



Case Series

The Use of Microcurrent Therapy in the Treatment of Cases Suffering from Post-Traumatic Trigeminal Neuropathic Pain Secondary to Iatrogenic Dental Treatment

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Abstract

Background: Post-traumatic Trigeminal Neuropathic Pain (PTNP) is typically reluctant to medical treatment and does not reduce significantly in response to analgesics or narcotics medication. The purpose of this article is to present three cases who had iatrogenic trigeminal neuropathic pain and were successfully treated with Frequency Specific Microcurrent (FSM) machine. **Content:** The three reported cases were extracted between January 2015 to December 2022. Three female patients were recruited. The average age was 46.6 years old (age range 32-65 years old). The duration of Post-Traumatic Trigeminal Neuropathic Pain (PTNP) ranged from 8 months to 4 years (28 months on average). The inclusion criteria accepted individuals with neuropathic pain secondary to dental treatment only, and the symptoms should last 3 months or more. Patients received treatment with FSM machine for 13 sessions on average, and the neuropathic pain was significantly relieved in most patients. **Conclusion:** Post-traumatic trigeminal neuropathic pain (PTNP) is relatively common and most patients regain their normal sensation within days to weeks. However, few disadvantage patients continue to suffer from lingering pain. Despite present-day improvement in drug therapies to deal with neuropathy symptoms, medications are still struggling to achieve good control of pain. The use of FSM machine on those cases with PTNP exhibited successful outcome. It is worth to design randomized controlled trial to further study the use of this new approach “frequency specific microcurrent” therapy in management of iatrogenic neuropathy.

Keywords: Post-Traumatic Neurologic Neuropathic Pain; Frequency Specific Microcurrent; Paresthesia; Nerve; Pain

Introduction

The international classification of orofacial pain (ICOP) describes post-traumatic trigeminal neuropathic pain (PTNP) as “a unilateral or bilateral facial or oral pain following and caused by trauma to the trigeminal nerve(s), with other symptoms and/or clinical signs of trigeminal nerve dysfunction, and persisting or recurring for more than 3 months” [1].

The Post-Traumatic Trigeminal Neuropathic Pain (PTNP) is an outcome of different dental treatments and represents a proportion

of close to 40% of all cases. Most of the individual regain their normal sensation within days to several weeks, but there are small number of cases continue to suffer from neuropathy. Estimates of the occurrence of PTNP are deficient, which is partly due to varying diagnostic terms and criteria. In general, approximately 3% of patients with trigeminal nerve injuries develop PTNP [2].

PTNP may result from a major craniofacial/oral trauma or may be subsequent to relatively minor dental treatments such as iatrogenic injuries. The most common underlying cause is impacted lower third molar extraction which can cause damage to inferior alveolar nerve or lingual nerve. Damage to the inferior alveolar nerve is explained by anatomical proximity between the apexes of the third molar and the canal that house the nerve [3,4].

Equally, injury to lingual nerve due to compression or strain force occurs during maneuvering to extract the molar [5-7].

PTTNP occurs secondary to other dental procedures include implant placement, local anesthesia and root canal therapy. These dental procedures may result in significant morbidity owing to their influence on speech, swallowing and social interaction [8-12].

PTNP has negative impact on patient's quality of life and wellbeing as it interferes with a variety of social functions and daily activities [13] and it is associated with a substantial psychosocial burden [14].

PTNP is characterized by wide inter-individual variability in clinical presentation following similar nerve injuries. It can be explained by variable interplay between genetic, environmental and psychosocial factors. Discrepancies in the location and the pattern of the injury may exhibit variation in PTNP clinical characteristics. It can be limited to the area of injury or spread across dermatomes, and it can be localized or diffused. The pain intensity may vary from mild to severe and often described as burning or shooting, and it is usually continuous, lasting most of the day and on most days. A limited number of patients report paroxysmal pain that can be spontaneous or initiated by function or touch. The reported PTNP age of onset is at the 5th decade of life, with a female predominance, but younger age can be affected. The exact mechanism for female preference to pain experience is not fully understood.

Painful neuropathies usually present with somatosensory signs or symptoms, which may be negative (e.g., hypoesthesia, hypoalgesia, or anesthesia) and/or positive (hyperalgesia, allodynia, or dysesthesia) as well as with spontaneous and/or provoked pain. PTNP patients can also report sensory disturbances such as sensitivity to hot or cold or flushing feeling of swelling that cannot be verified by examination or imaging [15]. PTNP results from dental treatment damage to peripheral nervous system either directly or indirectly, rather than stimulation of pain receptor. Some studies noted that in an early stage of nerve injury, negative symptoms commence with hypoesthesia and anesthesia. Later, positive symptoms, like formication paresthesia, occur. The latter symptom can be spontaneous or provoked, which can be burning in nature indicating discharge of type C nociceptive or lancinating or pin-and-needle pain suggesting ectopic discharges arising in the axon of A delta fiber [16,17].

It has been suggested that the variation in PTNP clinical presentations may be also related to altered activity of different nerve fibers, caused by pathophysiological complexities of sensory processing in nerve trunk axonal damage or perineural inflammation as well as to alteration in the patients' ability to modulate pain [15]. Neuroinflammation is a proinflammatory cytokine-mediated process that can be provoked by systemic tissue injury but it is

most often associated with direct injury to the nervous system. Chronic neuropathic pain is mediated by inflammatory cytokines IL-1, IL-6, TNF- α , and substance P [18,19].

Any inflamed tissue eventually experiences calcium influx and then fibrosis, and neural tissues are no exception. PTNP is usually diagnosed when the symptoms of neuropathy lasted for at least 3 months or more [20].

It is commonly difficult to treat and does not reduce significantly in response to medication and surgical repair can be carried out on limited cases [21].

Frequency Specific Microcurrent (FSM) is an electro physical modality used in pain management that delivers very low intensity electric current to tissues within the microampere (μ A) rang, approximately 1000 times lower than the current intensity used in transcutaneous electrical stimulation (TENS) [22]. Microcurrent application is based on the principle that a current close to the cellular current of the body can overcome electrical resistance of injured or inflamed tissue, restore cellular homeostasis and facilitate tissue regeneration in contrast to TENS, which primarily works by blocking the transmission of pain signals.

Although the mechanism of action of FSM is not yet clear, these microcurrents of physiological amperage when delivered to damaged or inflamed tissue is said to alter cell membrane function, reduce inflammation, and promote healing by maintaining intracellular Ca²⁺ homeostasis and upregulating ATP production [23-25].

Most of FSM research studies and case reports were carried out on neuropathy with a sign of hypoesthesia, anesthesia, hyperalgesia and allodynia. The effect of FSM on negative symptom of neuropathy is usually able to revive the nerve. However, if the nerve fails to respond to secretory effect of FSM machine, the nerve is most likely badly severed.

FSM is low risk and cost-effective making it an ideal tool for treating neuropathic pain. The preliminary clinical data, cytokine data and collected anecdotal reports encouraged me to use FSM on the patient with iatrogenic trigeminal neuropathy. FSM can be considered as a valuable adjunct in the treatment of neuropathic dysesthesia [26-30].

There are two types of FSM machines were used, Precision Care and AutoCare machines. The Precision Care is a digital battery-operated two-channel three-digit specific microcurrent device. The channel A has frequencies responsible for "pathology" such as acute inflammation, fibrosis and secretion, and the channel B runs frequencies responsible for different type of tissue, in our case, it was neural tissue (Figure 1). The AutoCare machine is a digital two-channel, three-digit specific microcurrent device programmed to run a sequence of specific frequency combinations in a protocol designed for the treatment of "neuropathic pain" (Figure 2).



Figure 1: Precision Care Frequency Specific Microcurrent Machine.



Figure 2: Autocare Frequency Specific Microcurrent Machine.

Case 1

A 65-year-old Kuwaiti female patient complained of “pins and needle” sensation after placement of two implant on right mandible. The implants were placed and crowns were restored on August 2018, immediately, patient had feeling of discomfort and uneasiness. Reviewing radiologic images (cone beam computed tomography and orthopantomogram), implant placed well away from inferior alveolar nerve and its canal. Multiple scaling was carried out with no benefit noted. Patient crowns were removed for about 6 months and paresthesia still persisted. On December 2019, implants were removed but pins-and-needle sensation continued. Medically, patient is hypertensive on Diavon and taking thyroid supplement for hypothyroidism. Blood tests (include, complete blood cell count and differential, biochemical test, thyroid function tests) were within normal range (Figures 3 and 4).

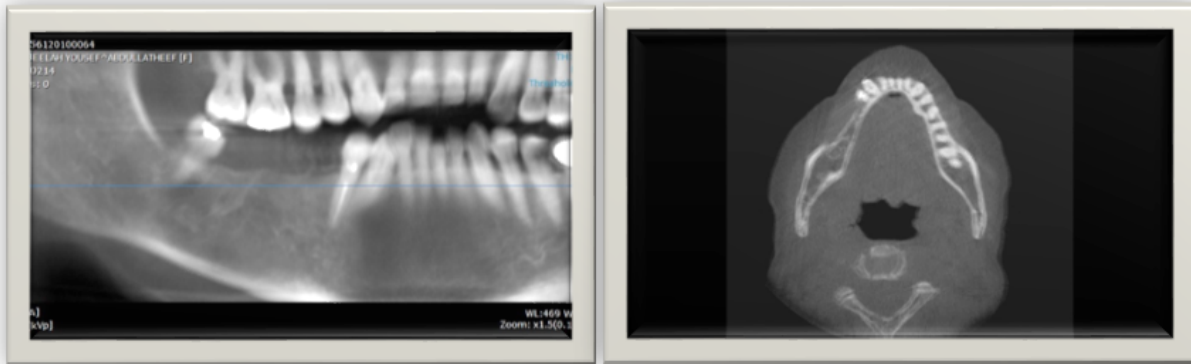


Figure 3a and 3b: Cone beam computed tomography reveal normal bone structure after implants removal for two years.

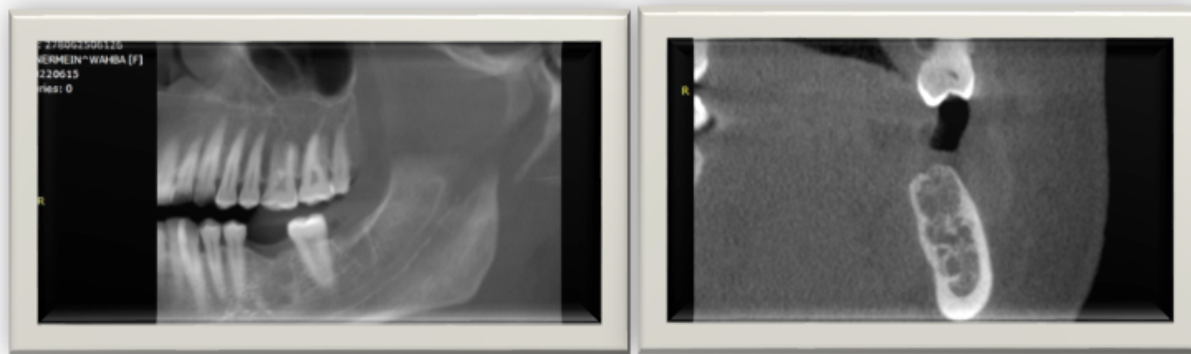


Figure 4a and 4b: Radiologic images reveal bone healing with sclerotic bone spicules.

The distribution of nerve on right lip and chin revealed dull sensation with pin-prick test and negative respond to 5mm and 10 mm two-point discrimination assessment. The response to Autocare FSM (which was set on nerve pain protocol) was not able to abate pin-and-needle sensation on the first three sessions. On the fourth session, the patient was able to feel some relief. As the therapy continued to eighth session, full resolution of paresthesia was resolved.

Case 2

A 32-year-old Kuwaiti female experienced 8 month of left tongue anesthesia after surgical extraction of impacted lower wisdom tooth. She was given methyl cobalamin injection for 6 weeks and B complex tablets for 2 months, but no nerve sensation regained and the patient continued self-traumatized her tongue. The usual neural investigations (pin-prick test, two-point discrimination test, and cold/hot test) confirmed presence of anesthesia on left tongue.

Precision FSM was set on the following frequencies, on channel (A) include 40, 284, 13,81,49 (frequency represent acute inflammation, chronic inflammation, fibrosis, secretion and vitality) and on channel (B) include 396 (frequency responsible for nerve). The patient response to the FSM treatment was disappointing for the five sessions. However, the patient exhibited “pins-and-needle” feeling on sixth to eighth session. She regained 80% of tongue sensation after fourteenth appointment. There were no further changes on her tongue sensation on successive visits.

Case 3

A 43-year-old Egyptian female complained dull, boring and pressing pain on left mandible after extraction of the tooth. She is on thyroid supplement for hypothyroidism. Patient had acute pain and swelling from left lower first molar in June 2019. She went to private dental clinic where the abscess was drained and root canal treatment was done. However, pain persisted and forced the patient to have the tooth extracted. Over the next 10 months, four expletory surgeries were carried out and multiple antibiotics courses but failed to relief her boring pressing pain. Cone-beam computed tomography image revealed no abnormalities in the extraction area.

Patient attended oral medicine clinic and examination of right and left jaw was tested with cold-warm detection threshold, blunt and pin-prick threshold and two-point discrimination test. She experienced unusual discomfort with paresthesia on the extraction site of left mandible and lower left lip.

Two FSM machine were used. Nerve pain protocol was used on Autocare FSM and Precision FSM was used to produce frequency that reduce inflammation (40, 284), fibrosis (13) and eradicate possible infection (61) on bone tissue (39, 59). On the second visit, patient felt reduce of dull pressing pain, and full recovery was appreciated by the 15th session.

Discussion

Iatrogenic dental injuries are common and it represents 40% of cases. Most affected individuals regain their normal sensation with days to weeks. However, small number of patients continues to experience persistent neuropathic pain. The patients, who were reported in this study, were subjected to different drug therapy from vitamin B supplement, and antibiotic drug to repair damaged neural tissue or resolve infection. The drugs fail to relieve Post-Traumatic Trigeminal Neuropathic Pain (PTTNP).

After reviewing Dr. McMakin's study of neuropathic pain treatment with FSM machine, I was encouraged to use FSM machine to manage neuropathic pain secondary to iatrogenic dental treatment. Despite unclear mode of action of FSM, these microcurrents of physiological amperage when delivered to injured or inflamed tissue is said to alter cell membrane function, reduce inflammation, and promote healing by maintaining intracellular Ca^{2+} homeostasis and upregulating ATP production [23-25].

In those case reports, I exploited the proposed healing effect of FSM machine on damaged neural tissue secondary to dental treatment. The FSM machine was used on 3 patients for average session of 10 and it showed remarkable improvement. It seems that machine's microcurrent physiological amperage was able to

run through diseased nerve and reduce inflammatory reaction, dissolve fibrosis and promote the health of the nerve. Dr. McMakin and associates' study confirmed that microcurrent of physiological amperage did reduce cytokine level of interleukin-1 and interleukin-6, tumor necrosis factor- α and the neurotransmitter substance P in patients suffering from fibromyalgia associated with cervical spine trauma. In addition, it elevates the level of endorphins [27]. It is likely that reduction of chronic inflammatory chemicals surrounding the neural tissues leads to regain of nerve tissue health, in our reported cases.

Holland reported on the morphological structural and electrophysiological post-injury changes after peripheral sensory nerve of the trigeminal ganglion in cats. He noticed that all nerve injuries resulted in lower conduction velocities and sensory impairment. He observed that neural tissue subjected to the crush injuries recovered faster with less central disruption than neural transection injuries [31]. What we can extrapolate from Holland's report, that full recovery of sensation for case (1) and case (3) was secondary to healing of possibly the crushed or strained neural tissue. However, case (2) showed partial recovery of the neural sensation due to fractional neural tissue transection.

In addition, Adams J. and McMakin C. showed the efficacy of FSM device to resolve chronic pain and adhesions after ulnar transposition surgery [32]. Frequency for fibrosis was used in 3 reported cases, the possible resolution of scar tissue around the neural tissue helped in restoring the normal function of the nerve. In addition, frequency for secretion was used to assist the rejuvenating neural tissue.

FSM machine showed excellent recovery of normal sensation after iatrogenic injury to trigeminal nerve branch. FSM machine has good potential to be used in PTNP. However, randomized clinical trial is highly recommended to further investigate the usefulness of FSM machine in neuropathic pain.

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