthesia (31%) were the procedures most frequently associated with these injuries, whereas pathology-related surgical procedures, including cyst enucleation, accounted for only 13% of cases [11].

As surgical extraction of 3MM is the most commonly performed procedure in oral surgery, numerous studies have specifically investigated the incidence of nerve injuries associated with this intervention. In India, Thaufiq Ahamed MI., *et al*. conducted a study involving 80 patients who underwent surgical extraction of 3MM to evaluate the incidence of IAN and LN injuries. They reported an incidence of 7.5% for LN injuries, whereas no cases of IAN injury were observed [12]. Another study from India conducted by Daware., *et al*. evaluated postoperative nerve complications following surgical extraction of 3MM in 163 patients. They reported an incidence of 2% for LN injuries, with no cases of IAN injury [13].

In the United Kingdom, Jerjes., *et al*. conducted a prospective study involving 3236 patients who underwent surgical extraction of 3MM. They reported an incidence of 1.8% for LN injuries and 1.5% for IAN injuries [14]. In Singapore, Ramadorai., *et al*. reported an incidence of 0.62% for IAN injuries and 0.08% for LN injuries following the surgical extraction of 1276 3MM [15].

Regarding dental implant placement, most studies have primarily focused on injuries to the inferior alveolar nerve (IAN). In a retrospective study conducted by Dannan A., *et al*. the incidence of IAN injury was evaluated in German patients who underwent mandibular implant placement with a distance of ≤ 2 mm between the implant apex and the superior border of the mandibular canal. Among the 169 patients included, 29 developed symptoms consistent with IAN injury, corresponding to an incidence of 2.95% [16]. This incidence is slightly higher than that observed in our study, in which no nerve injuries occurred following dental implant placement.

In our study, eight patients exhibited a close relationship between the surgical site and the IAN, as demonstrated by panoramic radiography and CBCT. However, only two of these patients developed IAN injury, indicating that no statistically significant association was found between proximity to the IAN and the occurrence of nerve complications. These findings are inconsistent with those reported by Verma., *et al*. who observed that all IAN injuries following surgical extraction of 3MM were associated with narrowing of the mandibular canal and close proximity between the IAN and the roots of the 3MM, as identified on both panoramic radiographs and preoperative CBCT scans [17].

Another study conducted by Hoshi R., *et al*. showed that, among 184 patients who underwent mandibular cyst enucleation, 31.6% developed IAN injury. One of the predictive factors identified was the absence of the cortical white lines separating the IAN from the cystic lesion. This radiographic finding indicates the absence of a protective bony boundary, suggesting an intimate relationship between the cyst and the nerve, thereby increasing the risk of nerve injury during surgery [18].

Regarding the operator's experience, the two cases of IAN injury observed in our study were performed by a resident doctor and an assistant professor, respectively. This association was statistically significant ($P < 0.001$). These findings are consistent with those reported by Jerjes., *et al*. who identified operator experience as a risk factor for nerve injuries. Among 1565 patients who underwent surgical extraction of 3MM performed by trainee practitioners, 2.5% developed IAN injury and 2.8% developed LN injury, compared with only 0.5% and 0.8%**,** respectively, among 1671 procedures performed by experienced specialists [19].

Furthermore, a systematic review by Kang F., *et al*. including 6738 surgical extractions of 3MM from six studies, demonstrated that patients treated by trainee practitioners had a higher prevalence of IAN injury (2.3%) than those treated by experienced specialists (0.9%) [20].

In contrast, the study conducted by Renton T., *et al*. reported that, among 290 general dental practitioners, 239 nerve injuries were recorded during their professional careers, whereas 206 nerve injuries were reported among 125 specialists. These findings suggest a higher incidence of nerve injuries among specialists than among general dental practitioners, which may be explained by the fact that specialists perform a greater number of high-risk surgical procedures [21].

IAN and LN injuries most commonly result in sensory disturbances manifested as numbness, tingling, pins and needles sensations, or electric shock-like sensations. Although pain is not consistently present, some patients may experience dysesthesia associated with unpleasant sensations in the affected area [15]. In our study, both patients presented with paresthesia characterized by numbness of the labiomental region on the operated side, associated with pins-and-needles sensations in the first patient and tingling in the second. Similarly, Garcia-Blanco M., *et al*. reported that paresthesia was the most common symptom, accounting for 50% of IAN and LN injuries, followed by anesthesia and dysesthesia, each observed in 17% of cases [10]. In another study, Caissie R., *et al*. described a series of 165 patients presenting with iatrogenic paresthesia involving the third division of the trigeminal nerve, in which the majority exhibited hypoesthesia (62%) or anesthesia (10%), whereas dysesthesia was reported in 22% of cases [22].

Given the frequency and diversity of these sensory disturbances, the implementation of appropriate preventive strategies is essential. Most iatrogenic paresthesias can be avoided through meticulous preoperative planning and the use of careful, atraumatic surgical techniques. Three-dimensional imaging, particularly CBCT, enables precise visualization of the course of the nerves and facilitates the identification of high-risk situations. Furthermore, informing patients about the potential risks and obtaining informed consent remain essential steps in the prevention of these complications [22,23].

Conclusion

Our study reported an incidence of 3.3% for iatrogenic injuries involving the IAN and the lingual nerve LN. Analysis of the risk factors revealed significant associations between patient age, the type of surgical procedure, operator experience, and the occurrence of these injuries. These findings provide valuable local epidemiological data and contribute to a better understanding of high-risk situations in oral surgery, thereby helping to guide future clinical practice and practitioner training.

Established Knowledge

- IAN and LN injuries are well-recognized complications of oral surgery and may present as paresthesia, dysesthesia, or anesthesia.
- The incidence of nerve injuries varies according to the type of surgical procedure, the operator's experience, and the patient's age.
- Surgical extraction of 3MM and dental implant placement are the procedures most frequently associated with these injuries.

Contribution of the Present Study

- This study reports a local incidence of 3.3% for IAN and LN injuries, thereby complementing the existing literature for our population.
- It confirms the significant influence of patient age, the type of surgical procedure, and operator experience on the risk of nerve injury.
- It provides data specific to the Department of Oral Surgery at the CCTD Ibn Rochd, Casablanca, which may help improve preventive strategies and practitioner training.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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