Mandibular third molar and inferior alveolar canal

Received: 12 April 2009 / Accepted: 12 July 2009

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Abstract

Purpose The purpose of this study was to determine the incidence of Inferior Alveolar Nerve (IAN) damage after surgical removal of lower third molars, to identify the cause and to construct a predictive model to assess the risk of IAN injury.

Materials and methods Patients were selected from the out patient department after proper clinical and radiological evaluation of mandibular third molars. 50 mandibular third molars of 50 different patients were removed under local anaesthesia. Standardized data collection including the patient's name, age, gender, proximity of inferior alveolar nerve were recorded.

Results A total 6% of the operated sides demonstrated impairment of labial sensation and vast majority of these disturbances subsided completely within six weeks.

Conclusion For IAN we found Patient's age, the development of roots, the degree of impaction and the radiographic position of the nerve canal to be significantly correlated to sensory deficit.

Keywords Sensory impairment · Disturbance · Inferior alveolar nerve · Mandibular nerve · Third molar surgery

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Introduction

The retention of the impacted third molars can be connected with infections, cysts, tumours, neuralgiform pain, masticatory dysfunctions, disturbances of occlusion and myoarthropathies. 100 years ago the removal of wisdom teeth was an operation which was carried out very infrequently, and only with severe complications, but now it is considered as a routine procedure. In the poliklinik for Dental Surgery at the University of Mainz, it is the most frequently performed operation, comprising 30% of total operations. Nevertheless, it is an operation with relatively high complication rate, which increases among older patients and occasionally leads to claims for legal liability. The most common complications are disturbances of sensation, residual root tips, infection of sockets and fracture of the jaw. The complication rate can be considerably reduced by early removal of the wisdom teeth [1].

The inferior alveolar nerve runs in a canal within the mandible usually near the apices of the third molar and, if the molar is impacted, a close relationship of the roots to the nerve is likely. Sometimes, during the surgical removal of a mandibular third molar, the inferior alveolar nerve is damaged leading to impairment of sensation in the lower lip; which is one of the most unpleasant postoperative complications.

Preoperative assessment must be carried out radiologically in an attempt to identify the proximity of the impacted tooth to the inferior alveolar canal [2].

Aims and objectives

To assess the relationship between the apices of the mandibular third molar and inferior alveolar canal by radiological and clinical methods, to plan the surgical procedure to avoid damage to the inferior alveolar nerve, to avoid the neuro sensory damage during the lower third molar

surgery, to treat the sensory damage if it occurs.

Materials and methods

50 patients who were reported to the Department of Oral and Maxillofacial Surgery, KLES's Institute of Dental Sciences, Belgaum, for the removal of lower impacted third molars were included into the study. Only patients with preoperative sensory deficit were excluded. A total of 50 impacted lower molars were removed. Indications for surgery were pathological findings as caries, cysts, pericoronitis or abscess formation, facilitation of orthodontic therapy. We recorded clinical, radiological and surgical features of the teeth to be removed as well as personal data of the respective patient [3].

Collection of data

Immediately before operating, we recorded the following preoperative data; the age and

Fig. 1 Darkening of the roots

Fig. 2 Deflected roots

Fig. 3 Interruption of white line

Fig. 4 Facial zones to be tested

sex of the patient, the angulation and degree of retention of the tooth (gingival or osseous impaction), the radiographic relationship between the apices of the third molar and the mandibular canal [4].

1. IOPA x-ray was taken to ascertain the darkening of the roots (Fig. 1); usually the density of the root is the same throughout its length and this is not disturbed when the images of the tooth and inferior alveolar canal overlap. When there is impingement of the canal on the tooth root, there is loss of density of the root; the root appears darker. Darkening of root is attributed to the decreased amount of tooth substance or loss of the cortical lining of the canal between the source of x-rays and the film [5,6,7].

Deflected roots (Fig. 2); Deflected roots or roots hooked around the canal are seen as an abrupt deviation of the root, when it reaches the inferior alveolar canal. The root may be deflected to the buccal or lingual side or to both sides so that it may completely surround the canal or it may be deflected to the mesial or distal aspect [8].

Interruption of the white lines (Fig. 3); the white lines are the two radio-opaque lines that constitute the roof and floor of

the inferior alveolar canal. These lines appear on a radiograph due to the rather dense structure of the canal walls. The white line is considered to be interrupted if it disappears immediately before it reaches the tooth structure, either one or both lines may be involved. The interruption of the white line(s) is considered to indicate deep grooving of the root if it appears alone or perforation of the root. The interruption is considered by some to be a 'danger sign' of a true relationship between tooth root and canal [6,7,9,10].

Winter's classification (1926); Winter described a method to classify the impaction of mandibular third molar taking into consideration, the long axis of the impacted tooth in relation to the long axis of the second molar. This allows description of vertical, mesioangular, horizontal and distoangular impactions.

2. Shift cone technique was used to ascertain the position of the canal whether it is buccal, lingual or below the apices of lower third molar [11].

Pre and post surgical neurosensory assessment of the inferior alveolar nerve was carried out by three methods [12].

1. *Light Touch (LT) test*; the lower lip and mental skin were lightly touched with a cotton wisp to check if the touch was perceptible.

2. *Two point discrimination (2-P) test*; a sharp millimeter divider was used to measure two points. The test was conducted by beginning with the points closed and progressively opening them in 1 mm increments until the patient could

discriminate two points. This distance was then recorded. Distance of 2mm greater than the preoperative value considered as abnormal.

3. *Tactile discrimination (TA) test*; TA was measured with needles weighing from 0.3–15 grams. A set needles was constructed for this test. The needles pressed the skin of each of the four zones through the loop by their own weight. The lightest needle that the patient felt as sharp was recorded. If the difference from the preoperative value was 1 gm or less, the result was estimated as normal.

These tests were done preoperatively and postoperatively after 4 days, 3 weeks and 6 weeks. All these tests were done on the lower lip and mental region, which were divided into four zones and each zone was measured separately. Each of the four facial zones was tested three times (Fig. 4).

Surgical technique

The surgery was carried out under local anaesthesia. Standard ward's incision [13] was given, the mucoperiosteal flap was then elevated with periosteal elevator, No.8 round bur was used to remove the bone from the superior, buccal and distal aspect of the crown, then the tooth was delivered with minimum force applied by means of coupland elevator to the mesial aspect of the tooth; in selected cases tooth division was carried out with straight handpiece. Then the tooth was luxated from the socket. Then the socket was irrigated with saline and betadine, suturing of the flap was carried out with 3–0 black braided silk sutures, which were removed after 7 days,

routine postoperative instructions along with antibiotics and analgesics were given to the patient for five days.

Before surgery, each patient was informed of possible complications, including the possible risk of nerve damage during the procedure and provided full informed consent [14].

Results

The study population consisted of 31 males and 19 females. The patients' age ranged from 16 to 60 years. The average age was 25.82. Sixty two percent of the surgical procedures were performed in men. The numbers of right and left sided operation sides were nearly the same. There was no association between sex and inferior alveolar nerve damage.

The statistical analysis was done by using chi-square test, according to the observation there is a chance of nerve damage as the patients age is above 35 years, but there is no statistical significant relation between the age of the patient and nerve damage in my study (Chi-square test=3, $p=0.001$) (Table 1).

Inferior alveolar nerve injury was more frequent in horizontal and distoangular third molars. 4 days after surgery patients called for the neurosensory tests, all the patients were specifically questioned about their chin and lip sensibility. In the event IAN sensory impairment was checked, the affected area was mapped and 2-point discrimination, pin-prick and light touch tests were assessed, 3 patients had inferior alveolar nerve dysfunction on the operated site (6% of the surgical procedure). Most patients who subjectively reported neurosensory disturbance also exhibited objective impaired function of the nerve in all of these tests. A six week follow-up examination by objective methods demonstrated normal sensations in all the patients. Subjective evaluation was normal in all cases after six weeks. Statistically, significant results of nerve damage found at four days, three weeks for all neurosensory testing modalities (chi-square test 163.6492, $p=0.05$) (Table 2).

Table 2 Showing neuro sensory test

Sl.no	Neuro sensory test	Pre-op	4th day (post-op)	3rd week (post-op)	6th week (post-op)	chi-square test
1.	Light Touch (LT)	N	Ab	Ab	N	$X^2=163.64$ ($P=0.05$)
2.	Two point discrimination (2-P)	2 mm	8 mm	5 mm	2 mm	
3.	Tactile discrimination (TA)	0.3 gms	7 gms	4 gms	0.3 gms	

N = Normal Ab = Abnormal

Discussion

The overall incidence of sensory impairment of inferior alveolar nerve in our study correlated with the figures assessed in other investigations [2,7,15,16,17,18,19,20,21].

The influence of the patient's age on the incidence of injury to the inferior alveolar nerve is discussed controversially. Several investigators demonstrated a correlation between these factors [22,23,24], whereas others did not [7,21].

In our study, there was no significant relationship between the patient's age and diminution of labial sensation. Removal of impacted teeth from adult patients was found to be more difficult and it came along with sensory loss more often than in the juveniles. Some papers dealing with nerve injuries following variant surgical procedures, including third molar surgery, observed a distinct female overrepresentation [20,23,25]. We were not able to confirm this, because in our study comprising only patients with third molar surgery, sensory diminution was evenly distributed among male and female patients. This observation is in accordance with the results of several other studies [7,19,21]. The teeth with radiographic evidence of completely developed roots, of deep impaction and of vertical proximity to the nerve canal were significantly correlated with sensory loss of the inferior alveolar nerve. Similar findings were published by Kipp [7] and by Wofford and Miller [21].

Radiological signs heralding a close relationship between the roots and the canal were significantly correlated to postoperative sensory diminution, as was

the intraoperative opening of canal. If the canal had been opened, postoperative disturbance of labial sensation occurred nearly five times more frequently than expected. In contrast to other papers [21,26] the use of rotating instruments in general was not significantly associated with nerve damage, but so did the osteotomy and the sectioning of the tooth in the depth of the socket. For this reason, we suggest that such measures putting the nerve at risk of direct injury should be avoided, if possible. Kipp [7] even proposes leaving small tips of the roots unremoved rather than risking injury to the inferior alveolar nerve.

Darkening of the root, interruption of the white line of the mandibular canal and deflection of the mandibular canal are warning signs of IAN damage [2,7]. Whenever there is nerve damage a standard protocol consisting corticosteroid should be initiated (Charles C Alling 1985) [27] along with multi vitamins like B₁, B₆, and B₁₂ can be used, which are known as Neurotrophic Vitamins. However, presently Methylcobalamin (cyanocobalamin derivative) is prescribed. Methylcobalamin is the active form of vitamin B₁₂ that is better absorbed than many of the other forms like cyanocobalamin. Methylcobalamin is important because it is delivered more efficiently to nerve tissues than regular B₁₂. Because of this, Methylcobalamin should be considered in the treatment of all neurological diseases. A therapeutic dose for conditions requiring Methylcobalamin would be a minimum of 1500 mcg and a maximum of 6000 mcg per day. Methylcobalamin is usually administered in divided doses three times daily [28].

Table 1 Showing age of the patients & postoperative alteration of sensation of the inferior alveolar nerve

Age of the patient	Sensory impairment of inferior alveolar nerve		
	Observed	Expected	chi-square test
16 – 25 yrs	0	0	$X^2=3$ ($P=0.001$)
26 – 35 yrs	0	1	
36 – 45 yrs	2	1	
> 46 yrs	1	2	

Conclusion

It is essential to assess the position of Inferior alveolar canal to the apices of the lower third molar preoperatively to prevent possible neurosensory damage. Neurosensory damage leads to functional, social and psychological distress to the patient. Detailed assessment of the preoperative radiograph is essential to plan the surgical procedure.

Prevention of IAN damage should be based on a thorough understanding of the anatomy, as well as on accurate planning of surgery, avoiding impingement of the third molar roots or surgical instruments in the mandibular canal. Risk factors should be identified before surgery, and the relationship with the third molar roots, the need to perform osteotomy, and the age of the patient must be carefully considered. Only on the basis of these principles can the rate of IAN damage be minimized [4].

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Source of Support: Nil, **Conflict of interest:** None declared.