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ORIGINAL ARTICLE

# A prospective, quantitative study on the clinical outcome of inferior alveolar nerve decompression and neurolysis

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**Key words:**
inferior alveolar nerve, nerve decompression, nerve injury, nerve repair, neurolysis, sensory testing

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## Abstract

**Aim:** The management of persistent anaesthesia or dysaesthesia following damage to the inferior alveolar nerve is difficult, and the benefit of interventions is often unclear. We have evaluated the outcome of inferior alveolar nerve decompression and neurolysis in a series of 25 patients, with injuries usually sustained during third molar removal, who had poor spontaneous recovery.
**Materials and methods:** The mean age at surgery was 45 years, and most patients were female (21 patients). The mean period between the initial injury and decompression was 28 months, and we assessed the final outcome at 1 year or more after decompression. Assessment included the responses to a series of standard questions, completion of visual analogue scales (VAS) and sensory tests.
**Results:** We found that after decompression fewer patients reported pain, and VAS scores were significantly reduced for the level of tingling. Patients also reported better subjective levels of sensation after decompression, and sensory tests confirmed small but significant improvements. The median subjective value of the operation was assessed by patients as 7 (range 0–10).
**Conclusions:** These data show that inferior alveolar nerve decompression results in significant reductions in the level of dysaesthesia and improvements in sensation. However, as the overall level of improvement is small, and some patients do not improve, the procedure should only be offered to patients who are significantly affected by their symptoms.

## Introduction

Damage to the inferior alveolar nerve is a potential complication of any surgical procedure that impinges on the mandibular canal. The most common cause is lower third molar removal, with a reported incidence of approximately 4%[1], and attempts are made to predict the likelihood of nerve damage on the basis of preoperative radiological appearance[2]. However, there is little evidence that any change in surgical technique that results from this information affects the outcome. We have published an algorithm to guide management decisions for patients who sustain an inferior alveolar nerve injury during third molar removal[3].

Inferior alveolar nerve injury results in partial or complete loss of sensation from the ipsilateral skin of the lower lip and chin, the buccal oral mucosa in this region, and from the lower teeth. Most patients who sustain an inferior alveolar nerve injury progressively regain normal sensation over the course of a few weeks or months, depending upon the severity of the injury. However, after the most severe injuries, where part or all of the nerve has been sectioned and the site may have been compromised by infection, recovery will be incomplete. These patients complain of persistent reduced sensation (hypoaesthesia) or some form of unpleasant painful sensation (dysaesthesia), and often seek further advice or treatment to reduce symptoms that can be very debilitating. The management of this group of patients is difficult, as treatment options are limited and there is little published evidence on outcomes. This paper reports an assessment of the efficacy of one surgical treatment modality, inferior alveolar nerve decompression and neurolysis.

There is a surprising paucity of published data on the efficacy of any form of exploration or repair of the inferior alveolar nerve. Various approaches have been described, including nerve grafting[4,5], entubulation[6–8] or nerve sharing[9,10]. Other authors describe a ‘cascade’ of options for managing the injury[11]. However, most reports are of single cases or only include small numbers, so their value remains uncertain. Rather remarkably, Mozsary and Syers[12] reported ‘complete recovery’ in 20 of 23 patients who had undergone some form of microsurgical reconstruction of the inferior alveolar nerve, but they used no form of objective testing. The largest report is an appraisal using retrospective postal questionnaires of 316 operations on the inferior alveolar nerve at seven units in the USA[13]. This included a range of procedures, with an overall success rate of 74%. Nevertheless, the authors’ primary conclusion was the need for a detailed prospective study of specific injury conditions and their response to standardised interventions; a more recent critical appraisal of publications has reiterated this view[14].

The procedure of inferior alveolar nerve decompression was first advocated by Merrill in 1964[15], and in subsequent studies on dogs[16] he showed that nerve regeneration was more successful when bone surrounding a crushed nerve was surgically removed. It has since been suggested that bony decompression should be followed by a neurolysis[17] to divide any constricting scar tissue in the epineurium[18]. Useful studies on the outcome of this type of procedure have been published recently by Greenwood and Corbett[19] and Strauss *et al.*[20].

Our study has assessed the long-term outcome of inferior alveolar nerve decompression and neurolysis in a series of 25 patients. The collection of data has been prospective, and the results of a series of sensory tests performed before and after the operation have been quantified to allow statistical comparisons. Our aim was specifically to address the following questions:

- Does inferior alveolar nerve decompression and neurolysis significantly reduce dysaesthesia?
- Does it significantly improve sensation?
- Is the level of improvement worthwhile?

## Materials and methods

We studied a series of 25 patients with damage to the inferior alveolar nerve, referred to our nerve injury clinic in Sheffield in the period 2000–2005. We included all patients who were deemed suitable for surgical intervention, and who attended for follow-up for at least 1 year postoperatively. The criteria for surgical intervention were as outlined by Robinson *et al.*[3]: early intervention (one patient in the present series) was undertaken if a radiograph revealed that a fragment of cortical bone from the roof of the mandibular canal had been displaced downwards and was obstructing the canal; late intervention was undertaken if patients had either a substantial sensory deficit or persistent dysaesthesia[17]. Patients with a minor degree of hypoaesthesia or mild paraesthesia were advised against any surgical intervention. Furthermore, all operated patients had radiographic evidence (usually on a sectional dental panoramic tomogram) of disruption of the mandibular canal at the site of injury (Fig. 1).

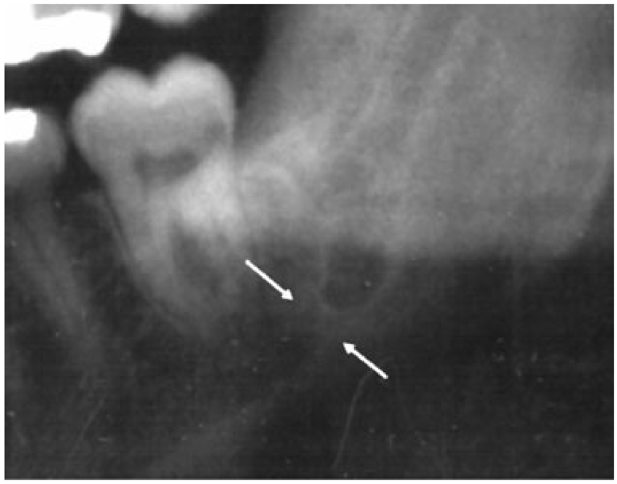

**Figure 1** A radiograph taken 23 months after removal of a lower third molar. The mandibular canal is disrupted with little evidence of continuity either radiographically or at the time of subsequent decompression. The white arrows indicate an area of bone formation across the site of the original canal with a cortical outline to the proximal section. Reproduced with kind permission of Churchill Livingstone.

The injuries were caused by third molar removal (18 patients), first molar removal (1 patient), impacted premolar removal (2 patients), implant placement (2 patients), cyst removal (1 patient) or management of a fractured mandible (1 patient). Of the 25 patients, 4 were male (mean age 33.2 years, range 22–43 years) and 21 were female (mean age 47.5 years, range 34–62 years), and the injuries were on the left side in 14 patients and on the right side in 11. The delay between initial injury and surgical treatment ranged from 2 months (the one early repair) to 96 months, with a mean of 28.4 ± 24.8 (SD) months.

### Surgical procedure

All of the surgical decompressions were performed under general anaesthesia by one of the three authors, and the technique was similar for each patient. We used an intraoral approach and gained access to a 2–3 cm length of the mandibular canal at the site of injury by removing a segment of buccal plate: the anterior, posterior and superior limits were defined by cuts through the cortex with a bur, a groove 'scored' at the level of the canal and the segment removed with a chisel and discarded. This approach is similar to that described by Miloro[21] but does not extend to the lower border of the mandible. More bone was then carefully removed with a large round diamond bur (approximately 4 mm diameter), together with dental excavators, until the neurovascular bundle could be gently eased laterally from the canal for examination (Fig. 2). Under the operating microscope, any lateral neuroma was excised and constricting scar tissue at the site of injury released by one or more longitudinal incisions through the epineurium (neurolysis). The mandibular canal restricts mobilisation of the central and distal stumps, and so a long segment of damaged nerve cannot be excised. A limited degree of re-approximation was, however, sometimes possible, and one or more sutures were inserted in six patients using 8/0 monofilament polyamide (Ethilon, Ethicon Ltd, Livingston, UK). In one patient, the procedure was combined with the removal of a dental implant that had caused the injury. The wound was closed with polyglactin 910 (Vicryl, Ethicon Ltd), and all patients were given prophylactic antibiotics and dexamethasone (8 mg preoperatively and 12 h postoperatively).

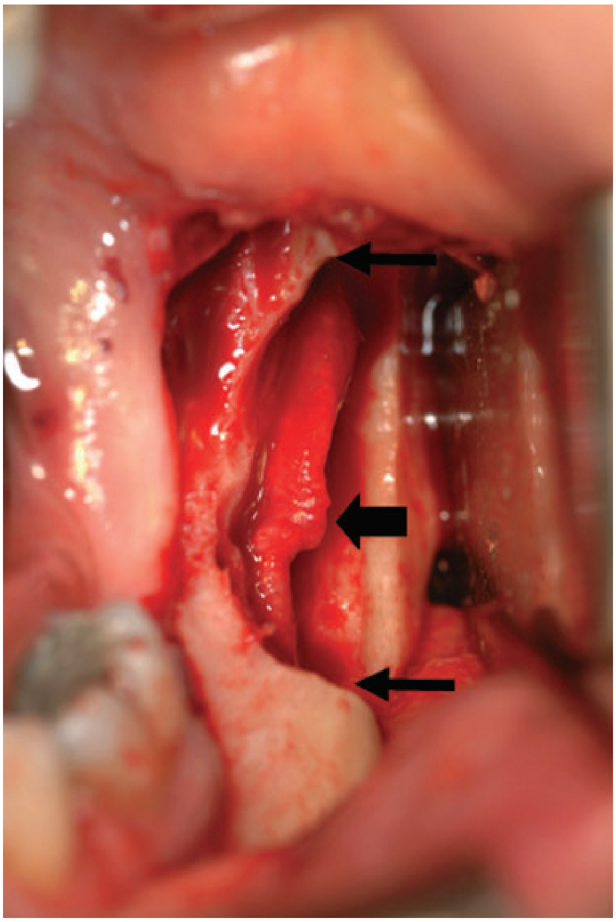

**Figure 2** A surgical picture showing exploration and decompression of the left inferior alveolar nerve. The small arrows indicate the site of the anterior and posterior cortical cuts made before a segment of the buccal plate was removed. The large arrow indicates a neuroma that extended laterally and towards the alveolar crest from the neurovascular bundle, and the bundle narrows distal to this point. Reproduced with kind permission of Churchill Livingstone.

## Assessment

In all patients, sensation on the affected side of the lower lip and chin was assessed both preoperatively and at 12 months or more (mean 16.63 months, range 12–41 months) postoperatively. Initially, each patient was asked a series of standard questions from a proforma: whether they had complete numbness after the initial procedure; whether the affected area was now completely or partially numb; whether it was hypersensitive (hyperaesthesia); what their subjective level of sensation was on a scale of 0% (numb) to 100% (normal); whether they could detect thermal stimuli normally; whether they had pain or tingling (paraesthesia) either spontaneously or initiated by touching, moving or thermal stimuli to the area; whether they tended to bite their lip by accident; and whether they thought that their speech was affected. They were also asked to complete three visual analogue scales (VAS) indicating the level of pain, tingling and discomfort from the affected area. Clinical examination determined whether palpation of the mucosa overlying the injury site (such as the alveolar crest at the site of tooth removal) evoked any sensations in the affected lip or chin. A series of sensory tests[22] was then undertaken in a quiet room with the patient's eyes closed, as follows.

## Light touch sensation

A von Frey hair that applied a force of 20 mN (2 g) was applied repeatedly at random sites on both sides of the lower lip and chin, and the patients asked to indicate whether they could feel it. For quantitative comparisons, responses on the side of injury were graded on a four-point scale: 0 – no response, 1 – occasional response, 2 – response in most areas, 3 – responses apparently similar to those on the unaffected side.

### Pinprick (pain) sensation

Forces of up to 150 mN (15 g) were applied with a pin attached to a calibrated spring, and the patients were again asked to indicate whether or not they felt anything. Within areas from which a sensation could be evoked, the pinprick sensation threshold was measured by asking the patients to indicate the point at which a pin applied with steadily increasing pressure became sharp rather than dull. This test was repeated at a number of sites. Responses on the side of injury were quantified as: 0 – no response, 1 – occasional response, 2 – response in most areas but with an increased threshold and 3 – responses apparently similar to those on the unaffected side.

### Two-point discrimination

This test was performed with an instrument comprising 10 pairs of blunt probes (each 0.8 mm in diameter) with separations ranging from 2 to 20 mm at 2 mm intervals[22]. The probes were drawn 5–10 mm vertically downwards over the affected area and the minimum separation that was consistently reported as two points was recorded as the two-point discrimination threshold. Values were recorded for the lip, halfway between the midline and the commissure, and in an equivalent position on the midpoint of the chin.

Finally, at the last testing session only, the patients were asked to give a subjective score to the value of the operation on a scale of 0 to 10. They were told that 0 indicated that the operation had been a waste of time, and that 10 indicated a perfect outcome. They were told to consider this only from their own perspective, ignoring the results of the sensory testing and the feelings of the operators.

Statistical comparisons between the results of tests at different stages were made with a paired *t*-test, $\chi^2$-test or Fisher's exact test, as appropriate (StatsDirect statistical software, version 2.6.2, StatsDirect, Altrincham, UK).

## Results

### Clinical observations

The extent of disruption of the inferior alveolar neurovascular bundle seen at operation varied widely; in some patients with significant symptoms the nerve seemed macroscopically intact, whereas in others it was markedly narrowed, scarred, or the canal largely obstructed by bone. In several patients who had sustained the inferior alveolar nerve injury during third molar removal, the operation revealed a band of soft tissue that passed through the socket, joining the neurovascular bundle and overlying mucosa. Some predecompression radiographs or computed tomography scans suggested that the neurovascular bundle had been drawn towards the surface at this point (Fig. 3). Palpation of the mucosa overlying the injury site evoked a sensation in the affected lip or chin in five patients prior to decompression. This implies that some damaged axons from the inferior alveolar nerve had regenerated inappropriately through the tooth socket or bony defect and had re-innervated the overlying mucosa. In one unusual example where the injury had been caused during removal of an impacted lower second premolar, palpation in the *lingual* sulcus evoked a sensation in the lower lip, and the operation revealed a bony defect between the neurovascular bundle and floor of the mouth. After decompression and neurolysis, palpation of tissues overlying the injury site evoked a sensation in the lip or chin in just two patients, neither of whom had this symptom preoperatively.

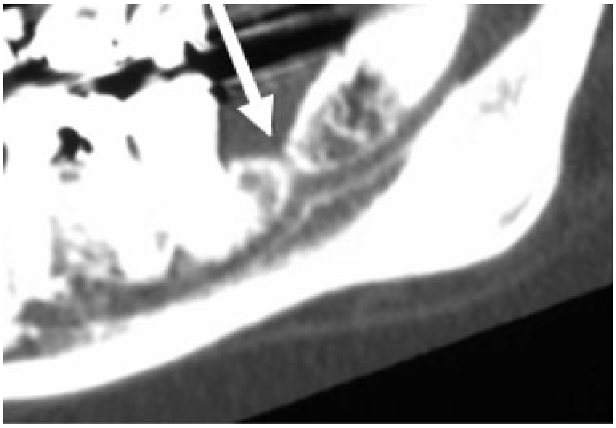

**Figure 3** A computed tomography scan showing displacement of the mandibular canal towards the alveolus at the site of previous third molar removal. The arrow indicates the site of a soft tissue connection between the neurovascular bundle and the overlying mucosa. Courtesy of Mr N. Whear.

### Responses to questions

Twenty-three patients reported complete numbness after the initial event that had caused the nerve injury, and the other two reported partial numbness. A comparison between the responses to questions asked preoperatively and at the final test is shown in Table 1, and reveals that only four patients still had complete numbness just prior to decompression. All patients continued to complain of partial numbness at the final postdecompression test. The same number of patients reported

**Table 1** The response of patients to specific questions on a proforma, before decompression and at the final assessment after decompression

| | Preoperatively | Postoperatively | Significance (*P*-value) |
|---|---|---|---|
| Complete numbness? (*n*) | 4 | 0 | 0.055† |
| Partial numbness? (*n*) | 21 | 25 | 0.055† |
| Hypersensitivity? (*n*) | 11 | 11 | 1‡ |
| Mean subjective level of sensation (%) | 35 (range 0–85) | 56 (range 5–100) | 0.01§ |
| Can detect thermal stimuli normally? (*n*) | 3 | 9 | 0.046‡ |
| Speech affected? (*n*) | 11 | 8 | 0.31‡ |
| Bite lip by accident? (*n*) | 15 | 12 | 0.21‡ |

†Fisher's exact test.
‡$\chi^2$-test.
§Paired *t*-test.

hypersensitivity of the lip and chin before and after decompression, but some of these 11 patients had changed; 4 patients with hypersensitivity preoperatively lost that symptom, but 4 others developed that symptom postoperatively. There was a highly significant increase in the subjective level of sensation reported by the patients (a mean improvement of 21%), and more of them indicated that they could detect thermal stimuli normally. There was a small but insignificant reduction in the number of patients who thought that their speech was affected by the sensory deficit, or that it caused them to bite their lip by accident.

The reported presence of pain or tingling, either spontaneously or initiated by touch, movement or thermal stimuli, is shown in Figure 4. This shows that the number of patients with these symptoms was usually lower after decompression, the only exception being an increase in the number of patients with hot-evoked pain or cold-evoked tingling. The number of patients with *no* spontaneous or evoked pain increased from 9 to 16 after decompression ($P = 0.048$) and the number with no tingling increased from 2 to 4 ($P = 0.33$).

## VAS scores

The pre- and postdecompression VAS scores for pain, tingling and discomfort are shown in Figure 5. All three parameters were reduced by decompression, with a mean reduction of approximately 12% for pain, 27% for tingling and 17% for discomfort. However, because of the wide variation between patients, this difference was only statistically significant for the level of tingling ($P = 0.009$).

## Sensory tests

On the unaffected side of the lip and chin, the patients were all able to detect light touch stimuli

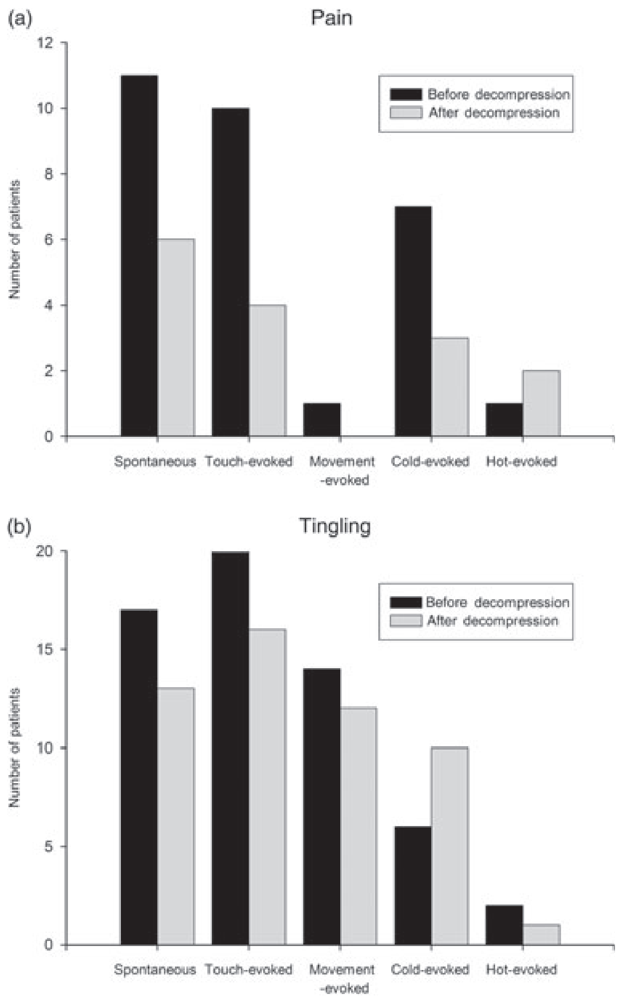


**Figure 4** The number of patients who reported pain (a) or tingling (b) either spontaneously, or evoked by touching, moving or thermal stimuli to the affected area.

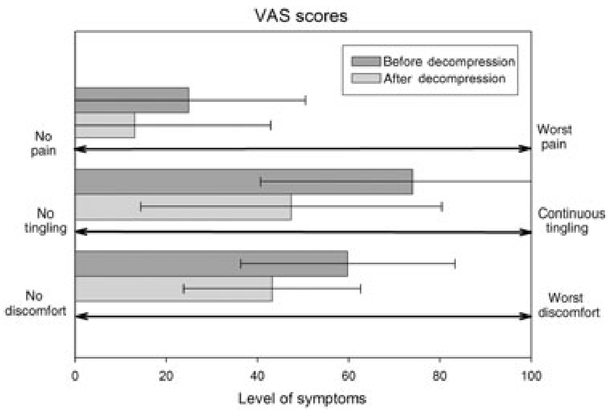


**Figure 5** Mean (±SD) visual analogue scale (VAS) scores for the level of pain, tingling and discomfort, measured before and after decompression. An absence of symptoms would be scored at the left end of the scale, and the worst imaginable (pain, discomfort) or continuous (tingling) symptoms at the right end. There was a significant reduction in tingling after decompression ($P = 0.009$, paired *t*-test), but the reductions in pain ($P = 0.07$) and discomfort ($P = 0.051$) were not significant.

with a 20 mN von Frey hair, pinprick stimuli of up to 150 mN, and two-point discrimination thresholds usually ranged from 2 to 4 mm on the lip and 6 to 10 mm on the chin.

The ability of patients to detect light touch stimuli on the side of injury improved after decompression; on the rating scale, the mean predecompression score was 1.96 ± 0.98 (SD) but was significantly higher after decompression (2.48 ± 0.59, $P = 0.003$, paired *t*-test). Similarly, scores for responses to pinprick stimuli also improved after the surgery (before decompression, 1.88 ± 0.72; after decompression, 2.28 ± 0.46, $P = 0.015$). Two-point discrimination thresholds for all of the patients before and after decompression are shown in Figure 6, for both the lip and chin. This reveals a shift towards lower thresholds postoperatively, and is confirmed by the mean values (lip: before decompression 11.2 ± 5.1 mm, after decompression 8.4 ± 4.0 mm, $P = 0.006$; chin: before decompression 13.3 ± 4.2 mm, after decompression 11 ± 5.6 mm, $P = 0.03$). Despite this threshold reduction (a mean improvement of approximately 21%), values remained substantially higher than on the unaffected side.

### Subjective assessment

The patients' subjective assessment of the value of the operation is shown in Figure 7. The scores covered the full range from 0 to 10, and the median score was 7.

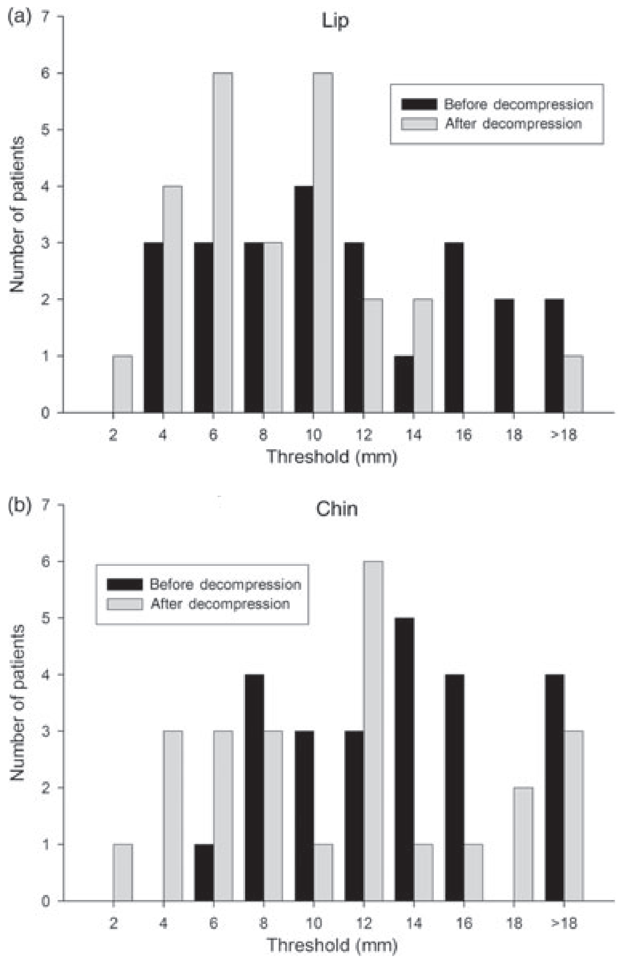


**Figure 6** The two-point discrimination thresholds on the lower lip (a) and chin (b) measured before and after decompression. Because of the size of the area being tested, a threshold of more than 18 mm could not be reliably assessed and all these results have been placed in the >18 mm column. Both charts show a shift of patients to the left (lower thresholds) after decompression.

## Discussion

This study has allowed us to answer the three questions posed in the introduction.

### Does inferior alveolar nerve decompression and neurolysis reduce dysaesthesia?

Pain from the area of sensory disturbance was reported prior to decompression in 64% of our patients, spontaneous tingling in 68% and hyperaesthesia in 44%. This operation appears to reduce dysaesthesia, as significantly fewer patients (36%) had pain after decompression, and the number with evoked pain or tingling was lower in all categories except for hot-evoked pain

 

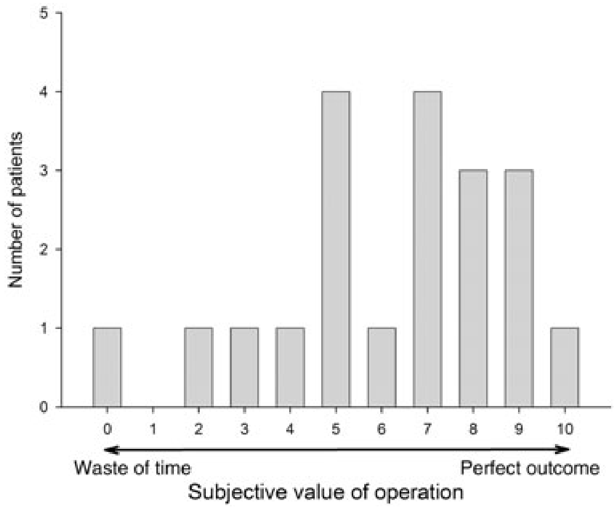


**Figure 7** The overall value of the operation as assessed subjectively by the patients on a scale of 0 (a waste of time) to 10 (a perfect outcome) ($n = 20$).

and cold-evoked tingling. These latter results may have arisen because of the increased innervation density in the peripheral tissues; that is, more nerve fibres had regenerated but more were behaving abnormally. Furthermore, the VAS scales for pain, tingling and discomfort all showed a reduction in symptoms after decompression, although this was only significant for the level of tingling.

Previous studies on the effect of inferior alveolar nerve surgery have provided little information on changes in the incidence or level of dysaesthesia. Gregg[17] expressed reservations about a surgical approach to the management of some forms of dysaesthesia resulting from inferior alveolar nerve injury, and specifically discouraged early intervention. Furthermore, our previous study on the outcome of *lingual* nerve repair[23] failed to show a significant reduction in the number of patients with dysaesthesia, although the level of symptoms often declined. The positive effects of inferior alveolar decompression in our current study are therefore encouraging. Similarly, Pogrel and Kaban[24] reported that most of their patients gained relief from dysaesthesia after trigeminal nerve repair, although they were reporting on a mixed population of inferior alveolar and lingual nerve procedures.

A question frequently asked by patients considering surgical intervention after a nerve injury is, 'Can the operation make my symptoms worse?' This is a sensible question for a patient who has already suffered one unfortunate complication. In general, a deterioration in symptoms would be an uncommon outcome, and patients free of dysaesthesia preoperatively usually remain free of dysaesthesia postoperatively. Greenwood and Corbett[19] have also indicated that none of their 12 patients had a worsening of symptoms after inferior alveolar neurolysis. However, as indicated above, enhanced regeneration of damaged nerve fibres may give rise to more abnormally behaving re-innervated terminals peripherally. Indeed, patients should expect paraesthesia during the process of re-innervation. Other evidence of a potentially unfavourable outcome was found when recording the number of patients who described hypersensitivity (hyperaesthesia) of the affected skin. Although the number of patients with this symptom was unchanged by the operation, four patients (16%) previously without hypersensitivity developed it postoperatively. It would be appropriate to warn patients of this possibility when they are considering surgery.

## Does inferior alveolar nerve decompression and neurolysis improve sensation?

This study provided clear evidence that decompression and neurolysis can improve sensation. The patients' subjective assessment of the level of sensation was significantly higher after decompression; there were significantly improved responses to sensory testing with light touch and pinprick stimuli; and two-point discrimination thresholds were reduced. However, the level of these improvements was small, and significant improvements were based on comparisons for the whole population before and after surgery. For an individual patient, the outcome was variable and some patients did not improve.

Previous studies on inferior alveolar nerve surgery have also shown improvements in sensation. In an early study, Riediger *et al.*[25] found 'good' or 'excellent' recovery in 80% of their patients who had exposure and direct suture repair of the damaged nerve, but in only 28% of patients who had an interpositional sural nerve graft. In a study confined to decompression and neurolysis, Greenwood and Corbett[19] reported that 5 of their 12 patients demonstrated an improvement in sensation, two regaining 'normal' sensation. Similarly, Strauss *et al.*[20] made statistical comparisons between pre- and postoperative data in 28 patients and found significant improvements in the results of all sensory tests. Although direct comparison between studies is difficult because of variations in methods and criteria, the general conclusion is that sensation can be enhanced in some patients by decompression and neurolysis.

## Is the level of improvement worthwhile?

The subjective scores of the 'operation value' indicate that patients usually considered it to be worthwhile, as the median score was 7 out of 10. Within this group, however, were four patients with a score of less than 5, including one with a score of 0. It is not possible to predict which patients will have a successful outcome preoperatively, so all patients must be apprised of the variable results achieved. Strauss *et al.*[20] reported that in their study of 28 patients, 10 reported significant improvement, 15 reported mild improvement and 3 had no improvement; these results appear similar to ours. Susarla *et al.*[26] showed that after trigeminal nerve repair there was a strong correlation between patient satisfaction and the results of sensory tests, but only 2 of their 19 patients had sustained an inferior alveolar nerve injury.

The level of improvement could also be assessed in our study by determining changes in the various parameters recorded. Thus, there was a mean improvement of 21% in the subjective level of sensation reported by the patients; a mean reduction of approximately 12% on the VAS scores for pain, 27% for tingling and 17% for discomfort; and a mean improvement of approximately 21% in the two-point discrimination thresholds for the lip and chin. Taken together, it therefore seems reasonable to advise patients that the operation could result in a '20% improvement' in their condition, although they may have a better or worse outcome. None of our patients regained 'normal' sensation, and all continued to describe partial numbness, so patients must be informed of this expectation, however successful the surgery. Our results show that this residual sensory disturbance may also continue to affect their speech and they may continue to bite their lip by accident. This information allows patients to have realistic expectations, and to make an informed judgement on whether or not to proceed. It also helps to ensure selection of only those patients for whom the symptoms are severe, and for whom any improvement is worthwhile.

## Other observations

It was interesting to note that the patients presenting for this treatment were predominantly female (84%) and usually middle aged. The high proportion of female patients is also evident in previous studies, such as those of Greenwood and Corbett[19] (75%), Strauss *et al.*[20] (61%) and Susarla *et al.* (74%[26]; 68%[27]). There is laboratory evidence for gender differences in susceptibility to the development of nerve injury-induced pain[28], and epidemiological studies show that older female patients are more likely to suffer from chronic neuropathic pain[29]. There is, therefore, a risk that the trend to remove lower third molars only when they cause symptoms later in life may render female patients more susceptible to the development of dysaesthesia if they sustain a nerve injury. It is also of note that the substantial population of (usually younger) patients in whom the inferior alveolar nerve is damaged as a result of mandibular fractures or orthognathic surgery rarely complain of dysaesthesia and rarely seek treatment. Therefore, in addition to patient susceptibility, the nature of the initial injury may be important.

Surprisingly, some patients report an improvement in sensation on the first postoperative day after decompression and neurolysis. Although we did not undertake any sensory tests at that stage, we would not expect any immediate improvement, and it is more likely that the patients were feeling the benefit of an early reduction in dysaesthesia (sometimes associated with a transient *reduction* in sensation). We have previously noted similar comments from patients who had undergone lingual nerve repair[23].

Despite decompression surgery, some patients are left with severe symptoms of dysaesthesia that cause great distress and disruption to daily life. For this group, a pharmacological approach is appropriate, but the drugs currently available are not universally effective and, at best, produce only partial relief of symptoms. Gregg[30] showed that tricyclic antidepressants can help in some patients. Carbamazepine and the more recently developed anticonvulsant drugs such as Gabapentin may also be of benefit[31], but are associated with side effects in many patients. The efficacy of these drugs after injury to the trigeminal nerve has yet to be confirmed in a clinical trial.

Most of our patients were assessed and treated surgically at long periods after the initial injury; the mean delay was 28 months and ranged up to 96 months. It is possible that we would have achieved better results with earlier decompression, but did not have this opportunity because of late referrals. Some previous papers on trigeminal nerve repair have suggested that late surgical intervention is followed by a poorer outcome than early surgery[25,32]. However, our previous study on the outcome of lingual nerve repair[23] and other studies on a range of trigeminal nerve procedures[27,33] have failed to confirm this relationship. After inferior alveolar nerve decompression and neurolysis, Strauss *et al.*[20] showed no significant correlation between the delay prior to repair and the extent of recovery. It is possible that, for an individual patient, early surgery has the potential to produce the optimal result, but when a large population is studied, other factors are dominant and mask this effect. The dominant factor is probably the extent of nerve injury caused by the initial operation. In future, improvements in outcome are likely to result from improving the potential for regeneration. This might be achieved, for example, by reducing the level of scar formation at the injury site[34], as new scar formation will inevitably follow the neurolysis. Other advances are needed to improve the management of patients with dysaesthesia.

## Conclusions

We conclude that inferior alveolar nerve decompression can reduce dysaesthesia and improve sensation, and is a worthwhile operation in carefully selected patients who have severe symptoms. Patients should be informed that, on average, there is a 20% improvement as a result of the operation, and that they will not regain normal sensation. There is a small risk of initiating hyperaesthesia or thermally evoked dysaesthesia in the affected area.

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