A new surgical technique for treatment of neuropathic pain conceived by compressed inferior alveolar nerve.

Original Article

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ABSTRACT

Purpose: we are evaluating the effectiveness of inferior alveolar nerve surgical decompression (IASD) in the management of compressed IAN neuropathic pain.
Method: Eight patients (5 male and 3 female) with a mean age of (49.9 ± 8.9) suffered from neuropathic pain due to compressed IAN. All Patients underwent IASD and nerve wrapping with collagen resorbable membrane. Patients were clinically evaluated using a VAS score preoperatively and then at 1, 3 and 6 months postoperative.
Results: All patients were treated with IASD procedure without any major complications. Minor postoperative edema occurred in 3 patients and regressed by medication while, 2 patients suffered numbness which spontaneously resolved gradually within 6 months. All patients showed significant improvement of their neuropathic pain on the VAS score at 1, 3 and 6 months post-operative (P <0.01).
Conclusion: IASD and nerve wrapping with resorbable collagen membrane represent a new effective modality for treatment of neuropathic pain due to compressed IAN.

Key Words: Trigeminal neuralgia, Nerve decompression, Inferior alveolar nerve, Neuropathic pain, Orofacial pain.

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INTRODUCTION

T Orofacial pain (OFP) and headache disorders are one of the most prevalent pain disorders, which affect over a quarter of the population. It induces significant reduction in quality of life and causes severe disability. Trigeminal neuropathy due to peripheral trigeminal nerve (CNV) compression is considered an important cause of OFP[1,2]. This postulate was driven from the evidence of other areas of the body such as the cubital tunnel syndrome due to ulnar nerve compression at elbow, as well as the carpal tunnel syndrome due to median nerve compression at wrist. Accordingly, there are numerous existing compression neuropathies that may affect different parts of the body[3].

In maxillofacial region CNV is considered the main sensory cranial nerve for almost all of the maxillofacial structures which provides innervation through its main three divisions; ophthalmic (V1), maxillary(V2) and mandibular nerves (V3)[4]. The V3 is composed of a large posterior and a small anterior division, out of the posterior division the IAN represent its largest branch. IAN originates from the posterior division of V3 in the infratemporal fossa and descends medial to the lateral pterygoid muscle along its lower border and finally emerges between the medial and lateral pterygoid muscles.

It further completes its course by passing between the spheno-mandibular ligament and mandibular ramus to enter the mandibular foramen and canal then continue its course giving off the mental nerve through the mental foramen until reaching the terminal part of the mandibular canal as the incisive nerve [5]. During its course the IAN has a complex relation with different surrounding structures which increases the risk of nerve irritation from abnormal compression by pulsating artery, stretching from muscles, or the narrow bony foramen. All these risks increase the probability of inducing symptomatic neuropathic pain [6- 8].

Treatment of neuropathic pain carries various challenges in order to provide effective curative methods. Numerous studies have applied the techniques of percutaneous procedures which include three main different techniques; glycerol injections, radiofrequency lesioning and balloon compression. These techniques primary depend on temporary nerve ablation or injury which results in

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disruption of pain signals for certain period of time. This pain relief usually lasts from few months with a maximum of few years yet, with higher risk of further recurrence.

The major side effect for percutaneous procedure is the decreased sensation in part or the whole side of the face or even its complete loss [9- 12]. On the other hand, peripheral neurotomy or avulsion of the affected nerve constitutes a more effective curative method of treatment for resistant cases. However, it adversely causes permanent loss of sensation in the area supplied by this nerve leaving the patients with an everlasting irritable numbness [13,14].

Recent concepts for management OFP due to CNV affection depends on understanding the etiology of this pain whether it is bony compression, muscular tension or pulsating vessels or other causes. This concept was developed by Bahman Guyuron who was able to manage frontal headache using the decompression of supra orbital and supra trochlear nerves from irritating adjacent tissues and offer it the name of migraine surgery. Later other researchers implement the same surgery on compressed supra orbital and supra trochlear nerves with high success rate and renamed it decompression surgery[15- 18] .

We devised a new implementation of the concept of decompression surgery on treating the neuropathic pain derived from the compression of the IAN. In this study we examine the effectiveness of inferior alveolar nerve surgical decompression (IASD) in the management of compressed IAN neuropathic pain.

PATIENTS AND METHODS:

The current Prospective study was conducted on 8 Patients suffering from orofacial neuropathic pain due to compressed IAN. The gender distribution was 5males and 3 females. Age ranges were from 3070- years with mean age 49.9 ± 8.9. All cases were selected from orofacial pain clinic in oral and maxillofacial surgery department, Minia University Dental Hospital (MUDH) and SHIFA OMFS clinic.

Preoperative evaluations were performed through three systematic steps: patient history, clinical evaluation and finally a radiographic examination with cone beam computed tomography (CBCT). Eligible Patients were fulfilling the following Inclusion Criteria: Neuropathic pain confined to IAN, patients didn`t exhibit significant improvement on standard trigeminal neuralgia medication, pain relieved after LA nerve block to the IAN. In addition to evidence of peripheral nerve compression caused by one or more of the following different causes; narrow bony foramen, obliterated canal, malunion fracture with compressed nerve between the fracture lines or presence of scared tissues or masses around the affected nerve. On the other hand, we excluded from our study: Medically compromised patients who couldn't tolerate surgical intervention, patients suffered from classic trigeminal neuralgia due to central vascular compression of trigeminal sensory root in the middle cranial fossa, Neuropathic pain related to central causes such as multiple scleroses or brain tumor….etc.

The study was approved by the Ethical Committee for Scientific Research at faculty of dentistry Minia University. All research procedures were fully explained to the selected patients including; risks, possible side effects and benefits of the study. Finally, a signed informed consent was obtained from every patient. All patients underwent IASD and nerve wrapping with collagen resorbable membrane by the same operator to standardize the procedure. We used an intraoral vestibular approach to gain an access to the inferior alveolar canal. Osteotomy was done using the piezoelectric device to remove a segment of buccal plate at the site of compression which previously determined by CBCT (Figure1).

The piezoelectric device allowed safe cutting and canal deroofing with bone removal around the mental foramen. Then the neurovascular bundle was gently retracted laterally by the help of a nerve retractor to ensure complete nerve freedom. A resorbable collagen membrane was cut and wrapped around the nerve to give more superior nerve protection during healing period and the nerve was safely repositioned inside the widened mandibular canal (Figure 2). Finally, the wound was sutured with polyglactin 30/ (Vicryl, Ethicon Ltd).

The Patients assessment was done using the visual analogue score (VAS) at 1, 3 and 6 months after surgery to evaluate the effectiveness of surgical intervention. The collected data were tabulated and presented as mean, Median and standard deviation values. Wilcoxon signed ranked test was used for testing the differences between the preoperative and postoperative VAS scores and the significance level was set as $P \leq 0.05$. Statistical analysis was performed with SPSS (Statistical Package for the Social Sciences) version 20.

RESULTS

Eight 8 patients suffering neuropathic pain caused by compressed IAN were included. All patients performed the IASD procedure without any major complications. Minor postoperative complications included; postoperative edema in 3 patients which gradually regressed by medication within seven days. Additional complications were temporary IAN numbness in two patients that was spontaneously restored within 6 months postoperatively.

The VAS changes showed a significant progressive improvement in pain score between preoperative, 1, 3 and 6 months postoperatively (P <0.01*). Moreover, scores between any two recorded periods showed significant improvement ($P < 0.025$) except the two final scores which were not significant ($P < 0.083$).

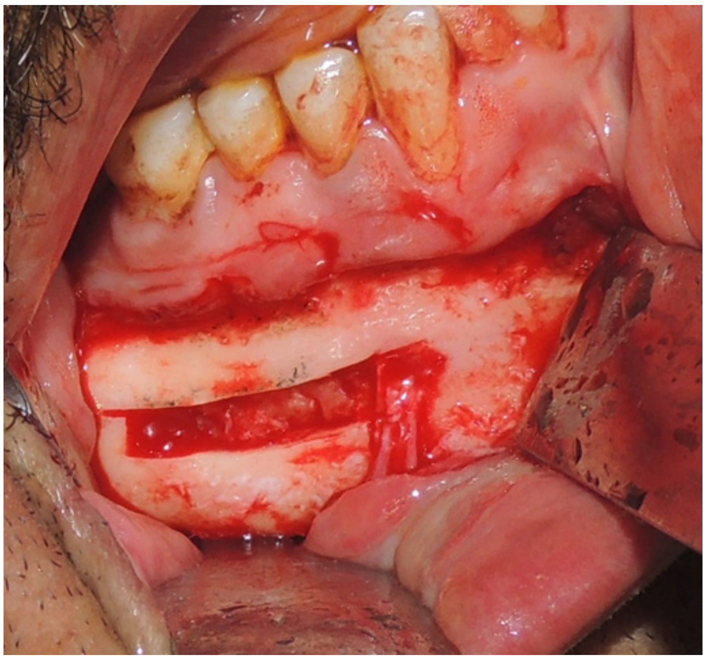

Figure 1: De-roofed mandibular canal with widened mental foramen.
A - Inferior alveolar canal. B - Mental nerve.

Figure 2: IAN repositioned in place and wrapped by collagen membrane
.Black arrow pointing to Collagen membrane

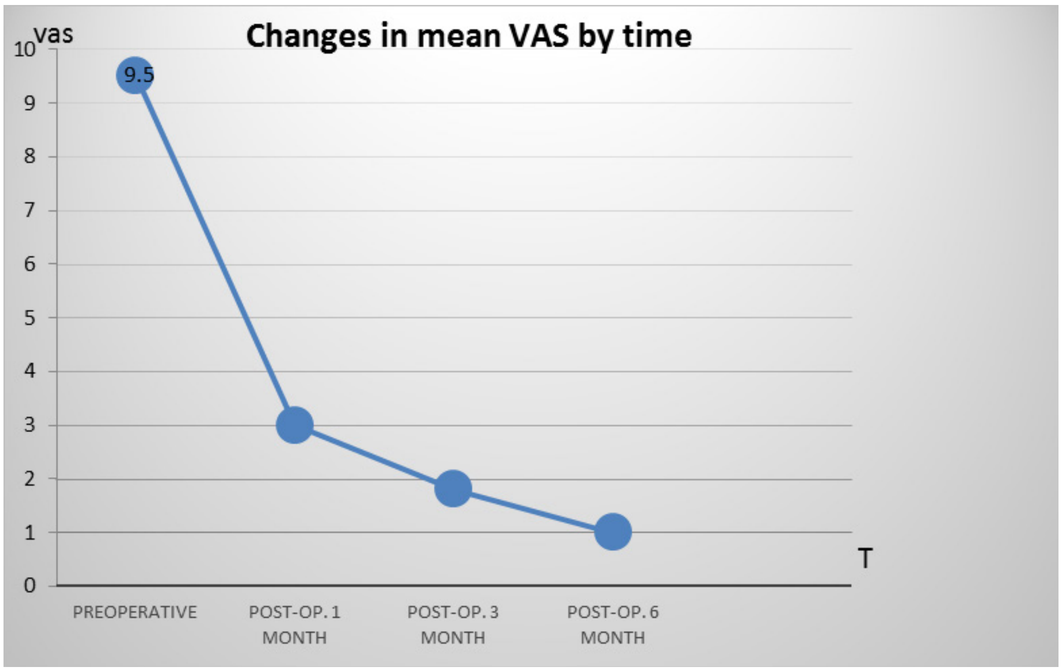

Figure 3: Changes in the mean VAS score by time

DISCUSSION

Nerve compression results in variable histopathological, morphological and physiological changes in nerve function. These changes were previously proved by numerous experimental studies applied in rats, pigs and other experimental animals. The basic pathophysiological mechanism of acute and chronic nerve compression is complex.

In general compression of peripheral nerve induces significant changes in intra-neural microcirculation and nerve fiber structure which leads to impairment of axonal transport, alteration in vascular permeability, edema formation and abnormality in nerve function. These pathological changes are manifested clinically by various clinical signs and symptoms which range from hypo/hyper algesia, hypo/hyperesthesia, allodynia or complete loss of nerve function. Depending on the results of these previous studies it was postulated that numerous neuropathic pains caused by nerve compression could be successfully managed by nerve decompression surgery [19-21].

Decompression surgery gained a great concern in the last decade and tested on different nerves compression situations e.g. Carpal tunnel syndrome (median nerve compression), optic nerve decompression, ulnar nerve decompression surgery and lumbar nerve roots decompression[22-25].

In head and neck region the effect of microvascular decompression (MVD) of Trigeminal nerve root from the overlying blood vessel is well documented as an effective procedure in management of classic trigeminal neuralgia. The study of the same effect on compressed extra-cranial part of CNV was not well covered in the literature. The available researches which discussed the effect of peripheral trigeminal nerve decompression only concentrated on supra orbital and supra trochlear decompression as an effective procedure in management of frontal headache [6,26,27].

Up to our knowledge this is the first study to assess the effect of surgical decompression on relieving the neuropathic pain caused by compressed IAN. [28].

We proposed our study with a major primary aim to assess degree of improvement after IASD on VAS at 1, 3 and 6 months postoperative. The VAS scoring system is considered to be one of the best methods for pain intensity evaluation. It provides a continuous scale for data on a straight line which is more preferable than the discontinuous methods, such as numerical and verbal rating scales[29,30].

The current study also verified that IASD allowed rapid patients improvement on VAS at one month postoperative and this improvement additionally increased up to six month postoperative ($P < 0.011$).

We also recommend enhancement of the IASD by nerve wrapping with collagen resorbable membrane. The IASD usually implemented under unfavorable conditions from irritating adjacent tissues which may exaggerate chance for scar formation and consequence suboptimal clinical outcomes. Wrapping the operated IAN with a protective barrier reduces fibrosis and adhesion formation and improved the clinical outcomes[31,32].

Our anticipated surgical technique of a new minimally invasive and reproducible procedure has very specific indications in management patients suffering idiopathic, post-traumatic or postoperative IAN entrapment neuropathy. Further prospective studies should be carried out with larger sample size to reflect efficacy of the technique.

CONCLUSION

We presented a novel significantly effective technique for management of neuropathic pain due to compressed IAN using surgical decompression with concomitant nerve wrapping by resorbable membrane.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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