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Observations on the exploration and external neurolysis of injured inferior alveolar nerves

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Abstract. The inferior alveolar nerve is sometimes injured during mandibular surgery, resulting in altered sensibility. Incomplete recovery may be the result of nerve entrapment by scar tissue. Twelve patients underwent external neurolysis of the inferior alveolar nerve following prolonged sensory impairment secondary to mandibular surgery. The mean time to external neurolysis was 14 months (range 12–24 months). Five patients demonstrated improvement in sensibility, two patients returning to normal sensation. No patient had a worsening of symptoms. The results demonstrate that external neurolysis can be a useful step during surgical exploration in carefully selected patients.

Key words: inferior alveolar nerve; nerve injury; external neurolysis; objective sensory testing.

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Sensory impairment in the tissues supplied by the inferior alveolar nerve is a recognised complication of mandibular surgery. In the majority of cases altered sensation is a transitory phenomenon. The incidence of immediate impairment in third molar surgery, for example, has been reported in the region of 4–5%[1] and permanent disturbance less than 1%[17]. Nerve injury may result from compression, stretching or complete section of the nerve, caused by bone movements, bone fragments or iatrogenic damage due to instrumentation. Nerve transection may be apparent at the time of surgery and ideally should be repaired by direct, tension free, suturing[4]. Other nerve injuries may not be readily apparent, and manifest only on review, the patient returning with a sensory impairment of the ipsilateral lower lip and chin. Such altered sensibility should be carefully assessed both subjectively and objectively. Subjectively, the nature of sensibility change, the area involved and importantly changes to either are recorded. A battery of objective testing exists from simple light touch perception through somatosensory monitoring[5]. The patient should be regularly reviewed and, as previously mentioned, complete resolution is seen in the majority of patients within days or weeks of injury. Some persistent nerve disturbances may be due to scar tissue entrapment of the nerve causing a conduction block or preventing regeneration as a result of compression[20]. It has been suggested that such entrapment may benefit from exploration of the nerve and release from scar in surrounding tissue, termed external neurolysis[12,13]. This study reports the use of external neurolysis of the inferior alveolar nerve following injury and incomplete recovery of sensation. In addition, the use of ''objective'' methods of testing of nerve sensibility will be discussed.

Material and methods

External neurolysis of the inferior alveolar nerve was performed on 12 patients with a unilateral sensory deficit persisting greater than 1 year. Seven patients had undergone surgical removal of an impacted wisdom tooth; four enucleation of a cystic lesion of the mandible and one sagittal split osteotomy with removal of lower third molar at the time of procedure (Table 1). In all cases no apparent damage to the inferior alveolar nerve was recorded in the original surgical procedure notes.

Subjective reporting

From the patient's description of preoperative symptoms, the presenting complaint was recorded in terms of paraesthesia, anaesthesia and dysaesthesia. Post-operatively patients were asked to report in what way, if any, their symptoms had changed.

Table 1. Patient presentation and surgical intervention

Patient	Sex	Age	Primary surgery	Time to explorative surgery (months)	Pre-operative complaint	Perioperative observations	Operative procedure
1	Female	42	Exodontia (48)	12	Hyperparaesthesia	Neuroma	External neurolysis
2	Female	28	Exodontia (48)	12	Paraesthesia	Root remnant	Root removal/neurolysis
3	Male	45	Enucleation cyst	12	Anaesthesia	Neuroma	External neurolysis
4	Female	22	Exodontia (38)	14	Paraesthesia	Tethering	External neurolysis
5	Female	24	Exodontia (38)	13	Paraesthesia	Disruption	External neurolysis
6	Female	44	Exodontia (48)	18	Anaesthesia/ dysaesthesia	Neuroma	External neurolysis/ neuroma resection
7	Female	45	Enucleation cyst	12	Paraesthesia	Neuroma	External neurolysis
8	Male	24	Exodontia (38)	16	Paraesthesia	Neuroma	External neurolysis
9	Female	37	Enucleation cyst	12	Paraesthesia	Bony spicule	Bony recontouring/ neurolysis
10	Female	49	Enucleation cyst	12	Paraesthesia	None	External neurolysis
11	Female	21	Osteotomy	24	Anaesthesia/ dysaesthesia	None	External neurolysis
12	Male	24	Exodontia (48)	12	Paraesthesia	Disruption	External neurolysis

Clinical sensory tests

All patients underwent sensibility testing prior to external neurolysis and 1 week and 1-year post procedure using five previously reported techniques, the contralateral ''normal'' side being used as a control[15]: light touch perception was assessed using predetermined lengths of monofilament suture to produce bending forces of 0.5 g and 4.5 g applied to the area of altered sensibility and perception noted[2]. Moving two-point discrimination was recorded as difference in discrimination distance noted between the injured and contralateral side when blunted callipers were applied to the skin in decrements of 1 mm[6]. Threshold to electrical stimulation was recorded using short duration (0.5 ms) monopolar direct current pulses applied approximately over the mental foramen. Current was increased until just perceptible to the patient[7]. In addition, the current to elicit a 50% reading on a visual analogue scale of no pain to worst pain imaginable was also noted. Trigeminal somatosensory evoked potential (TSEP) recording was performed using stimulating electrode placement as for electrical threshold recording. Recording scalp electrodes were placed at C3/C4/FZ according to the 10-20 system[9]. The mean latency of P20 peaks over 256 successive events was recorded and the delay between injured and non-injured sides determined[3,7].

Operative procedure

A similar operative procedure was performed under general anaesthesia in each case. Buccal decortication of the second/third molar region was carried out. A bony window was created just inferior and distal to the second molar using a bur and finished with a chisel to minimise risk of further damage to the inferior alveolar nerve. The inferior alveolar nerve was identified and traced proximally to the site of ''injury''. The nerve was examined under an operating microscope and external neurolysis performed[8]. Additional procedures were performed as appropriate (Table 1).

Results

The mean delay to external neurolysis following initial surgery was 14 months, at which point all patients reported symptoms to be persistent, Table 1. The surgical procedure was uneventful in all patients.

In five patients a neuroma ''in-continuity'' was apparent at the site of injury on nerve exposure. In patient 3, a limited internal neurolysis was performed in addition to external neurolysis. In patient 6, a neuroma was seen which appeared to involve one fascicle only. This neuroma was resected and the adjacent epineurium aligned without suturing. External neurolysis only was performed in the three remaining neuroma patients. In patients 5 and 12, although the nerve was in continuity, a degree of epineurial disruption was present and an attempt was made to anastamose the involved segments. A root remnant was found in close proximity to the nerve in patient 2 (confirmed by subsequent histology) and was removed prior to external neurolysis.

At 1 year, two patients subjectively reported complete recovery, with three patients reporting an improvement in symptoms. The remaining seven patients felt that symptoms had remained unchanged.

Results of objective testing are given in Table 2. With the exception of light touch, results are given as the difference in measurements between injured side and contralateral ''normal'' side. M2PD testing demonstrated a mean pre-operative difference of 5 mm between injured and normal distributions. Patient 2 demonstrated no difference in discrimination distance within 1 week, maintained at 1 year. Similarly, patient 7 perceived only 1 mm difference in 2-point discrimination at 1 week and 1 year. Patients 1 and 5 noted a 2 mm and 1 mm difference respectively at 1 year, decreasing from 5 mm post-operatively. All four patients reporting an improvement in M2PD also reported a subjective improvement. Only patient 8 recorded a significant increase in discrimination, 3 mm, following neurolysis, although subjectively no change was noted. The remaining patients demonstrated consistent results at all testing points.

The electrical stimulus testing demonstrated a similar pattern of results for both threshold and 50% VAS pain scale, with a mean increase of 1 mA from threshold to 50%, the mean difference between pre-operative injured and normal values being 3 mA and 4 mA, respectively. Again patients 2 and 7 demonstrated no difference in injured and normal values post-operatively. Patients 6 and 9 demonstrated a reduction in stimulation difference at 1 week, patient 9 returning to an essentially normal value at 1 year. Patient 4, who reported a subjective complete recovery, showed a persistent 2 mA difference in threshold stimulation pre- and post-operatively, although stimulation to 50% pain returned to normal at 1 year. As with M2PD, the remaining patients