Acta Scientific Dental Sciences
Volume 2 Issue 3 March 2018
Research Article

Soft Tissue Laser for Management of Mandibular Nerve Injuries

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Received: November 27, 2017; **Published:** February 01, 2018

Abstract

Purpose: Injuries to sensory nerves are one of the complications associated with trauma, surgeries, or dental implants resulting in various degrees of para/anesthesia. The aim of this work was to propose a treatment protocol for nerve injuries of the mandible.

Materials and Methods: Recognition of the site of nerve injury was performed using cone beam cross section tomography. Seven patients suffering from lingual, mental, and inferior alveolar nerve injuries received 10 sessions of soft tissue laser therapy in combination with injections of vitamin B12 and systemic corticosteroids. Patients were requested to record improvement of complications on a scale of 10 points two days after each session ($\alpha = 0.05$).

Results: After completion of the sessions, six patients recorded marked improvement in sensation and reduction of para/anesthesia or swelling sensation

Conclusion: Soft tissue laser therapy and fortifying vitamin therapy could be used to assist healing of sensory nerve injuries of the mandible.

Keywords: Soft Tissue Laser; Mandibular Nerve

Introduction

The lingual, mental, and inferior alveolar nerves provide sensory function to different regions of the mandible. After immergence from their foramina, the lingual and mental nerves travel bellows the connective tissue till the end of their course. Sensory nerve injuries could result from trauma, surgeries involving reflection of muco-periosteal flaps, or osteotomies related to insertion of dental implants or different distraction techniques [1]. Needle injury and pressure resulting from swelling or infection could also lead to similar symptoms [2].

Depending of the severity of the injury, complications could range from minor swelling or burning sensation to partial or complete loss of sensation. Traditional treatment options of nerve injuries focused on administering vitamin B_{12} injections in combination with different forms of physiotherapy to stimulate blood circulation in the region of injury [3,4]. Recent trials encouraged local applications of neural growth factor to stimulate nerve repair [5,6]. However, the outcome of nerve recovery cannot be accurately predicted [7].

Cone beam computerized tomography (CBCT) is a recent technology, where imaging is accomplished by using a rotating gantry to which an x-ray source and detector are fixed. A divergent pyramidal or cone shaped source of ionizing radiation is directed through the middle of the area of interest onto an area of x-ray detector on the opposite side. The x-ray source and detector rotate around a rotation fulcrum fixed within the center of the region of interest. During the rotation, multiple (150 - 600) sequential planar projection images of the field of view (FOV) are acquired in complete or sometimes partial arc [8].

This procedure varies from a traditional medical CT which uses a fan-shaped x-ray beam in a helical progression to acquire individual image slices of the FOV and then stacks the slices to obtain a 3D representation. Each slice requires a separate scan and separate 2D reconstruction. Because CBCT exposure incorporates the entire FOV, only one rotational sequence of gantry is necessary to acquire enough adaptation for image reconstruction. It produces 3D data at a lower cost and requires lower absorbed doses compared to conventional CT found in the practice of medical radiology [9]. Modern CBCT provides the dentist with a clear view related to the region of nerve injury and could assist in precise detection of area of nerve involvement. Tracing inferior alveolar nerve canal, detection of mental foramen, and sublingual ridge could easily be performed on cross section views using modern CBCT imaging techniques [10].

Diode laser is currently being used as a method of bio-stimulation of injured tissue. The frequency and power of soft tissue laser could be adjusted to diffuse the energy of the delivered beam to the surrounding soft tissue thus stimulating blood circulation and accelerating healing mechanism of the injured tissue [4]. The laser beam could be also used to disinfect the involved tissue and to reduce microbial inflammation as well [11]. A recent study associated laser irradiation with increased level of neural growth factor and brain derived neurotrophic factor both known of their regenerative potentials [12]. However not much could be found in dental literature about the interaction of soft tissue laser with nerve injuries to the mandible. The aim of this study was to assess the healing power for soft tissue laser on sensory nerve injuries of the mandible.

Material and Methods

Selection of patients

Approval of ethics committee was obtained before commencing with the study. Scope of the study, working methodology, and expected outcome were introduced to all patients. Written consent forms were signed by every patient. Seven patients suffering from sensory nerve injuries related to trauma or surgeries related to the mandible were selected for this study. Patients were requested to assess the severity of their complains on a scale of 10 points and the severity of para/anesthesia was clinically re-assessed using a mild prick of a sharp probe on a scale of 10 points (Table 1) [13]. Surgical guides were prepared, and patients were requested to perform high resolution CBCT on the involved region.

After recognition of location of site of nerve injury, patients were prepared to receive one soft tissue laser session (Simpler, Brendola, Italy) using diode laser irradiation (1 wt/cm^2 for 3 minutes) every 5 days with a total of 15 sessions. Open windows made to surgical guide insured accurate positioning of fiber optic tip each session. Patients were requested to re-assess the severity of their complains at the beginning of every new session. The surgical guides were used to align the pointing device of the laser beam 10 mm away from soft tissue. Power was adjusted to 10mW at 50hz frequency.

Patients received weekly intra-muscular injections of vitamin B_{12}, also, were prescribed an oral corticosteroid (Deltacortril, Pfizer Limited, Sandwich, Kent CT13 9, NJ) in an ascending dose of 5 mg/day for 10 days, 10 mg/day for 10 days, 15 mg/daily for 10 days, after which the dose was reduced using same steps [14].

Two patients suffering from inferior alveolar nerve compression related to misplaced dental implants requested to remove the implants by the same oral surgeon. A depth stopper was placed at the tip of the fiber optic cable allowing insertion of the tip of the fiber optic to 10mm vicinity of the inferior alveolar canal. After the fifth session, a new implant was inserted to the correct position. One Sample T test and Chi square tests were used to analyze the data (SPSS 14.0, Chicago, Ill).

Results

Six patients reported significant ($t = 10.8$, $P < 0.001$) improvement of the initial complain (Table 1), while one patient suffering from complete anesthesia of the lower lip did not report any meaningful change after completion of the proposed therapy. After the third session, patients suffering from burning and swelling sensation reported marked improvement of their condition and complete disappearance of the symptoms after the final session of laser irradiation. Patients suffering from partial paresthesia reported improvement of sensation at different segments of the involved region. None of the patients reported discomfort or pain during laser sessions despite that no topical or infiltration anesthesia were administered. Insertion of the fiber optic tip in the location of the removed implants did not cause any disturbance to the patients, however, both patients reported warming sensation during activation time of the laser device.

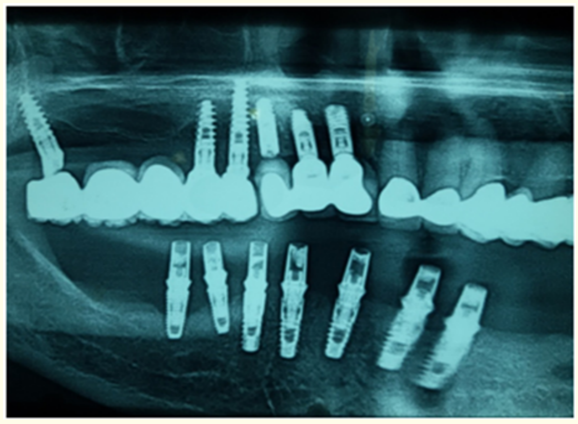

Figure 1A: Post-extraction x-ray image depicting entrapment of inferior alveolar nerve between the two roots of impacted third molar.

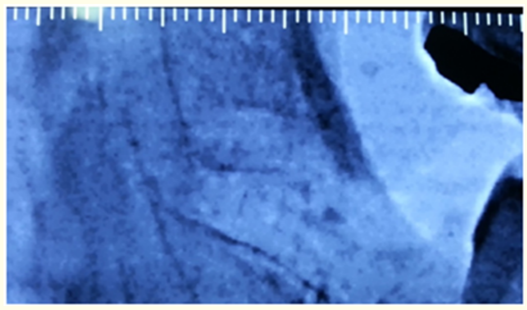

Figure 1B: Post-extraction CBCT image showing area of involvement of inferior alveolar nerve as localized inflammation of the region.

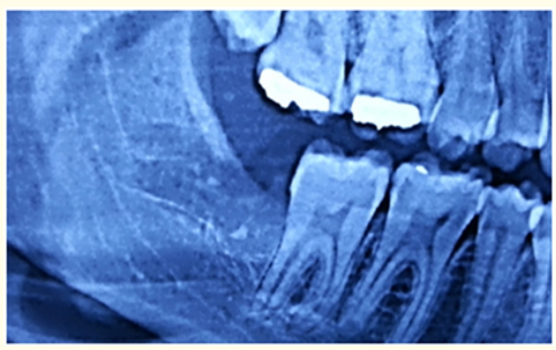

Figure 2A: Digital x-ray depicting pressure injury to the mental nerve by dental implant in premolar region.

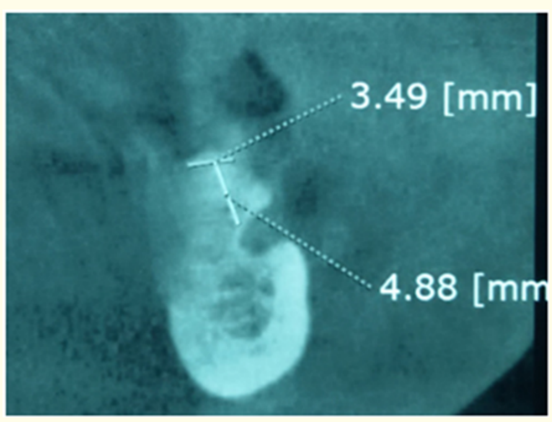

Figure 2B: CBCT cross section image of the previous case showing location of orifice of mental nerve after removal of dental implant and site of treatment.

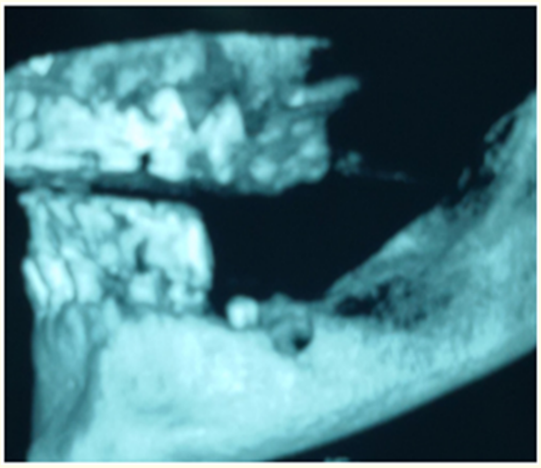

Figure 3: CBCT cross-section image depicting compression injury to mental nerve during muco-periosteal elevation flap before insertion of dental implant. Notice superficial path of the mental nerve.

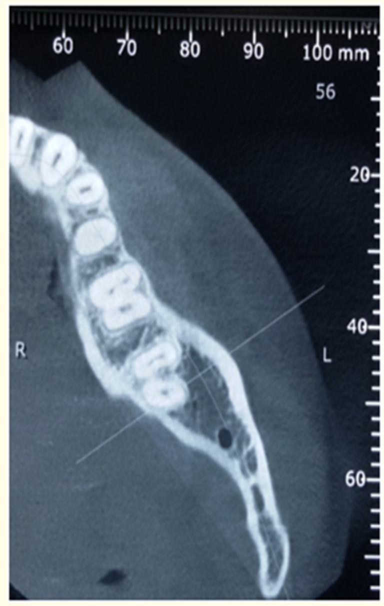

Figure 4: CBCT cross-section image showing injury of lingual nerve due to fracture of lingual cortical plate during removal of impacted third molar tooth.

Patient Number	Figure	Nerve	Cause	Complain	Scale Before	Scale After
1	Figure1	Lingual	Surgery	Paresthesia	7	2
2		Lingual	Surgery	Swelling/burning sensation	6	0
3		Lingual	Trauma	paresthesia/numbness	7	3
4	Figure 2	Mental	Implant	Paresthesia/numbness	5	2
5	Figure 3	Mental	Surgery	burning sensation	8	3
6	Figure 4	Inferior alv	Surgery	Paresthesia/numbness	8	2
7		Inferior alv	Surgery	anesthesia	10	8

Table 1: Nerve injury, cause, and scale of severity before and after treatment.

Discussion

Entrapment or compression injuries of sensory nerves of the mandible are one of the complications of trauma and oral surgeries. Mandibular nerve has the capacity to recover from minor injuries as partial cuts and crushes [15]. The risk of repair surgery, the associated complications, and the unpredicted prognosis unfavours this approach. Accurate determination of the location of nerve injury was performed using CBCT images. Custom made surgical guides allowed fixed positioning of the laser irradiation tip in standardized position during each session. The depth penetrating power of the laser beam insured that sufficient energy reached the involved nerve. Although the direct effect of the absorbed energy was direct warming of the surrounding tissue, it could also assist in reduction of inflammatory cell infiltration, resorption of formed blood clot and associated edema, and in acceleration of blood circulation [16].

The lingual nerve was the fasted to respond to the benefits of soft tissue laser. This is due to its superficial path beneath the lingual mucosa resulting in better absorption of the delivered energy. The mental nerve was the second in response putting in consideration that the irradiated field was only limited to the mental foramen. The deeper position of the inferior alveolar nerve in its canal, the density of the surrounding trabecular bone, and the thickness of the cortical plates resulted in weakening of the laser beam energy before it could reach the damaged nerve.

In this study, the drilled osteotomy was used to allow direct access of the laser beam over the involved nerve. Repositioning of dental implant resulted in partial recovery of the crushed inferior alveolar nerve after 3 weeks. In association with soft tissue laser irradiation and proper medication the symptoms completely disappeared after 9 weeks [17]. Additionally, it should be noted that early referral of patients will improve prognosis of treatment before distal degeneration of involved nerve [18].

Beside the well-known healing benefits of soft tissue laser, improvement of nerve function and reduction of patients complains could also be related to improvement of the conditions of the surrounding tissue and due to acceleration of the healing of the damaged nerve itself. In combination with the fortifying effects of the given vitamin injections and the anti-inflammatory umbrella of the administered corticosteroids, the recovery of nerve injuries was markedly improved [7].

Conclusions

Within the limitations of this study, soft tissue laser therapy assisted the healing power of damaged sensory nerves of the mandible.

Bibliography

1. Meek MF., *et al*. "A randomised controlled clinical trial to compare the incidence of injury to the inferior alveolar nerve as a result of coronectomy and removal of mandibular third molars". *British Journal of Oral and Maxillofacial Surgery* 43.1 (2005): 7-12.

2. Ozkan BT., *et al*. "Paresthesia of the mental nerve stem from periapical infection of mandibular canine tooth: a case report". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics* 105.5 (2008): e28-e31.

3. Shi X., *et al*. "[An experimental study on physiotherapy for traumatic facial nerve injury]". *Zhonghua Kou Qiang Yi Xue Za Zhi* 35.6 (2000): 450-452.

4. Rochkind S., *et al*. "Chapter 25: Phototherapy in peripheral nerve injury: effects on muscle preservation and nerve regeneration". *International Review of Neurobiology* 87 (2009): 445-464.

5. Wang L., *et al*. "Effects of nerve growth factor delivery via a gel to inferior alveolar nerve in mandibular distraction osteogenesis". *Journal of Craniofacial Surgery* 20.6 (2009): 2188-2192.

6. Wang L., *et al*. "Effects of locally applied nerve growth factor to the inferior alveolar nerve histology in a rabbit model of mandibular distraction osteogenesis". *International Journal of Oral and Maxillofacial Surgery* 38.1 (2009): 64-69.

7. Misch CE and Resnik R. "Mandibular nerve neurosensory impairment after dental implant surgery: management and protocol". *Implant Dentistry* 19.5 (2010): 378-386.

8. Scarfe WC., *et al*. "Maxillofacial cone beam computed tomography: essence, elements and steps to interpretation". *Australian Dental Journal* 57.1 (2012): 46-60.

9. Lange J., *et al*. "Estimating the effective radiation dose imparted to patients by intraoperative cone-beam computed tomography in thoracolumbar spinal surgery". *Spine (Phila Pa 1976)* 38.5 (2012): E306-E312.

10. Ueda M., *et al*. "Clinical significance of computed tomographic assessment and anatomic features of the inferior alveolar canal as risk factors for injury of the inferior alveolar nerve at third molar surgery". *Journal of Oral and Maxillofacial Surgery* 70.3 (2012): 514-520.

11. Khullar SM., *et al*. "The effects of low level laser treatment on recovery of nerve conduction and motor function after compression injury in the rat sciatic nerve". *European Journal of Oral Sciences* 103.5 (1995): 299-305.

12. de Oliveira Martins D., *et al*. "Laser therapy and pain-related behavior after injury of the inferior alveolar nerve: possible involvement of neurotrophins". *Journal of Neurotrauma* 30.6 (2012): 480-486.

13. Jarrosson C, *et al*. "[Evaluation of sensory deficit of the inferior alveolar nerve after mandibular osteotomy]". *Revue de Stomatologie et de Chirurgie Maxillo-Faciale* 106.3 (2005): 139-145.

14. Cafaro A., *et al*. "Effect of low-level laser irradiation on unresponsive oral lichen planus: early preliminary results in 13 patients". *Photomedicine and Laser Surgery* 28.2 (2010): S99-S103.

15. Eppley BL., *et al*. "Effect of different surgical repair modalities on regeneration of the rabbit mandibular nerve". *Journal of Oral and Maxillofacial Surgery* 47.3 (1989): 257-276.

16. Ozen T., *et al*. "Efficacy of low level laser therapy on neurosensory recovery after injury to the inferior alveolar nerve". *Head and Face Medicine* 2 (2006): 3.

17. Bagheri SC and Meyer RA. "Management of mandibular nerve injuries from dental implants". *Atlas of Oral and Maxillofacial Surgery Clinics of North America* 19.1 (2011): 47-61.

18. Kraut RA and Chahal O. "Management of patients with trigeminal nerve injuries after mandibular implant placement". *Journal of the American Dental Association* 133.10 (2002): 1351-1354.

Volume 2 Issue 3 March 2018