LINGUAL, INFERIOR ALVEOLAR AND MYLOHYOID NERVES SENSORY IMPAIRMENT FOLLOWING REMOVAL OF MANDIBULAR THIRD MOLARS

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ABSTRACT

The objectives of this study were to investigate the incidence of sensory impairment of the lingual, inferior alveolar and mylohyoid nerves following lower third molar removal and to compare the outcome with the results of other studies with the intention of implementing any change in the treatment protocol, if indicated and to predict the need for routine postoperative follow up and it's cost implications.

A total of 2456 mandibular third molars were removed from 1275 patients of which 585 were operated under general anaesthesia and 690 received local anaesthesia with or without sedation. Of the 1275 patients, 58 (4.57%) experienced transient sensory impairment affecting single or a combination of the above nerves. Only 15 (1.18%) patients had anaesthetic impairment and the rest 43 (3.42%) patient's injury was paraesthetic in nature. All of these resolved completely during the period of study except one patient who suffered permanent impairment of the lingual nerve functions and this occurred in general anaesthetic group. No permanent sensory impairment was recorded for inferior alveolar and mylohyoid nerves. Surgical criteria and treatment justification with appropriate patient information sheet and the need for follow up is discussed.

Key words: *Lingual Nerve, Inferior Alveolar Nerve, Mylohyoid Nerve, Third molars, Paraesthesia, Sensory impairment.*

INTRODUCTION

The surgical removal of third molar teeth remains the commonest surgical procedure carried out at most Oral and Maxillofacial units. Mandibular third molars are the most frequently impacted teeth. 91.9% of the extractions are carried out without any serious complications.[1] Injury to the lingual, inferior alveolar and sensory branch of the mylohyoid nerves caused by the surgical removal of mandibular third molars is an infrequent but unpleasant complication. The aim should be to minimize the chances of nerve injury by careful surgical technique. Damage to these nerves is a common cause of litigation and is on the increase.[2,3]

The lingual nerve carries sensory and taste innervation from the anterior two thirds of the tongue, adjacent floor of the mouth and the lingual gingivae. Human cadaveric studies by Pogrel et al and McGeachie[4,5] showed that the lingual nerve lies on the inner surface of the mandible for a mean distance of 27.7 mm and only periosteum separates it from the bone. In 15% of the cadavers it may lie at or above the crest of the lingual plate of the mandible. They also found the variability in lingual nerve position on the opposite sides in the same cadaver. Kiesselbach and Chamberlain[6] also found that in 17.6% of human cadavers the lingual nerve was at or above the alveolar crest and in some cases may lie in the retromolar tissues. These anatomical variations and close approximation of the lingual nerve to the third molar make it prone to risk during mandibular third molar surgery.

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Early post operative dysaesthesia has been quoted up to 11.5% cases. Sensory deficiency beyond 6 months is likely to be permanent.[7] The reported incidence of permanent sensory loss ranges from 0.07% to 3%.[7-12] Rud[10] found 2% lingual nerve impairment in patients who had undergone mandibular third molar removal when the lingual plate was removed in comparison to 3% where the lingual plate was split but retained. In 932 mandibular third molar operations, 502 of which were surgical, VanGool et al;[13] encountered one incidence (0.1%) of permanent lingual nerve dysaesthesia. In a prospective study of 1400 operations, Rood[14] found only a single case (0.07%) of permanent lingual nerve sensory impairment. Robinson and Smith found 6.9% lingual sensory disturbance in cases of lower third molar removal if a lingual flap was raised and retracted using Howarth's periosteal elevator in comparison to 0.8% sensory disturbances if no lingual flap was raised. Blackburn and Bramley[15] found the similar findings in their study and noted lingual nerve disturbances in 18% of the cases where lingual flap was raised and 4% of the cases when the lingual flap was not raised.

The inferior alveolar nerve enters the mandibular canal with its accompanying vessels via the mandibular foramen and runs downward and forwards in medio lateral direction within bony canal below the apices of the teeth. It leaves the bony canal at mental foramen as mental nerve which carries sensory innervation from the mucosa and skin of the lower lip.[16] In some cases the nerve is very close to the roots of the mandibular third molars and even makes deep impression on the roots or passing through them. The nerve is at risk in these cases during lower third molar surgery. The presence of radiolucent band corresponding to the mandibular canal superimposed over the root of the mandibular third molar and loss of canal's lamina dura were both significantly related to postoperative sensory complications.[17] The incidence of damaging the inferior alveolar nerve ranges from between 0.5-5%, with only a 1% rate of permanent damage.[18] Feifel et al;[19] showed that the high resolution CT is the most accurate way of establishing the canal root relationship. The permanent sensory deficiency following mandibular third molars removal is approximately 1%.[14,20]

The incidence of nerve complications increase with the age and difficulty of surgery. Osborn et al;[21] noted overall sensory impairment was 6.5 times greater for patients over 24 years of age than under 24 years. Martis et al;[22] found 3% lingual nerve and 2% inferior alveolar nerve paraesthesia in cases of surgery in the presence of acute infection in contrast to the control group of 0.1% and 0.3% respectively.

The mylohyoid nerve leaves the inferior alveolar nerve just before it enters the mandibular canal. It runs downward and forward in a shallow groove on the medial surface of the mandible following a course roughly parallel to its parent nerve. At this location it is liable to be effected by insertion of Howarth's elevator for retraction of lingual flap and removal of the lingual plate after split. Its sensory component supplies the small area on the chin prominence.[16] Robert and Harris[23] noted that all patients who had paraesthesia of the area supplied by mylohyoid sensory nerve, had their teeth removed by lingual split technique under general anaesthesia. Therefore, it seems justifiable to mention that the deep insertion of the Howarth's elevator is most likely the cause of this injury.

METHODOLOGY

A prospective study was carried out for the period of two years. A protocol was designed and informed patient's consent was obtained.

Patients were assessed clinically and only those with symptomatic third molar teeth were advised surgery for their removal. The degree of difficulty was assessed by clinical evaluation of the patient for surgical access and cooperation and the surgical difficulty by assessment of the position of the tooth on the orthopantomogram. They were divided into two groups of local and general anaesthesia, according to the perceived degree of difficulty.

A total of 1351 patients participated in this study, 76 patients were excluded because of compromised medical history. Of the 1275 patients, 512 (40%) were males and 763 (60%) were females, between the age range of 16 to 40 years and the mean age being 23 years. A total of 2456 mandibular third molars were removed.

The 585 (46%) patients were operated under general anaesthesia while 690 (54%) patients received local anaesthesia. No patient under general anaesthetic received supplementary local anaesthetic. The surgeon's experience ranged from consultant to senior house officer but no analysis was done to differentiate the incidence of complications with respect to the seniority. The reason for this was to assess the efficacy of a surgical procedure which should be suitable for use by operators with all levels of experience

from senior house officer to consultant, and whether it should be advocated for routine use in third molars surgery.

The distal incision was made along the external oblique ridge to the gingival margin of the partially erupted third molar or disto buccal aspect of the second molar tooth. A relieving incision was made from the second molar running downward and forward along the line of the free and attached mucosa to the distal aspect of the first molar tooth. A Howarth's periosteal elevator was gently introduced beneath the periosteum in a disto lingual direction in the loose reteromolar tissues where it was easier to identify the sub periosteal plane. The flap was then elevated in a forward direction to the distal aspect of the second molar tooth. Care was taken to avoid tearing of the periosteum. The lingual flap was retracted using a single Howarth's periosteal elevator without tension and moved mesially or distally as required to protect the lingual nerve during the procedure. The low speed burs were used for bone removal and to section the teeth for the local anaesthetic group and chisels, burs or a combination of both were used for the general anaesthetic group. The wound was closed using one or two 3.0 vicryl suture on a cutting needle. The operative information was recorded on a specially designed form (*Table 1*). On discharge, the patients were given verbal and written post operative care instructions with a contact telephone number in case of concern.

TABLE 1. INFORMATION RECORDED ON THE STUDY FORM

Information recorded before operation	
– Patients name, age, sex, hospital number and address	
– Operation side - right, left or both	
– Anaesthetic - general or local with / without sedation	
– Lingual flap raised - yes or no	
Information recorded at one week	
– Sensory impairment for each nerve	
Lingual - yes or no	If yes - right, left or both paraesthesia, anaesthesia, dysaesthesia
Inferior alveolar - yes or no	If yes - right, left or both paraesthesia, anaesthesia, dysaesthesia
Mylohyoid nerve - yes or no	If yes - right, left or both paraesthesia, anaesthesia, dysaesthesia
Follow up	
1 month	recovered - improved - no change
3 months	recovered - improved - no change
6 months	recovered - improved - no change
1 year	recovered - improved - no change

The first post operative assessment was carried out at one week after the operation. The patients were asked to describe any abnormal sensation. The objective examination was carried out for response to light touch with cotton wool, sharp stimulation with probe and two point discrimination using divider as described by Ferdousi & McGregor[24]. The response to these tests was compared to the normal side and differences were recorded. Those who had sensory impairment were requested for further examination for 1 month, 3 months, 6 months and one year post operation or until complete sensory recovery. The data was analysed for local and general anaesthetic groups separately and together. Minitab computer software was used for statistical analysis. Chi square test was used to analyse the level of differences between the groups. The results were considered significant if P value was less than 0.05.

RESULTS

The lingual, inferior alveolar and mylohyoid nerves sensory impairment for overall procedures and separately for general and local anaesthetic groups, at one week post operation, was summarised in Table 2, 3 and 4. The nerve complication rate was significantly higher for the general anaesthetic group (Table 5). The majority of the nerves recovered within first month of operation.

12 of 14 for the local anaesthetic group and 51 of 60 for the general anaesthetic group of lingual nerve paraesthesia recovered within 12 weeks. The rest of the patients, except two for the general anaesthetic group, recovered completely in the next three months. The reduction in area of paraesthesia was a good sign of recovery. Two patients (0.08%) had no improvement within one year and were considered as permanent. The difference between general anaesthetic and local anaesthetic group at one week was statistically significant ($P<0.0001$)

The majority of inferior alveolar nerve sensory impairment cases recovered within 12 weeks. However, for the general anaesthetic group 3 patients took

up to 6 months and one patient up to one year for complete recovery. The difference between these groups at one week post operation was not statistically significant (P<0.07).

The sensory component of the mylohyoid nerve was effected in only 5 of the 1097 (0.5%) for the general anaesthetic group and no such complication was noticed in the local anaesthetic group. All these recovered within one month except one who took 13 weeks for recovery.

TABLE 2: OVERALL INCIDENCE OF SENSORY IMPAIRMENT FOR **2456** MANDIBULAR THIRD MOLAR OPERATIONS FOR GENERAL AND LOCAL ANAESTHETIC GROUPS

Nerves	Numbers at one week	Numbers at one year
Lingual	74 (3%)	2 (0.08%)
Inferior alveolar	41 (1.7%)	0
Mylohyoid (sensory part)	5 (0.5%)	0.00

TABLE 3: INCIDENCE OF SENSORY IMPAIRMENT FOR **1097** MANDIBULAR THIRD MOLAR OPERATIONS FOR GENERAL ANAESTHETIC GROUP

Nerves	Numbers at one week	Numbers at one year
Lingual	60 (5.5%)	2 (0.08%)
Inferior alveolar	24 (2.2%)	0.00
Mylohyoid (sensory)	5 (0.5%)	0.00

TABLE 4: INCIDENCE OF SENSORY IMPAIRMENT FOR **1359** MANDIBULAR THIRD MOLAR OPERATIONS FOR LOCAL ANAESTHETIC GROUP

Nerves	Numbers at one week	Numbers at one year
Lingual	14 (1%)	0.00
Inferior alveolar	17 (1.2%)	0.00
Mylohyoid (sensory)	0.00	0.00

DISCUSSION

The incidence of sensory deficit was first recorded at one week post operative visit. This protocol was adopted to avoid inconvenience to the patient for calling next day of the operation and due to the difficulty of assessing sensory innervation in the presence of swelling and discomfort.

Various studies have been under taken to find out the incidence and the possible causes of the lingual and inferior alveolar nerve sensory impairment following mandibular third molar surgery so that improvement in management can be made to minimise this rare but troublesome complication. Schawartz[2] mentioned 18 different causes of lingual paraesthesia from his survey. The main causes were damage caused by injection needle, retraction of lingual flap, anatomical anomaly and loss of lingual plate due to long standing infection, cysts or lingually inclined third molar. No single cause could be solely implicated for this complication. In some cases surgeons were amazed for such a sequelae with easy flip out impactions. In other studies the removal of disto lingual bone, depth of impaction and surgical techniques are thought to be common contributory factors.[7,25] Rood[14] concluded that removal of bone with burs was more likely to cause permanent inferior alveolar and lingual nerves damage than when mandibular wisdom teeth were removed using the lingual split technique with chisels. On the other hand, Robinson and Smith[26] advocated the opposite.

The placement of the Howarth's periosteal elevator may cause the crush injury to the lingual nerve and is not wide enough to protect the nerve during lingual bone removal.[9,15] The use of wide retractor provides good protection to lingual nerve during bone removal but on the other hand it is more difficult to insert and can cause tear to the lingual flap especially if the second molar is lingually inclined.[27] We used single Howarth's periosteal elevator to retract the lingual flap taking utmost care not to damage the lingual periosteum during elevation. All assistants were strongly advised to avoid tension on the lingual flap.

TABLE 5: THE COMPARISON OF SENSORY IMPAIRMENT FOR LINGUAL AND INFERIOR ALVEOLAR NERVES FOR LOCAL AND GENERAL ANAESTHETIC GROUPS AT ONE WEEK POST OPERATION

Nerves	L A group	G A group	Significance level (P value)	x^2 and degree of freedom value
Lingual	14/1359	60/1097	<0.001	$x^2 = 40.9$, df = 1
Inferior alveolar	17/1359	24/1097	<0.07	$X^2 = 3.2$, df = 1

Jerjes has linked experience of the surgeon to be a crucial factor in determining incidence of nerve damage[28]. Herpy and Goupil[29] have reported that the rate of sensory impairment for the consultant and trainee was 2.1% and 3.8% respectively after mandibular third molar surgery and it increased with the increase of patient's age. In this study no attempt was made to discriminate the skill level of the operator. Although, in general, the easier removal were done by junior staff under supervision and the more difficult teeth were removed by consultant or higher surgical trainee. The purpose of doing so was to assess the technique which should work for all levels of experience and to predict overall need for postoperative follow-up. The overall rate of temporary lingual and inferior alveolar nerve sensory impairment at one week after operation was 3% & 1.7% and permanent paraesthesia at one year was 0.08% & 0% respectively. The difference for the general anaesthetic and the local anaesthetic groups was statistically significant (P<0.001), in agreement with the findings of Blackburn & Bramley[15]. The permanent damage to the lingual nerve was recorded only in general anaesthetic group. This may be due to the selection criteria as most difficult cases were done under general anaesthesia. The selection of the patients for general anaesthesia was purely on the basis of perceived difficulty of surgery based on clinical and radiographic examination. As most cases recovered within a few weeks, the pattern of injury to the nerves was likely to be neuropraxic. Killy & Kay[30] suggested that the temporary higher incidence of lingual nerve paraesthesia for lingual split technique may be related to strong traction applied while chiselling or removal of bone fragments. We strictly kept the retractor adjacent to the bur or chisel by moving forward or backward during surgery. The lingual split was the main technique for bone removal in general anaesthetic group and traction exerted on the lingual nerve during split removal of lingual bone may be implicated with higher incidence of sensory impairment for general anaesthetic group. As the difficult teeth were done under general anaesthesia which require prolong lingual flap retraction causing traction peresis of the lingual nerve.

No permanent sensory impairment of the inferior alveolar nerve was noticed. One patient for general anaesthetic took up to one year to recover. The incidence of sensory impairment at one week for local and general anaesthetic groups was 1.2% and 2.2% respectively and all were of paraesthetic in nature. The difference between these two groups was not statistically significant (P<0.07). Almost all of these were of paraesthetic nature and reduction in the area of sensory impairment was a good sign of recovery. Muhonen et al;[31] had 7/550 (1.27%) inferior alveolar nerve dysaesthesia and all of them recovered with in a few months. The compression of the nerve during elevation by lever effect was the most likely cause of this complication especially when roots were angled sharply just above the inferior alveolar canal. Feifel et al;[19] have mentioned the other possible causes of inferior alveolar nerve damage during mandibular third molar surgery which includes partial or complete severance of nerve by rotating elevating instrument, inter- or intraradicular path of the nerve, angled roots and compression of the nerve by fragments of the roots.

No study in the past has directly looked into the involvement of the sensory branch of the mylohyoid nerve in lower third molar removal. Roberts and Harris[19] have isolated the small area at the chin adjacent to midline supplied by mylohyoid sensory component by infiltrating the local anaesthetic 1 cm deep to the lingual mucosal reflection opposite the third molar to block the nerve in the mylohyoid groove. In our study sensory impairment to mylohyoid nerve was noticed only in five cases at one week after operation only in general anaesthetic group who had lingual split in similarity to Roberts and Harris[19]. This again is likely to be due to deep insertion of Howarth's elevator and retraction during removal of lingual split. All of these recovered within one month predicting neuropraxic type of injury.

CONCLUSION

The overall results were comparable with many previous studies[7,13,32], and supports the surgical protocol we followed in the surgical management of mandibular third molars. The use of single Howarth's periosteal elevator with care gives the acceptable out come.

The surgical experience of the operator does not appear to be directly related to the incidence of the sensory impairment following mandibular third molar surgery. It is suggested that using correct technique of sub periosteal dissection the lingual flap is a safe procedure avoiding the long-term damage to the lingual nerve. It is simple and applicable to all levels of surgical development. There was only one case of permanent sensory impairment of the lingual nerve.

In this series a small number of post operative complications led us to conclude that routine follow up is not obligatory and only selective post operative

review is recommended, in agreement with Pratt[33]. It avoids the inconvenience to the patients and saves the resources of the health services.

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