Evaluation of Incidence of Neurosensory Deficits following removal of Impacted Mandibular Third Molar: A Prospective Clinical Study of 100 Cases

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ABSTRACT

Background: Nerve injuries after surgical extraction of third molars are one of the most undesirable complications that are distressing for the patients. Neurosensory evaluation helps in determining the severity of nerve dysfunction to decide on the appropriate choice of management and monitor the recovery pattern. Aim: The purpose of this study was to evaluate the incidence of neurosensory deficit after third molar surgeries and to examine the pattern of recovery of these neurosensory deficits in affected patients. Materials & Methods: A prospective clinical study of 100 impacted lower third molar surgical removal performed in the Department of Oral and Maxillofacial Surgery between June 2017 and May 2018. Patients underwent surgical removal of impacted third molar as per standard protocols followed in the department. Patients were evaluated 1 week post surgery and assessment of wound healing status and post-surgery neurosensory deficit was carried out. Sensory alterations experienced by the patient were reported and objective assessment was performed using light touch test, two-point discrimination threshold, and pin-prick pain threshold in patients complaining of neurosensory disturbances. Results: Of the 100 impacted mandibular third molars that were surgically extracted, the most common type of impaction was vertical (37%), followed by distoangular (26%), mesioangular (20%) and lastly horizontal (17%). Of 100 surgical removal third molars, three (3%) resulted in IAN related neurosensory deficits. Two patients had a complete recovery by the end of 2 months, and one patient had a complete recovery by the end of 4 months. Conclusion: The study concluded the need for a larger sample size to lay down views on the incidence of neurosensory disturbance and the pattern of its recovery in the Indian scenario. KEYWORDS: Impacted third molar, inferior alveolar nerve, neurosensory deficit, neurosensory testing

INTRODUCTION

Face is the reflection of your inner conscience. The face, particularly, the perioral region, is the area having the highest density of peripheral receptors and therefore it is difficult to tolerate any neurological disturbances in facial regions as compared to other parts of the body.¹ Neurosensory deficits can be caused by trauma, pathologies causing compression of the nerves, or post-operative, which may cause minimal to a severe disability affecting the patient’s daily activities and so the quality of life. Removal of impacted third molar is the most common surgical procedure performed in the oral cavity, and its common complications include pain, swelling, and neurosensory deficits. Dysfunction of the inferior alveolar nerve after extraction of mandibular third molars, although uncommon, is one of the most undesirable complications, and is acknowledged to be very distressing for most of the patients affected.² Injury to the inferior alveolar nerve may be classified as direct or indirect. Direct injury can occur during the injection of local anesthetics or during surgical instrumentation such as removal of bone, sectioning of teeth, socket curettage, or manipulation of an elevator. Indirect trauma may result from rotating the tips of the root and involving the walls of the canal during surgical manipulation, or from postsurgical edema or hematoma that compresses the nerve.

Neurosensory evaluation is performed to determine the degree of sensory disturbance, monitor sensory recovery, and decide whether or not surgical intervention is indicated.³ Clinical neurosensory testing is generally divided into 2 basic categories based on the specific functional outcome

receptors by cutaneous contact, mechanoreceptive & nociceptive. Each clinical testing is specific for different fibers. A disparity exists amongst the testing methods recommended to evaluate these deficits in the orofacial region. Controversies over the superiority of the subjective & objective testing versus intraoperative testing of the sensory nerve conduction velocity has resulted in an evolution of a plethora of testing devices & methods, although no set protocols exist to identify & deal with such complications.

Management modalities ranging from observation & regular follow up to low-level laser treatment, nerve grafting, micro neurosurgical anastomosis, & nerve sharing have been advocated in the literature. The objective behind performing this study was to evaluate the incidence of neurosensory deficit after third molar surgeries and to examine the pattern of recovery of these neurosensory deficits in affected patients.

MATERIALS AND METHODS

This was a prospective clinical study of surgical removal of 100 impacted lower third molar performed in the Department of Oral and Maxillofacial Surgery between June 2017 and May 2018. The study was approved by the Institution’s Ethics Committee, and patients gave written informed consent for the same. Patients having pathologies associated with the lower third molars, or with any preexisting neurosensory deficit related to the inferior alveolar nerve (IAN) and lingual nerve (LN) were excluded from the study. The following data were included in an questionnaire format which comprised of pre-operative findings such as sex, age, type of impaction (mesioangular, horizontal, distoangular or vertical), operator’s experience, and condition of the erupting lower third molars. The surgical procedure carried out for removal of impacted third molar comprised of Using standard ward’s or modified ward’s incision, the elevation of full-thickness mucoperiosteal flap, buccal bone guttering using Moore-Gilbe’s technique, tooth sectioning if required, removal of the tooth, socket debridement, irrigation using 5% betadine solution and wound closure using 3-0 silk. Patients were evaluated 1 week post surgery and assessment of wound healing status and post-surgery neurosensory deficit was carried out. Sensory alterations experienced by the patient were reported and objective assessment was performed using light touch test, two-point discrimination threshold, and pin-prick pain threshold in patients complaining of neurosensory disturbances.

1. Two-Point Discrimination Test: A caliper device was used for two-point discrimination test wherein the probes of device were moved across the skin or mucosal surface at constant pressure and patient were asked whether they felt one or more points. The minimum distance between the two points at which the patient could markedly distinguish were recorded for that particular region. Probes with larger separation distance were selected in cases of incorrect answers whereas those with smaller separation distance were selected whenever correct answers were recorded.

2. Pin Prick Test: A sharp dental probe were used in this test which when applied in pricking motion on the skin, the pain experienced by the patient were recorded. Each region was tested thrice on both sides and any difference noted by the patient on both sides were recorded. Tongue, mucosa, lip and skin over the chin region were included as regions for conducting this test.

3. Light Touch Assessment: Light touch assessment was conducted to evaluate the threshold of the patient following tactile stimulation. Cotton stick which was used to perform this test, was applied randomly over the test zones and the area of anaesthesia was mapped till the tactile stimuli were felt.

In patients with neurosensory deficit post-surgery, the region involved was mapped and were started on tablet Neurobion Forte for a month and were monitored regularly postoperatively to assess the pattern of recovery at the end of 1st, 3rd and 6th months as per standardized assessment protocol.

RESULTS

A total of 100 patients were enrolled in this study; 59% were female, and 41% were male (Figure 1). The participants enrolled in this study had an average age of 26.3 years. Of the 100 impacted mandibular third molars that were surgically extracted, the most common type of impaction was vertical (37%), followed by distoangular (26%), mesioangular (20%) and lastly horizontal (17%) (Figure 2). With regards to the experience of the dental operator, 100% surgical extractions were performed by oral and maxillofacial surgery (OMS) postgraduates. Three extractions (3%) resulted in IAN related neurosensory deficits. The remaining ninety-seven (97%) extractions did not present with IAN-related neurosensory deficits or any neurosensory complications.

Type and difficulty score of impaction: Vertically impacted tooth were the most common type (37%). The mean difficulty score ranged from 4.5 for mesioangular, 5.6 for horizontal, 5.97 for vertical, and 6 for the distoangular type of impaction. Though the incidence of
Inferior alveolar nerve: The three patients with unilateral IAN deficit after lower third molar surgery were reviewed postoperatively at regular time intervals till their symptoms were resolved completely. There were zero dropout of patients during the entire duration of study. All the three patients with neurosensory disturbance had Grade 1 injury as described in Sunderland classification. By the end of follow-up of 6 months, all three patients (100%) seemed to have experienced total recovery. Of those, two patients had a complete recovery by the end of 2 months, and one patient had a complete recovery by the end of 4 months. None of the patients had permanent damage associated with the inferior alveolar nerve.

DISCUSSION

Dysfunction of the inferior alveolar nerve after surgical extraction of mandibular third molars, although not very common, is one of the most undesirable complications, and is acknowledged to be very distressing for most patients affected. Dysfunction of the nerve may be perceived as tingling, numbness, or as a burning, painful sensation affecting the lower lip, chin, teeth or labial gingiva.²

At a Consensus Development Conference on the removal of third molars in 1979, it was established that in due of any possible surgical risks which includes incidence of permanent alteration of greater than 0.5%, or any transitory alteration with an incidence of 5% or more, should be informed to the patient in order that the patient while signing informed consent must be able to weigh up the risks of nerve damage against the possible consequences of retaining the impacted tooth. Although the incidence of such a complication is quite low, its frequency increases as the roots of the impacted tooth move closer to the IAN.⁴

The impactions were categorized based on Winter’s classification of 3rd molar impaction (Winter, 1926) as well as the Pell–Gregory classification in relation to ascending ramus of the mandible (class I, II and III) and position of 3rd molar in relation to the occlusal surface of 2nd molar (Position A, B, and C) in our study. The most common type of impaction in our study was vertical (37%), followed by distoangular (26%), mesioangular (20%), and lastly, horizontal (17%). Cheung et al.⁵ in his prospective clinical study of 4338 cases concluded that there was no statistical difference in the incidence of IAN deficit according to the type of impaction (p = 0.48) even though the incidence of IAN deficit for each type of impaction ranged from 0.15% to 0.65%. In 1940, Robinson described a series of 300 patients, four of whom (1.3%) had labial paresthesia after the removal of third molars. Frank selected cases on the basis of radiographic proximity of the roots of impacted tooth to the mandibular canal, and 16 of 300 patients (5.3%) experienced postoperative paresthesia that lasted from one to 21 months; two cases were unresolved after 18 and 21 months. Rud⁶ reported an increased incidence of
altered labial sensation related to Position C horizontal and distoangular impactions compared with erupted teeth. Van Gool and others reported 13 cases of inferior alveolar nerve dysesthesia resulting from 932 operations (1.5%); all resolved within four months. Poyton reported a 5.2% incidence of altered labial sensation in their series of 1,355 extractions of third molars.

Literature studies have reported an association of age with increased risk of nerve damage in third molar surgeries. Bruce et al. compounded in their study that the risk of nerve damage was significantly higher for patients aged 35 years or older than for those aged 14–24 years. Black concurred that there was a strong association between age and IAN deficit and recommended removal of third molars before the age of 20 years. It has been seen from the literature that the age and increased risk of LN deficit have a positive correlation with increased risk of LN injury. The mean age group of participants in our study was 26.3 years, with the three cases reported with neurosensory disturbance in age group 20–30 years. The mean age group of patients in Cheung et al.’s prospective study was 27.2 years, which are congruent with those observed in our study. Cheung et al. in his study, had 61% female and 39% male participants, which correlate with those in our study (59% female, 41% male). There is no correlation between the gender and the risk of increased IAN or LN deficit as studied from the literature. Observation drawn from the study suggested that technical difficulty increased with age owing to reduced bone elasticity and a higher incidence of hypercementosis of the wisdom teeth, and these might account for the higher risk of the neurosensory deficit. Gender does not contribute to the risk of a neurosensory deficit, which agrees with all the reported studies.

The lack of experience and skill of the operator performing the surgery is often considered as one of the risk factors for neurosensory deficit in lower third molar extraction. Sisk et al. suggested that more frequent complications occur including LN injury with operators who have less experience compared to those with more experience ones. Valmaseda-Castellon et al. also found a significantly higher rate of LN damage among first-year surgical trainees than among third-year surgical trainees. In agreement, Jerjes et al. noted a higher risk of IAN and LN injury among third molar extractions performed by junior operators. In our study, all cases were performed by skilled operators in the department.

Kipp et al. in their study reported an increased risk of neurosensory deficits with horizontally impacted lower third molars compared with other types following their surgical removal. Carmichael and McGowan reported a similar finding and suggested that vertical impacted lower third molars carried a lower risk of nerve damage. Of the three patients with IAN deficit in our study, two patients had a mesioangular type of impaction and one patient with a distoangular type of impaction. These findings relate to those reported in the literature with vertical impacted carrying a lower risk of nerve damage.

Rather than the angulation of tooth impaction, the relationship of the root and the nerve presenting specific radiographic signs seemed to be more directly related. Several specific radiographic signs that indicate wisdom tooth roots are close to the IAN were proposed by several authors. In this study, darkening of the root, deflected root, and diversion of IAN were positively associated with an increased risk of IAN deficit, while other radiographic signs were not found to be associated. The literature review conducted by Leung and Cheung quoted the highest incidence of IAN deficit in lower impacted teeth that presented with radiographic sign of diversion of IAN canal (30%), which were followed by the darkening of the root (11.6%), and deflected root by the IAN canal (4.6%). Prospective studies with larger sample sizes to determine the risk of IAN deficit associated with specific radiographic signs are required. By the results shown by Kim et al., age, impaction depth, and the 5 radiographic superimposition signs: darkening of the roots, deflection of the roots, narrowing of the roots, dark and bifid apex of the roots and narrowing of the canal were significantly associated with neurosensory deficits of the IAN after third molar extraction. The number of subjects in this study were significantly big (12,842 patients) which enhanced the reliability of their results.

Simpson’s study supported the common belief that the sensory deficit resulting from surgery of third molars is seldom permanent, although symptoms may persist for many months. Initial postoperative symptoms may be any form of dysesthesia, and various sensory disturbances may be experienced as improvement occurs. Return of normal sensation, when it occurs, usually takes place within the first six months after surgery. Neurosensory deficits spontaneously recover in six months post surgery. Hillerup (2007) noticed a significant improvement in 66% of IAN deficits associated with third molar surgery. The authors concluded that more than 50% of patients with IAN or LN deficits achieved total recovery during the 6-months of follow-up. The observations drawn from our study demonstrated that two patients recovered in 2 months post-operatively while one patient recovered by 4 patients. Risk factors appreciated in panoramic radiographs are not always accurate, since its a bidimensional-imaging feature. More conclusive findings can be obtained in three-dimensional imaging, such as cone-beam computed tomography (CBCT), enabling a better and more accurate visualization of anatomical structures in relation to the lower third molar. However, the significant financial value of CBCT can prove hurdle for certain populations and hence it is not always available to every surgeon. This recovery of sensation within the first two months after surgery clearly points to the fact that the nature of the injury was just nerve compression or torsion brought about during the manipulation of the tooth.
CONCLUSION
The observations drawn from this study indicated the need for a larger sample size to lay down views on the incidence of neurosensory disturbance and the pattern of its recovery in the Indian scenario. The age and gender predilection is seen in the study was in correlation to that reported in the literature. The selection criteria in the current study design could have been altered based on the difficulty index, and relation with the IAN canal as in the current study, all impacted molars that agreed to follow-up were chosen, and hence the current incidence could not be attributed as the true reflection of the neurosensory impairment. Authors have attempted to correlate damage to nerves with anatomical development of the region of the mandibular third molar, while some have studied nerve degeneration and regeneration phenomena after the injury to the inferior alveolar nerve. Several surgical and nonsurgical techniques have been suggested to improve the regeneration of the mandibular nerves. Despite all these, there are not many literature reports that have actually compiled the preoperative assessment, incidence of neurosensory disturbance after third molar surgery, different treatment options to prevent the occurrence of nerve damage, pattern of recovery and the surgical and nonsurgical options to improve the regeneration after nerve damage in a single study. Future studies can be designed that can address all these points and boost the research on this very commonly discussed topic to a new horizon.

REFERENCES

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