

Prognostic Factors Governing the Recovery from Inferior Alveolar Nerve Injury after Surgical Extraction of Mandibular Third Molar

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Abstract

Background: This study aims to find out prognostic factors governing the recovery from inferior alveolar nerve (IAN) injuries after the third molar removal. **Materials and Methods:** The prospective study was conducted on 100 patients who underwent extraction of mandibular third molar (MTM) where the root apices were in close approximation to IAN canal. The patients were evaluated postoperatively for any IAN deficit. **Results:** About 13% nerve injuries (temporary being 12% and 1% permanent) were observed. About 100% recovery was seen within one month in patient of the 2nd decade, 66.6% of patients recovered within 1 month of the 3rd decade, 66.7% of patients recovered within 3 months belonging to the 4th decade, and 100% recovery was seen in patient of the 5th decade after 6 months. About 85.3% of females had IAN deficit recovered within 3 months whereas 50% of males recovered within 1 month period but results were insignificant. Recovery was significantly delayed when hemorrhage (HAE) from IAN canal was seen along with nerve exposure (NE). **Conclusion:** Mostly nerve injuries were temporary recovering within 6 months. Prognosis of nerve injury was better in younger and when no HAE from socket or NE was noticed. Recovery from nerve injury was equivocal for male and females.

Keywords: Inferior alveolar nerve damage, Mandibular third molar extraction, Neurosensory deficit, Neurosensory disturbance, Recovery from nerve injury.

INTRODUCTION

Inferior alveolar nerve (IAN) injuries occurring after surgical extraction of mandibular third molar (MTM) are always unexpected and unintentional but mark a psychological impact on patient and are a subject of litigations and malpractice.^[1] The contiguity of MTM roots with mandibular canal being the reason for the damage of IAN. Symptoms of nerve deficit may be manifested as numbness in lower teeth, chin, or lip; difficulty in speech and mastication; drooling of fluids and saliva; and allodynia. Mostly IAN injuries are transient in nature with spontaneous recovery ranging from 0.5% to 5% and permanent injuries <1%.^[2]

Thus, evaluating the prognostic factors predicting the recovery from IAN injury following MTM extraction is important for surgeon as well as patient. Therefore, we conducted a study on 100 patients with an aim:

1. To evaluate the most common type of nerve injury following the third molar removal
2. To study the duration of recovery of IAN after its damage
3. To assess whether age of patient affects the recovery from nerve injury

4. To find the association between the gender and recovery of the nerve from the injury
5. To establish the relation between the intraoperative findings (hemorrhage [HAE] and nerve exposure [NE]) and the recovery of the nerve damage.

MATERIALS AND METHODS

This prospective study was conducted on patients who reported to the outpatient Department of Oral and Maxillofacial surgery, People's College of Dental Science and Research Centre for the surgical extraction of MTM from January 1, 2018, to January 2, 2019. This study followed the Declaration of Helsinki on medical

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protocol and ethical clearance was obtained from the Institutional Ethics Committee (Ref/PCDS/ACAD/8/2017-18/11) approval date – December 15, 2017. Informed written consent was obtained from the patients. The patient with mesioangular impacted MTM with close approximation with IAN canal showing any one of Rood's criteria on orthopantomogram was included in the study.^[3] Patient with impacted MTM other than mesioangular and any kind of systemic or neurological illness were excluded from the study.

Under aseptic condition, extraction was carried out in enrolled 100 patients by a single operator. Intraoperatively, if HAE or NE was seen, it was noted. Post-operative antibiotic (amoxicillin 500 mg thrice a day) and an analgesic (diclofenac 50 mg twice a day) were prescribed for 5 days. Patients were recalled after 7 days later for suture removal and were then evaluated for IAN damage by a different examiner (blinded). First, patients were evaluated subjectively by asking them whether they noticed any change in sensation of the lower lip/chin. If any altered sensation was observed by patient, the altered area was mapped followed by objective sensory tests like brush directional stroke using a painting brush,^[4] 2-point discrimination through a caliper,^[5] light touch test using a cotton swab,^[1] and pin prick test through a probe.^[5] The unaffected site was considered as control. Injured patients were recalled after 15 days, 1 month, 3 months, and 6 months, postoperatively. At every follow-up visit, the affected area was objectively examined and was considered to be recovered when subjective and objective test returned to normal. The restoration of sensory impairment if subsided within 6 months duration it was considered temporary, and if it remained unresolved after 6 months, it was regarded as permanent.^[6] Data analysis was carried out with the Statistical Package for the Social Sciences 21.0 for Windows. Chi-square test of significance (χ^2) was used and statistical significance was considered when $P < 0.05$.

RESULTS

A total of 100 patients were taken up for the study meeting the inclusion criteria. The age of patients included in the study ranged from 18 to 60 years (mean age was 28.23 years). The male: female ratio was 55:45. Twenty-seven (27%) patients presented with teeth in Winter's Class I relation and 73 (73%) patients presented with teeth in Winter's Class II relation. Twenty-three (23%) teeth were in Position A, 58 (58%) in Position B, and 19 (19%) in Position C.

Incidence of nerve injury and duration of recovery from nerve injuries

Out of 100 patients, nerve injury was seen in 13 patients (13%). Of which, 6 patients (46.15%) recovered within 1 month; 3 patients (3%) in 3 months; 3 patients (3%) within 6 months; and only in 1 patient (1%), the recovery was not observed within 6 months. Thus, temporary nerve deficit was seen in 12 patients (12%) and permanent in 1 patient (1%).

Age and recovery from nerve injuries

The incidence of nerve injury seen in two patients of the 2nd decade (20%), six patients of the 3rd decade (10.53%),

three patients of the 4th decade (11.11%), one patient of the 5th decade (20%), and one patient of the 6th decade (100%) (Table 1). Patient in the 2nd decade of life showed 100% (two patients) recovery within 1 month of surgery. About 66.6% (four patients) in the 3rd decade of life recovered within 1-month period, 16.7% (one patient) recovered in 3 months, and 16.7% (one patient) recovered in 6 months period, respectively. About 66.6% (three patients) of the 4th decade recovered in 3 months and 33.3% (one patient) recovered in 6 months. Patient of the 5th decade showed 100% (one patient) recovery but after 6 months, whereas 100% (one patient) of the 6th decade recovered within 6 months period. Thus, in the study, age was found to be significantly associated with recovery, that is, younger patient recovered faster (Table 2).

Gender and recovery from nerve injuries

Three female patients (42.85%) recovered within 1 month; 3 females (42.85%) recovered within 3 months; and in 1 female (14.28%), it took 6 months to recover from nerve injury. About 50% (3 patient) of male patients recovered within 1 month, 2 patients (33.3%) of male recovered in 6 months period, whereas in 1 patient (16.6%), it took more than 6 months for nerve injury to recover. Statistically gender was not significantly associated with recovery from nerve injuries (Table 3).

Recovery from nerve damage on sighting HAE or NE intraoperatively

Out of 13 patients in whom nerve injuries were observed, intraoperatively in 9 patients, we found either HAE or NE or both, whereas in four patients, we did not find any intraoperative finding. HAE alone seen in five patients, NE seen in one patient, and in three patients, HAE seen along with NE. The patients in whom intraoperatively HAE within the socket or NE was not observed, 75% injuries (three patient) recovered within 1 month and 25% (one patient) injuries recovered in 6 months period. Whereas the patients in whom HAE or NE was observed, 33.3% (three patients) recovered within 1 month, 33.3% (three patients) recovered within 3 months, 22.2% (two patients) recovered within 6 months, and 11.1% (one patient) recovered after 6 months period (Table 4). The result clearly shows a significant association between nerve recovery and intraoperative HAE with or without NE. Thus, nerve recovery was faster when no sign of intraoperative NE or HAE was observed.

DISCUSSION

Hippocratic concept of *primo nil nocere* is always a concern of a surgeon, but the vicinity of the third molar apices to IAN canal poses it to the damage during MTM extraction. Mostly IAN injuries are transient in nature with spontaneous recovery ranging from 0.5% to 5% and permanent in nature <1%.^[2] Thus, recovery from nerve injury becomes a major concern for patient and surgeon. Unlike lingual nerve damage, IAN injuries recover faster because of the guidance provided by bony mandibular canal.^[7] Therefore, we conducted a study to

Table 1: Incidence of nerve injury

Age decade	Number of patients	Nerve injury absent	Nerve injury present	Nerve injury percent	Chi-square test	P-value
2 nd decade	10	8	2	20.00	7.74	0.10 (not significant)
3 rd decade	57	51	6	10.53		
4 th decade	27	24	3	11.11		
5 th decade	5	4	1	20.00		
6 th decade	1	0	1	100		

Table 2: Comparison between age and recovery from nerve injuries

Age range	Nerve injury (+)	Recovery period (%)				Chi-square test	P-value
		0–1 months	1–3 months	3–6 months	More than 6 months		
10–20 years	2	2 (100)	0 (0)	0 (0)	0 (0)	60.03	0 (Significant)
21–30 years	6	4 (66.7)	1 (16.7)	1 (16.7)	0 (0)		
31–40 years	3	0 (0)	2 (66.7)	1 (33.3)	0 (0)		
41–50 years	1	0 (0)	0 (0)	0 (0)	1 (100)		
51–60 years	1	0 (0)	0 (0)	1 (100)	0 (0)		

Table 3: Comparison between gender and recovery

Gender	Nerve injury	Recovery period				Chi-square test	P-value
		0–1 months	1–3 months	3–6 months	More than 6 months		
Female	7	3 (42.9)	3 (42.9)	1 (14.3)	0 (0)	4.77	0.31 (Not significant)
Male	6	3 (50)	0 (0)	2 (33.3)	1 (16.7)		

Table 4: Comparison of recovery with intraoperative findings

Intraoperative findings	Nerve damage	Recovery period				Chi-square test	P-value
		0–1 months	1–3 months	3–6 months	More than 6 months		
No intraoperative findings present	4	3 (75)	0 (0)	1 (25)	0 (0)	104.1	0.00 (Significant)
Intraoperative findings seen	9	3 (33.3)	3 (33.3)	2 (22.2)	1 (11.1)		
HAE	5	2 (40)	2 (40)	0 (0)	1 (20)		
NE	1	1 (100%)	0 (0)	0 (0)	0 (0)		
NE+HAE	3	0 (0)	1 (33.3)	2 (66.6)	0 (0)		

HAE: Hemorrhage, NE: Nerve exposure

enumerate and evaluate those prognostic factors which affect the recovery from nerve.

The incidence of nerve injury in our study was 13% which is consistent with studies in the literature.^[2] About 12% recovered in less than 6 months so were considered temporary in nature and 1% did not recovered in 6 months so were considered permanent.^[2] The reason being that mostly injuries sustained during MTM extraction were compression type which are neuropraxia in nature which recovers within 6 months.^[8]

Age and recovery from nerve injuries

About 100% recovery was seen in patients under the 2nd decade of life within 1 month of surgery whereas in the 3rd decade of life only 66.6% recovered within the 1 month, 16.6% of patients recovered in 3 months, and 16.6% in 6 months. All cases of nerve injuries that occurred in the 5th decade of life took over 6 months to recover whereas, all patients in the 6th decade of life recovered within 6 months. The results

were statistically significant indicating that there was a direct correlation between age and time taken for recovery from nerve damage. The results are in accordance with that observed by Queral-Godoy *et al.*,^[9] Miloro and DaBell,^[10] and Blondeau and Daniel.^[11] The reason for delayed recovery in older patients was due to decreased nerve regeneration or neuronal plasticity.^[9] Rich vascularity and rapid regeneration of nerve in younger hastens recovery process.^[12,13]

Gender and recovery from nerve injuries

Three female patients (42.85%) recovered within 1 month; 3 females (42.85%) recovered within 3 months, and in 1 female (14.28%), it took 6 months to recover from nerve injury. About 50% of male patients (three cases) recovered within 1 month, 2 males (33.3%) recovered in 6 months period, whereas in 1 male (16.6%), it took more than 6 months to recover from nerve injury. Statistically, gender was not significantly associated with recovery from nerve damage. Thus, our results

are consistent with study in literature whereas gender was not related to recovery from nerve injuries.^[1]

Recovery from nerve damage on sighting HAE or NE intraoperatively

Intraoperative hemorrhage and NE played an important role in post-operative recovery from IAN deficit. Pogrel *et al.* on cadaveric mandible demonstrated that most inferior alveolar vessel travel above the nerve and thus bleeding is encountered before NE.^[14] Three criteria have been mentioned by Tay and Go which help in identifying an exposed IAN in socket: Tubule, pale, or whitish structure in third molar socket; structure oriented in a mesiodistal direction; and structure at a level in the socket consistent with the radiographic appearance.^[8]

The patients in whom intraoperatively HAE or NE was not experienced, 75% injuries recovered within 1 month and 25% injuries recovered in 6 months period. Whereas the patients in whom HAE or NE was observed, 33.3% recovered within 1 month, 33.3% recovered within 3 months, 22.2% recovered within 6 months, and 11.1% recovered after 6 months period. Thus indicates that recovery period is prolonged when HAE with or without NE is observed, which is statistically significant supporting the results obtained by Tay and Go,^[8] Gülicher and Gerlach,^[15] Valmaseda-Castellón *et al.*,^[16] Gallesio *et al.*,^[17] and Leung and Cheung.^[18] Leung and Cheung found 20.8% IAN deficit on NE as compared to the group where no NE was observed.^[18] Whereas Bell^[19] did not found any post-operative IAN deficit in patients with IAN exposure. Tay stated that in an exposed IAN bundle, there is 1:5 chances of developing paresthesia and those patients who developed post-operative paresthesia have 1:4 chances of it to persist for <1 year because the third molar extraction includes crush or compression injury which recovers within 6 months.^[8] Gregg^[12] stated that spontaneous recovery is more likely when epineural sheath of exposed nerve is intact and continuous and at least one wall of the mandibular canal is intact which can serve as a natural bony conduit for nerve regeneration.

According to Valmaseda-Castellón *et al.*, hemorrhage within the socket occurs due to disruption of IAN bundle and this HAE and post-operative swelling compresses the nerve causing sensory impairment which is observed 24–48 h later.^[16]

CONCLUSION

Most of the patients had IAN injuries recovered within 6 months of injury indicating that the nerve injury following third molar surgery is essentially temporary in nature. Recovery from nerve damage was faster in younger age group and in patients whom intraoperative NE or HAE within the socket was not observed. Gender did not affect recovery from nerve injuries.

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