



**Sudan University of Science and
Technology
College of Graduate Studies**



**The Effects of Diode Laser Therapy in Treatment of
Trigeminal Neuralgia**

**فعالية العلاج بالليزر أشباه الموصلات لإعتلال العصب
الخامس**

**A Graduation Project Dissertation Submitted as Partial Fulfillment of the
Requirements for the Degree of Post Graduate Diploma of Laser
Applications in Medicine. Dentistry**

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Dedication

First and foremost to our, Allah.

To the springs that never stops giving, our parents.

To our loves, brothers, sisters and friends.

To the people who paved our way to of sciences and Knowledge.

TO All our teachers.

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالى:

(سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

(سورة البقرة: الآية 32)

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Abstract

Trigeminal neuralgia (TN) is mainly a periodic, unilateral, sharp, and electric shock-like pain which passes through trigeminal nerve branches, Treatment of trigeminal neuralgia conventionally by alcohol and the other by surgical intervention, Alternative treatment is by using laser.

To evaluate the effect of laser therapy (Diode laser solase-808 and solase-976) for treatment of trigeminal neuralgia

Hospital-based cross sectional descriptive study in Military hospital that turn the patients in to Health and beauty medical polyclinic, Khartoum, Sudan. 8 patients with Trigeminal neuralgia above 40 years.8 patients (50%) male and (50) female, in period extending from January to June 2018, were participated. Patient were diagnostic by TN and have a previous conventional treatment .laser used was diode laser 976 nm, and parameter use were 0.800 mW as starting dose and end 2.5 Watt .

VAS was used to analysis degree of pain. Compressible, variable used ANOVA test to compare between Sessions in degree of pain and Duration of pain during treatment by laser with level of significant $P < 0.05$ The presented facial pain (75.0%). Most common patients pain in face (62.5%) All patients had pain in one side of face (100.0%). prevalent pain with ear, throat , tongue ,near to the tonsil (37.5%) and (37.5%) without pain .Most patients have facial pain constancy (25%). Facial pain background during half of waking hours (37.5%) their pain was starting when something touch their face(75.0%).Most patients used drugs frequently (carbamazepine & gabapentin) about(75.0%).Mean of the pain duration of the laser treatment measured by seconds drops rapidly from (492 s) at the 1st(Diode laser solase-976)treatment session and (78 s) at the 2nd(Diode laser solase-976)treatment, then complete to decrease slightly through the remaining 10 sessions until it reaches zero (0.0s) at the twelfth session.

Results of this study are consistent with Health and beauty medical polyclinic Khartoum state (2018) .male and female affected by trigeminal neuralgia. The prevalence Patients in fifth decade of age showed a higher frequency rate of trigeminal neuralgia.all of the patients received 12 sessions of laser treatment, which made them feeling better without any side effects , and reduce the degree and duration of pain.

مستخلص الدراسة

هذه الدراسة مبنية على علاج العصب الخامس الذي كان يعالج مسبقا بالطرق التقليدية كالحقن بالكحول والتدخل الجراحي مقارنة بطريقتنا الحديثة العلاج بدايود ليزر الطول الموجي له 967 نانو متر والتي طبقناها على المرضى الثمانية المحولين من مستشفى أمدرمان العسكري و مستشفى الأسنان الجامعي بالخرطوم.

اعتلال العصب الخامس هو بشكل اساسي حالة متناوبة احادية الجانب حاد , على شكل الم صعقة كهربائية تنتقل خلال فروع العصب الخامس وتؤثر في العيون والشفاه والأنف وفروة الرأس ومقدمة الرأس والفكين ويحصل في جانب واحد من الوجه في 95% من الحالات .

من أجل تقييم تأثير دايود ليزر في علاج مرض إعتلال العصب الخامس .

دراسة توضيحية معتمدة منهجياً على المستشفيات، قد تمت في مستشفى السلاح الطبي التي من خلالها قد تم توجيه المرضى إلى مجمع عيادات الصحة والجمال الطبي في الخرطوم ، السودان . عينة المرضى قد شملت ثمانية مرضى قد تم تشخيصهم بإعتلال العصب الخامس و تتراوح أعمارهم إلى ما فوق الأربعين سنة . ثمانية من المرضى (50%) الذكور و (50%) من الإناث ، في الفترة ما بين يناير إلى يونيو ٢٠١٨ . بدأت الجرعة الاولى من علاج الليزر للمرضى من 0.800 ملي وات وانتهت الجرعة الأخيرة 2.5 وات .

الفئة العمرية الأكثر تأثراً تتراوح أعمارهم ما بين (٤٢-٧٠) سنة . الألم الوجهي المحسوس (٧٥.٠%) . أغلبية المرضى المتأثرين بالألم في الوجه (٦٢.٥%). جميع المرضى كان لديهم الألم الوجهي في جانب واحد من الوجه، فقط البعض (٣٧.٥%) من المرضى يترافق لديهم هذا الألم مع الم بالاذن والحلق واللسان واللوزتين .

(٢٥%) من المرضى لديهم الألم على شكل مستمر، بينما (٣٧.٥%) منهم يطول لديه الألم لنصف عدد ساعات الاستيقاظ اليومية، ٧٥% يبدأ لديهم الألم الوجهي عند لمس شئ ما للوجه . ٧٥% من المرضى كانوا يتناولون الادوية من مثل (Carbamazepine & Gabapentin) من حين لآخر. تقلص متوسط مدة الألم خلال جلسة العلاج بالليزر من (٤٩٢ ث) خلال الجلسة الأولى من العلاج بالليزر المنخفض المستوى الى (٧٨ ث) في الجلسة الثانية من العلاج، واستمر بالنزول تدريجياً خلال الجلسات العشر (١٠) المتبقية الى ان انعدم الألم اثناء الجلسة الثانية عشر (١٢) والأخيرة .

هذه الدراسة تمت في مجمع عيادات الصحة والجمال الطبي ولاية الخرطوم(2018) وكانت نسبة الذكور تساوي نسبة الإناث في هذا المرض الذين أعمارهم في الخمسين فأكثر وكل مريض خضع ل 12 جلسة علاجية وجميعهم حصلوا على نتائج علاجية مذهلة بدون اي أعراض جانبية مصاحبة لليزر واختفاء الألم بشكل كامل .

Chapter One

Introduction

Chapter One

Introduction

1.1-Background of the study

Trigeminal neuralgia (TN) is mainly a periodic, unilateral, sharp, and electric shock-like pain which passes through trigeminal nerve branches and feels in the eyes, lips, nose, scalp, forehead, and jaw and is limited to one side of the face in majority of cases (95%). The episodes of pain last up to two minutes and between two episodes the patient is painless. It may occur spontaneously or be triggered by daily activities, such as washing, shaving, talking, brushing teeth, eating and drinking. This pain usually takes only a few seconds (Falaki, F., Nejat, A.H. and Dalirsani, Z., 2014). Its frequency varies from a single attack during the day to more than one attack per minute that affects the individual's quality of life. The most commonly involved branches are maxillary or mandibular division and the least frequently involved is ophthalmic branch. Pain usually starts after stimulation of trigger points. Some normal activities such as chewing and speaking are common triggers for beginning of the pain (Jainkittivong, A., Aneksuk, V. and Langlais, R.P., 2012.).

Different methods have been used for relief of the pain, and the aim of this study was to review studies on the use of laser therapy for trigeminal neuralgia as a new strategy. Although trigeminal neuralgia (Tic douloureux) is one of the most painful conditions which are often reported in patients older than 50 years of age, it may affect younger people or even children. It is estimated that 1 in 15,000 people suffers from trigeminal neuralgia; however, numbers may be significantly higher due to frequent misdiagnosis. (Falaki, F., Nejat, A.H. and Dalirsani, Z., 2014.)

The earliest descriptions of TN as a clinical entity date back to the 1600s provided by prominent physicians at the time including, Drs Johannes Michael Fehr and Elias Schmidt, secretaries of the Imperial Leopoldina Academy of the Natural Sciences, and famous philosopher John Locke. However, the term tic douloureux was not made up until nearly a century after in 1756 Christmas (ad), by Nicholas Andre who believed that the condition stemmed from a nerve in distress and classified it as a convulsive disorder. He conceptualized the disease in terms of convulsions and used the term tic

douloureux to imply contortions and grimaces accompanied by violent and unbearable pain. In 1773, an English physician; Dr. John Fothergill presented his experience with 14 patient encounters and deemed the cause to be related to cancer rather than a convulsive disorder, thus coining the term, Fothergill's disease. In his remarkable and accurate description, he stated, "The affection seems to be peculiar to persons advancing in years, and to women more than to men (Patel, S.K. and Liu, J.K., 2016.) Low Level laser Treatment (LLLT) is a treatment strategy which uses a single wavelength light source. Laser radiation and monochromatic light may alter cell and tissue function. (4,1) Many authors have reported significant pain reduction in a number of conditions such as rheumatoid arthritis, fibromyalgia, post-operative pain, headache, nervous system diseases, myofascial pain syndrome, chronic neck pain, and low back pain as a result of laser application. (Ilbuldu, E., Cakmak, A., Disci, R. and Aydin, R., 2004., Dubenko, E.G., Zhuk, A.A., Safronov, B.G. and Bondarenko, M.I., 1976, Iijima, K., Shimoyama, N., Shimoyama, M., Yamamoto, T., Shimizu, T. and Mizuguchi, T., 1989). Clinical studies of the effects of Low Level laser Treatment on injured nerves have revealed an increase in nerve function and improved capacity for myelin production. LLLT has also been shown to be effective for promoting axonal growth in injured nerves in animal models (Costantini, D., Delogu, G., Lo, L.B., Tomasello, C. and Sarra, M., 1997, PINHEIRO, A.L., CAVALCANTI, E.T., PINHEIRO, T.I., ALVES, M.J., MIRANDA, E.R., DE QUEVEDO, A.S., MANZI, C.T., VIEIRA, A.L. and ROLIM, A.B., 1998., Iijima, K., Shimoyama, N., Shimoyama, M., Yamamoto, T., Shimizu, T. and Mizuguchi, T., 1989, Walker, J.B., Akhanjee, L.K., Cooney, M.M., Goldstein, J., Tamzyoshi, S. and Segal-Gidan, F., 1987).

Here we review papers available about the effect of Low Level laser Treatment on trigeminal neuralgia. An online search of PubMed, Scopus, Science Direct, Inter science, and Iran Medex using key words "trigeminal neuralgia" and "low-level laser"

from 1986 until July 2011 was performed. Studies with methods not including the exact details of laser therapy were excluded from the review.

1.2-Research Problem

Trigeminal neuralgia is usually caused by demyelination of trigeminal sensory fibers within either the nerve root or, less commonly, the brainstem. In most cases, the trigeminal nerve root demyelination involves the proximal, CNS part of the root and results from compression by an overlying artery or vein. Most cases are caused by compression of the trigeminal nerve root, usually within a few millimetres of entry into the pons, i.e. the root entry zone. In a few cases, trigeminal neuralgia is due to a primary demyelinating disorder. Other, rare causes include infiltration of the nerve root, gasserian ganglion or nerve by a tumour or amyloid, and small infarcts or angiomas in the pons or medulla. Once all of these possibilities have been excluded, there remain a small proportion of patients in whom the aetiology is undetermined prior fossa (Love, S. and Coakham, H.B., 2001.).

1.3-Literature Review

1.3.1-Definition: Trigeminal neuralgia (TN or TGN) is a chronic pain disorder that affects the trigeminal nerve.[Custead, R., 2016.] There are two main types: typical and atypical trigeminal neuralgia.[Custead, R., 2016.] The typical form results in episodes of severe, sudden, shock-like pain in one side of the face that lasts for seconds to a few minutes.[Custead, R., 2016.] Groups of these episodes can occur over a few hours.[Custead, R., 2016.] The atypical form results in a constant burning pain that is less severe. [Custead, R., 2016.] Episodes may be triggered by any touch to the face.[Custead, R., 2016.]

Both forms may occur in the same person.[Custead, R., 2016.] It is one of the most painful conditions and can result in depression.[Okeson, J.P., 2005]

1.3.2- signs and symptoms : This disorder is characterized by episodes of severe facial pain along the trigeminal nerve divisions. An individual attack usually lasts from a few seconds to several minutes or hours, but these can repeat for hours with very short intervals between attacks. In other instances, only 4-10 attacks are experienced daily. The episodes of intense pain may occur paroxysmally. To describe the pain sensation, people often describe a trigger area on the face so sensitive that touching or even air currents can trigger an episode; however, in many people, the pain is generated spontaneously without any apparent stimulation. It affects lifestyle as it can be triggered by common activities such as eating, talking, shaving and brushing teeth. The wind, chewing, and talking can aggravate the condition in many patients. The attacks are said by those affected to feel like stabbing electric shocks, burning, sharp, pressing, crushing, exploding or shooting pain that becomes intractable.[citation needed].The pain also tends to occur in cycles with remissions lasting months or even years. 1–6% of cases occur on both sides of the face but extremely rare for both to be affected at the same time. This normally indicates problems with both trigeminal nerves, since one serves strictly the left side of the face and the other serves the right side .The severity of the pain makes it difficult to wash the face, shave, and perform good oral hygiene. The pain has a significant impact on activities of daily living especially as people live in fear of when they are going to get their next attack of pain and how severe it will be. It can lead to severe depression and anxiety.[MFDS, R., 2013]

1.3.3-Causes

The exact cause is unclear but believed to involve loss of the myelin around the trigeminal nerve. This may occur due to compression from a blood vessel as the nerve exits the brain stem, multiple sclerosis, stroke, or trauma. Less common causes include a tumor or arteriovenous malformation.[Custead, R., 2016.] It is a type of nerve pain.[Custead, R., 2016.] Several theories exist to explain the possible causes of this pain syndrome. It was once believed that the nerve was

compressed in the opening from the inside to the outside of the skull; but leading research indicates that it is an enlarged or lengthened blood vessel – most commonly the superior cerebellar artery – compressing or throbbing against the microvasculature of the trigeminal nerve near its connection with the pons.[Nurmikko, T. J and Eldridge, P. R (2009).] Such a compression can injure the nerve's protective myelin sheath and cause erratic and hyperactive functioning of the nerve. This can lead to pain attacks at the slightest stimulation of any area served by the nerve as well as hinder the nerve's ability to shut off the pain signals after the stimulation ends. This type of injury may rarely be caused by an aneurysm (an outpouching of a blood vessel); by an AVM (arteriovenous malformation);[Singh, N., Bharatha, A., O'Kelly, C., Wallace, M.C., Goldstein, W., Willinsky, R.A., Aviv, R.I. and Symons, S.P., 2010.] by a tumor; such as an arachnoid cyst or meningioma in the cerebellopontine angle;[Babu, R. and Murali, R., 1991.] or by a traumatic event such as a car accident.[Foreman, S.M. and Croft, A.C., 2002] Short-term peripheral compression is often painless.[Okeson, J.P., 2005.] Persistent compression results in local demyelination with no loss of axon potential continuity. Chronic nerve entrapment results in demyelination primarily, with progressive axonal degeneration subsequently.[Okeson, J.P., 2005.] It is, "therefore widely accepted that trigeminal neuralgia is associated with demyelination of axons in the Gasserian ganglion, the dorsal root, or both." [UF, and Shands (2012) Trigeminal neuralgia and hemifacial spasm Archived February 15, 2012, at the Wayback Machine] It has been suggested that this compression may be related to an aberrant branch of the superior cerebellar artery that lies on the trigeminal nerve. Further causes, besides an aneurysm, multiple sclerosis or cerebellopontine angle tumor, include: a posterior fossa tumor, any other expanding lesion or even brainstem diseases from strokes.[UF, and Shands (2012) Trigeminal neuralgia and hemifacial spasm Archived February 15, 2012, at the Wayback Machine] Trigeminal neuralgia is found in 3–4% of people with multiple sclerosis, according to data from seven studies.[Bayer, D.B. and Stenger, T.G., 1979.][Okeson, J.P., 2005] It has been theorized that this is due to damage to the spinal trigeminal complex.[Cruccu, G., Biasiotta, A., Di Rezze,

S., Fiorelli, M., Galeotti, F., Innocenti, P., Mameli, S., Millefiorini, E. and Truini, A., 2009.] Trigeminal pain has a similar presentation in patients with and without MS.[De Simone, R., Marano, E., Morra, V.B., Ranieri, A., Ripa, P., Esposito, M., Vacca, G. and Bonavita, V., 2005.] Postherpetic neuralgia, which occurs after shingles, may cause similar symptoms if the trigeminal nerve is damaged.[citation needed] When there is no [apparent] structural cause, the syndrome is called idiopathic.

1.3.4-Dignosis of Trigeminal Neuralgia: Trigeminal neuralgia is diagnosed via the result of neurological and physical test, as well as the individuals medical history.[Babu, R. and Murali, R., 1991.]

1.3.5- Treatment:

1.3.5.1- Medical: The first old option treatment of trigeminal neuralgia is anticonvulsants drugs , especially carbamazepine . Carbamazepine is the main anticonvulsants used for control of trigeminal neuralgia .Prevent attacks of neuralgia in 60% of patients'. must be given continuously prophylactically for longperiods. It is notan analgesic and, if given when an attack starts, will not relieve the pain.is contraindicated in pregnancy as it is teratogenic. Is typically given in 100mg doses twice daily for 2 weeks initially, then three times daily, increasing by 100mg every 3 days to a maximum of 1000mg/day. Most patients respond to 200–400mg carbamazepine three times daily. The dosage of the drug used initially should be kept small to minimum especially in elderly patients to avoid nausea, vomiting and gastric irritation. Complete blood count with platelet count, liver function screening should be done prior to treatment, a month after treatment and at 3 to 4 months intervals, particularly, if patient continues to receive a high dose (1000 to 1500 mg/day).(Babu, R. and Murali, R., 1991.)

1.3.5.2- surgical :The second option of treatment of trigeminal neuralgia if the medication be ineffective, or if it produces excessive undesirable side-effects, such as

facial numbness after the procedure.[Zakrzewska, J.M. and Akram, H., 2011] Microvascular decompression appears to result in the longest pain relief. [Zakrzewska, J.M. and Akram, H., 2011.][Wayback Machine.2015] Percutaneous radiofrequency thermorhizotomy may also be effective[20] as may stereotactic radiosurgery; however the effectiveness decreases with time.[Dhople, A.A., Adams, J.R., Maggio, W.W., Naqvi, S.A., Regine, W.F. and Kwok, Y., 2009]

1.3.5.3- (Diode laser solase-976) for Trigeminal Neuralgia: is a treatment strategy which uses a single wavelength light source. Laser radiation and monochromatic light may alter cell and tissue function. The effect of(Diode laser solase-976) on nerve injury by increase nerve function and improve capacity for myelin production via different mechanisms such as decreasing the level of histamine, acetyl choline, serotonin, bradykinin and prostaglandin E2, increasing acetyl choline esterase ,lymphatic drainage, ATP, aerobic metabolism, pain threshold,beta endorphins and enkephalins, balancing the activity of adrenaline- non adrenaline and decreasing the production of P substance in the posterior spinal horn .

Low level diode laser is mostly used for treatment of wounds, inflammation and chronic pain. Laser therapy regulates the blood flow and the spasm of arterial muscles and regulates the basic metabolism of tissues with limited source of energy to enhance oxygenation of hypoxic cells in trigger points .In Trigeminal neuralgia the pain relief by laser decrease the release of substance that stimulate pain receptors and significantly increases the pain threshold by stimulating the synthesis of endorphins .In these study the type of laser is solase laser that appropriate for incision ,excision ,vaporization, ablation and coagulation of oral soft tissues as well as tooth whitening and temporary pain relief . The clinician must completely understand the patient's medical history prior to treatment. Exercise caution for general medical conditions that might contraindicate a local procedure, such conditions mea include allergy to local or topical anesthetics, heart disease (including pacemakers),lung disease, bleeding disorders, sleep

apnea or an immune system deficiency, or any medical conditions or medications that may contraindicate use of certain light/laser type sources associated with this device. Medical clearance from patients physician is advisable when doubt exists regarding treatment .Never direct the laser beam toward a person's eye or thyroid gland and eyes of patients , dentists and assistants must always be protected with the laser protective eyewear provided within the unit ,even when only the aiming beam is activated . Before use the laser should be determined the wavelength according to type of case to approach for the treatment .in these study the always start treatment at the lowest power setting and increase as required.

1.4- Objectives of this Dissertation

1.4-1 General objective

To evaluate the effect of(Diode laser solase-976) through treatment of trigeminal neuralgia refer from Military hospital Om Durman , Education Dental Hospital – Khartoum To Health and Beauty Center , Sudan (2018)

1.4-2 Specific objective

1. To compare the effect of (Diode laser solase-976) with placebo irradiation or medical drugs and surgical treatment modalities.

1.5 -Justification

The trigeminal neuralgia treatment byLow Level laser Treatment is inadequate and there is lack of recent records, So these Research select this topic because:

- trigeminal neuralgia is poor prognosis with medical and surgical treatment
- treatment the trigeminal neuralgia for long periods and with sides effect
- There is no previous and recent study in sudan.

Chapter Two

Materials and Methods

Chapter Two

Materials and Methods

2.1- Study design

The research done in two part clinical trials study design according to Military hospital that turn the patients in to Health and beauty medical polyclinic.

2.2- Study area

This research study done in Military hospital that turn the patients in to Health and beauty medical polyclinic.

2.3- study type

Non -probability sampling (convenience)

2.4- Study Population

Required of patients admitted in Military hospital that turn the patients in to Health and beauty medical polyclinic with Trigeminal neuralgia in age above 40 years during period 2018

2.5- Inclusion criteria

Patients with Trigeminal neuralgia both sexes (male, female) ; age above 40 years

2.6- Exclusion criteria

- 1- According to age: patient below 40 years.
- 2- Patients with other diagnosis of facial pain .

2.7- sample size

8 patient with Trigeminal neuralgia of sexes, treatment and age above 40 years

2.8- Variables

- Age

- Gender
- Residence
- Site
- Nature of pain
- Duration
- Causes
- Drugs
- Investigation

2.9 - Data Collection

This data collected by asking direct closed question for patient who admitted to Military hospital that turn the patients in to Health and beauty medical polyclinic related to Trigeminal neuralgia and their awareness Questioner consists of three part :

- 1- Personal data
- 2- Trigeminal neuralgia statistic

2.10 - Ethical Consideration

- 1- Scientific and ethical approval from International University of Africa was obtained
- 2- Written consent taken from Health and beauty medical polyclinic
- 3- This information obtained will remain strictly confidential

2.11- Data Analysis

Data analysis by statistical package of social sciences program using SPSS software program .The frequency and distribution will be calculated and will be calculated and analyzed using frequency and percent and then the chi-square test performed to asses relation between factor and percent

Chapter Three

Result and Discussion

Chapter Three

Result and Discussion

3.1-Results

This research was conducted on patients diagnosed with trigeminal neuralgia, and will be treated by (Diode laser solase-976), a total of eligible 8 patients was enrolled in this study 4 males (50%) and 4 females (50%), ages was of the participating patients was ranged from 42 years to 70 years in a mean of 54.88 ± 11.15 .

A total of 8 enrolled patients was living in Khartoum state, Sudan. 4 patients in Khartoum city 50.0%, and 4 in Omdurman city 50.0%

7 of 8 enrolled patients before start of treatment, was presented with facial pain, 6 patients of them mentioned that they are always with facial pain (75.0%), one patient mentioned he rarely have facial pain.

The eight patients had the facial pain started in different onsets ranging from 2 years to 20years; the mean of these durations was (8)

Five patients (62.5%) mentioned that the pain predominantly always located in their face, the three others mentioned that sometimes the pain predominantly located in there face.

All eight (100.0%) who were enrolled had the pain just on one side of their faces and almost brief, three (37.5%) of them was always with pain in the ear, throat, tongue, and near the tonsils, while three (37.5%) was without pain, and one was facing this pain sometimes and one rarely.

According to facial pain constancy two (25%) out of total eight was always with constant facial pain, one (12.5%) with sometimes constant, rarely two (25%) constant pain, and three (37.5%) never with constant pain.

Facial background pain constancy during half of waking hours was varying scientifically, only one (12.5%) out of total eight was always with pain at this period, two (25.0%) sometimes, also another two (25.0%), while three (37.5%) never had this facial background pain during half of this period.

Six (75.0%) out of the eight enrolled patients, their pain was starting when something touch their face, and remaining tow (25.0%) never had pain started due to face touch.

Two (25.0%) Treated Patients was with constant facial numbness prior to start of treatment, three (37.5%) with sometimes constant facial numbness, one (12.5%) rarely with pain, and on the other hand two (25.0%) was never with this numbness.

All 8 patient was frequently on the drugs (Tegretol& Neurontin) that was known for them, six (75.0%) of them was currently on this drugs, and two (25.0%)

Fortunately no one of the eight (100%) enrolled patients was with tumors or multiple sclerosis.

Just Half (50.0%) out of the eight patients was under gown surgical treatment for the trigeminal neuralgia.

Five (62.5%) patients was sometimes treated by laser previously while the other three (37.5%) didn't.

After the start of the first (Diode laser solase-976) treatment ever, the all eight (100%) patient felt better, and nobody (0%) of them faced any side effect of (Diode laser solase-976) treatment.

At the first (Diode laser solase-976) treatment session the mean of the pain degree during treatment was enhancing rapidly starting from 5.12 during fist session to the fifth session ,then gradual decrease until approaching very low mean of the pain degree of (0.25) at the twelfth Session of(Diode laser solase-976) Treatment .

Mean of the pain duration of the laser treatment measured by seconds drops rapidly from (492 s) at the 1st(Diode laser solase-976)treatment session and (78 s) at the 2nd(Diode laser solase-976) treatment, then complete to decrease slightly through the remaining 10 sessions until it reaches zero (0.0s) at the twelfth session. We used in this study Visual Analog Scale for Pain (VAS Pain).

Table 3.1: Show the samples according to the age group

Mean ± (SD Years)	Median	Range(years)
54.88± 11.15	53.50	42-70

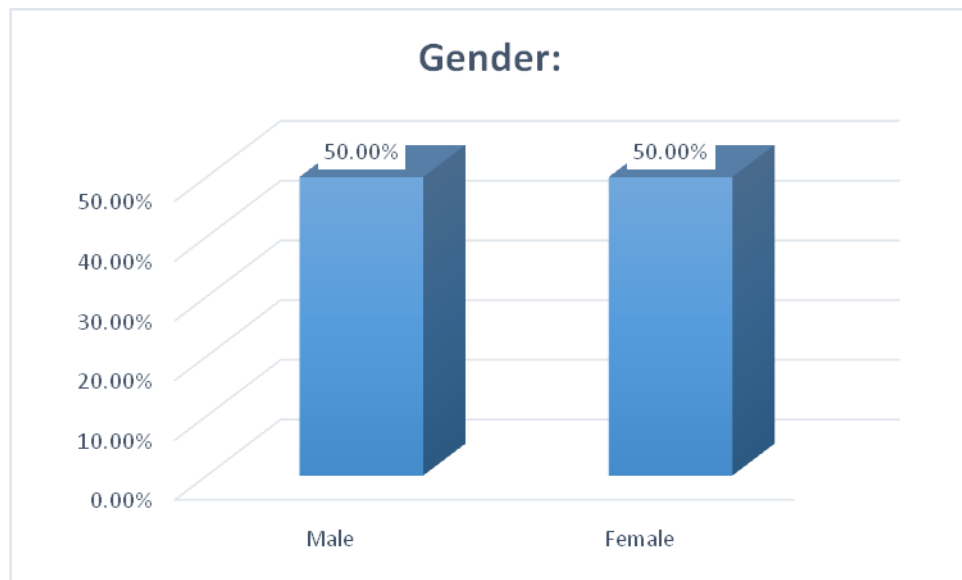


Figure 3.1: Distribution of samples according to gender

Table 3.2: Distribution of samples according to the Presence of facial pain

	Frequency	Percent
Always	6	75.0%
Rare	1	12.5%
Sometimes	0	0.00%
No	1	12.5%
Total	8	100%

Table3.3: Distribution of samples according to the Painpredominately in the face

		Frequency	Percent
Valid	Always	5	62.5 %
	Sometimes	3	37.5 %
	Total	8	100.0%

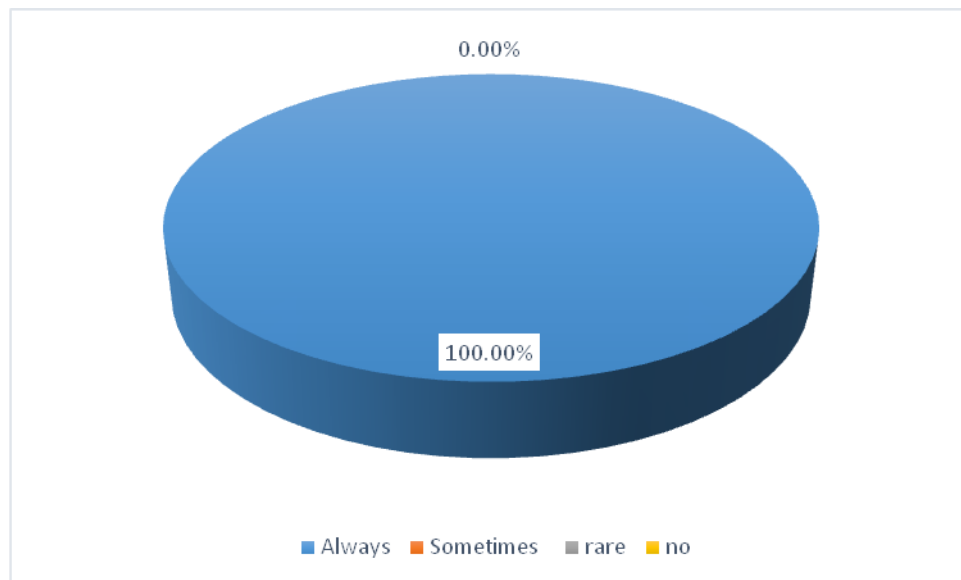


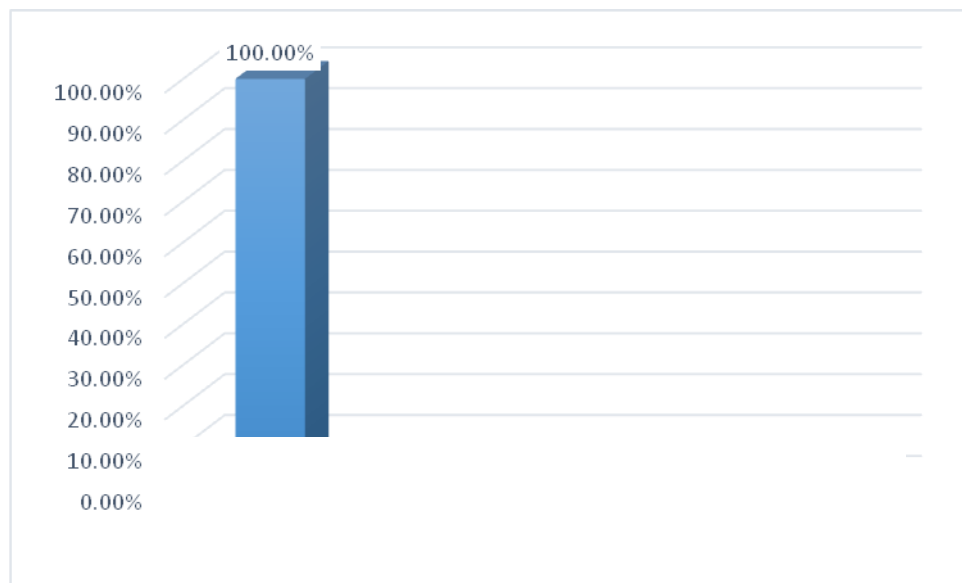
Figure 3.2: Show the All patients come complain of facial pain(TN) from one side of the face (unilateral)

Table 4: Distribution of samples according to the Pain radiation deep in ear

		Frequency	Percent
Valid	Always	3	37.5 %
	Sometimes	2	25.0 %
	no	3	37.5 %
	Total	8	100.0%

Table 5: Show the Pain predominately in the back of throat or tongue near the area of tonsil

		Frequency	Percent
Valid	Always	3	37.5 %
	Sometimes	1	12.5 %
	rare	1	12.5 %
	no	3	37.5 %
	Total	8	100.0%



F

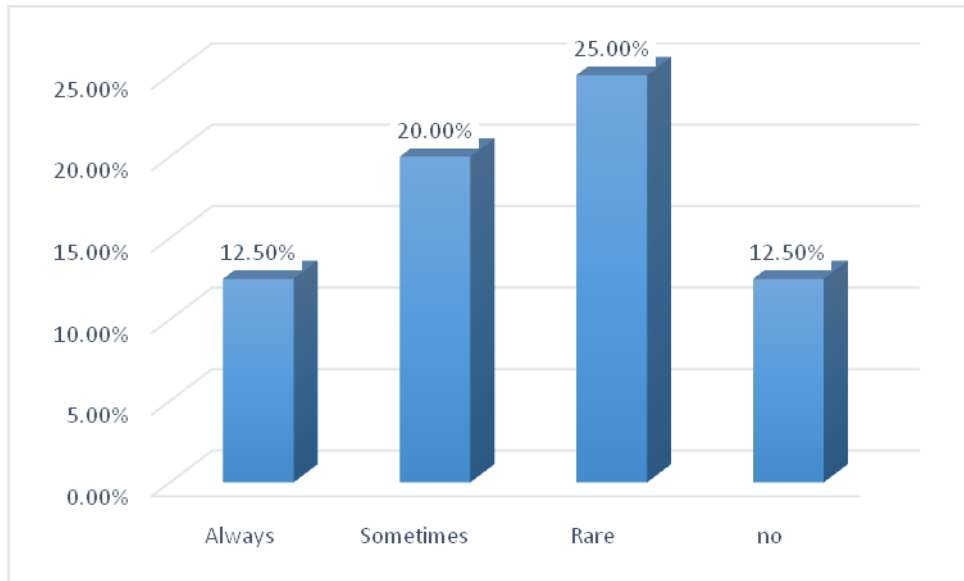


Figure 3.4: Show the Constant background of facial pain

Table 3.6: Show the Constant background facial pain for more than half of waking hours

		Frequency	Percent
Valid	Always	1	12.5 %
	Sometimes	2	25.0 %
	rare	2	25.0 %
	no	3	37.5 %
	Total	8	100.0%

Table 3.7: show the Trigger zone or stimulating pain by something touching or brushing

		Frequency	Percent
	Always	6	75.0%
	Sometimes	2	25.0%
	Total	8	100.0%

Table 3.8: Show the Complain of numbness in any part of face

		Frequency	Percent
	Always	2	25.0 %
	Sometimes	3	37.5%
	rare	1	12.5 %
	no	2	25.0%
	Total	8	100.0%

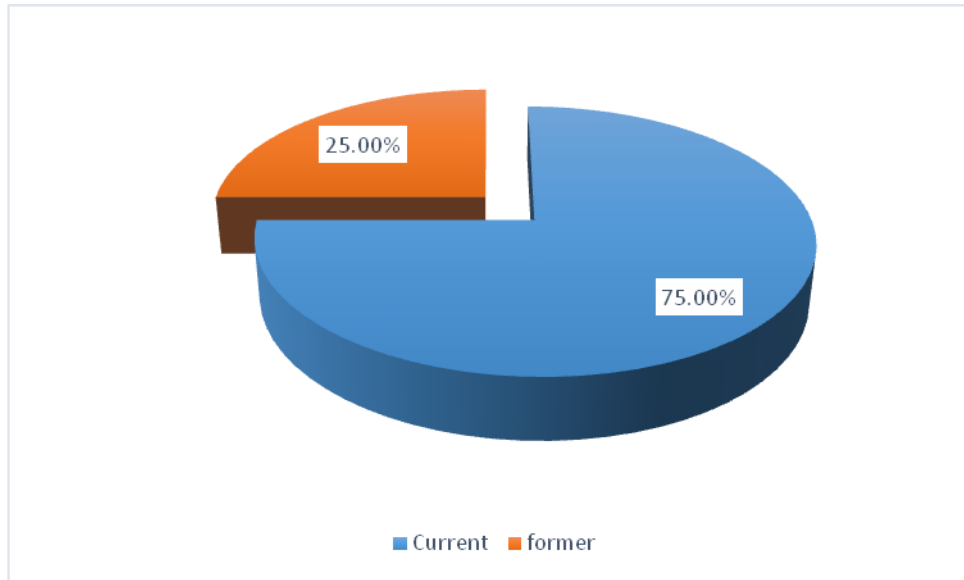


Figure 3.5: Show the Conventional medication used for treatment trigeminal neuralgia

Table 3.9: Show all the patients used the Conventional medication for treatment trigeminal neuralgia like Tegretol

	Frequency	Percent
Always	8	100.0%

Table 3.10: Show All the patients known the drugs they taken

	Frequency	Percent
Yes	8	100.0%
No	0	0.0 %

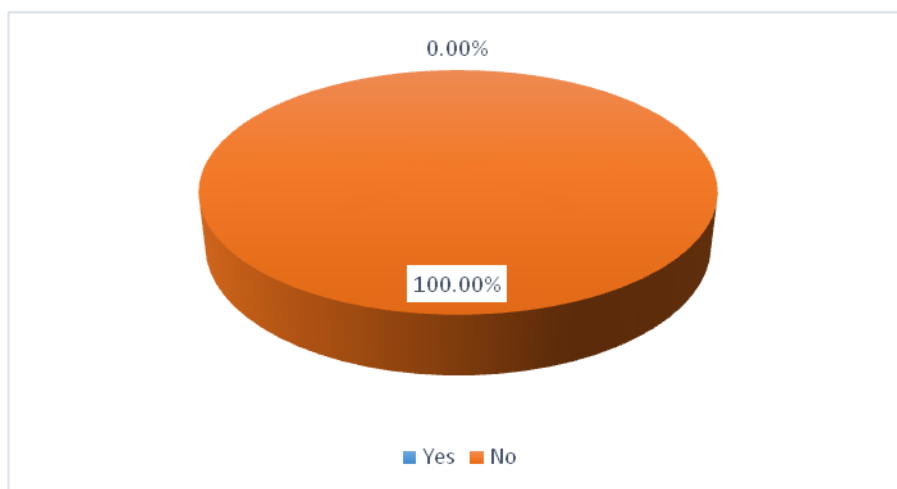


Figure 3.6: Show that no patient has tumor or multiple sclerosis

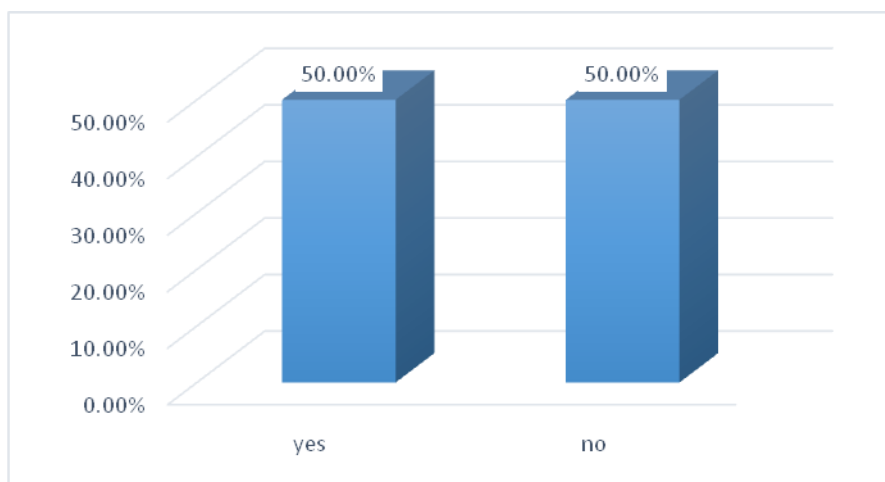


Figure 3.7: Show From the history four patients undergone surgical treatment

Table 3.11: Show All patients felt better after the first laser treatment

	Frequency	Percent
Yes	8	100.0%
No	0	0.0 %

Table 3.12: Show the Compilations after laser therapy

	Frequency	Percent
Yes	0	0.0%
No	8	100.0 %

* In this research, all of the patients received 12 sessions of laser treatment, which made them free of pain (trigeminal neuralgia) without any side effects.

Table 3.13: Show the Degree of pain during treatment by laser

Session	Mean \pm SD	Median	P value
Session 1	5.12 \pm 4.25	5	<0.000*
Session 2	3.62 \pm 3.29	2.5	
Session 3	2.25 \pm 2.05	2	
Session 4	1.62 \pm 1.30	1.5	
Session 5	1.25 \pm 1.03	1	
Session 6	1.12 \pm 1.30	1	
Session 7	1 \pm 0.99	1	

Table 3.14: Show the Degree of pain during treatment by laser

Session	Mean \pm SD	Median	P value
Session 8	0.75 \pm 0.46	1	<0.000*
Session 9	0.63 \pm 0.75	0.5	
Session 10	0.38 \pm 0.51	0.5	
Session 11	0.25 \pm 0.46	0	
Session 12	0.25 \pm 0.46	0	

Decision

While the p value for Degree of pain during treatment by laser is less than (0.05) then the difference is significant.

Report

There is Statistical significant difference between Sessions in Degree of pain during treatment by laser using significant level (0.05).

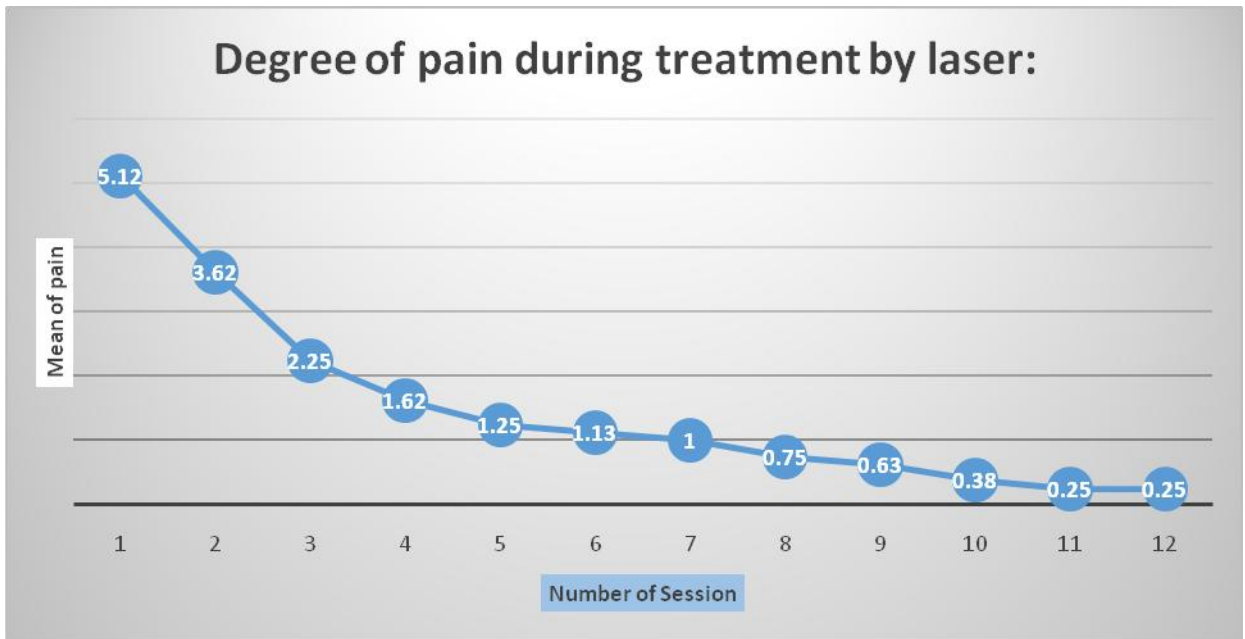


Figure 3.8: Show the Degree of pain during treatment by laser

Table 3.14: Show the Duration of pain during treatment by laser

Session	Mean ± SD	Median	P value
Session 1	492 ± 629	150	<0.001*
Session 2	78 ± 80	35	
Session 3	35 ± 40	7.5	
Session 4	31 ± 46	7.5	

Session 5	28 ± 31	1	
Session 6	28 ± 31	3.5	
Session 7	27 ± 31	0	

Table 3.15: Show the Duration of pain during treatment by laser

Session	Mean ± SD	Median	P value
Session 8	25 ± 20	0	<0.001*
Session 9	9 ± 20	0	
Session 10	7 ± 17	0	
Session 11	4 ± 10	0	
Session 12	0 ± 0	0	

Decision

While the p value for Duration of pain during treatment by laser is less than (0.05) then the difference is significant.

Report

There is Statistical significant difference between Sessions in Duration of pain during treatment by laser using significant level (0.05).

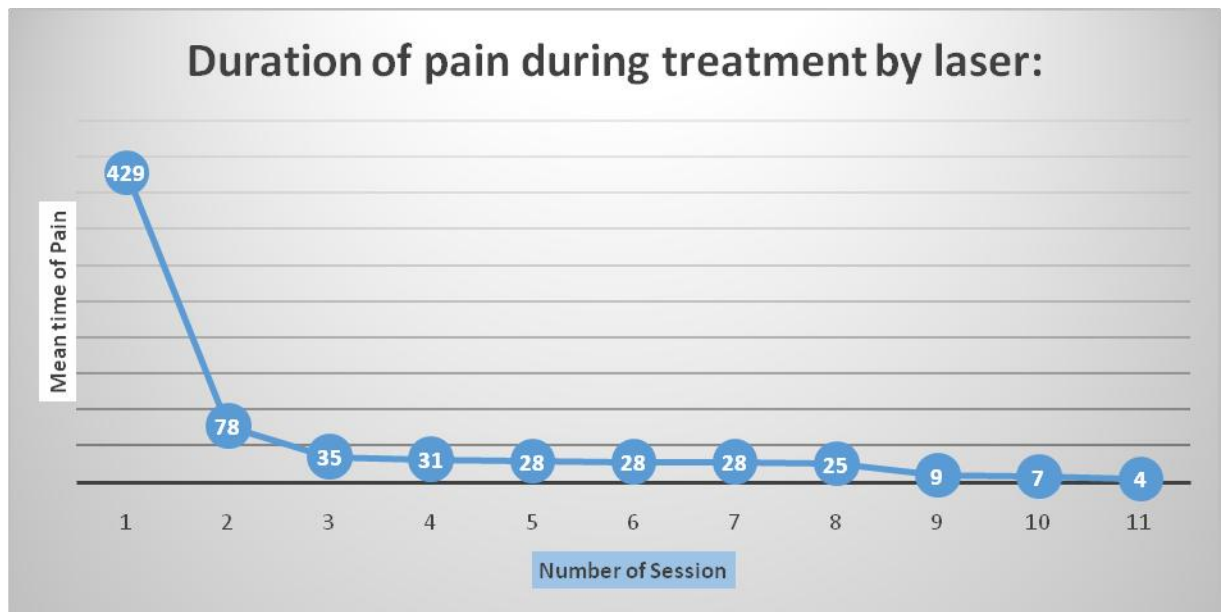


Figure 3.9: Show the Duration of pain during treatment by laser

Table 3.16: Pain Starting

Mean \pm (SD Years)	Median	Range(years)
5.12 \pm 3.83	4.50	0 - 10

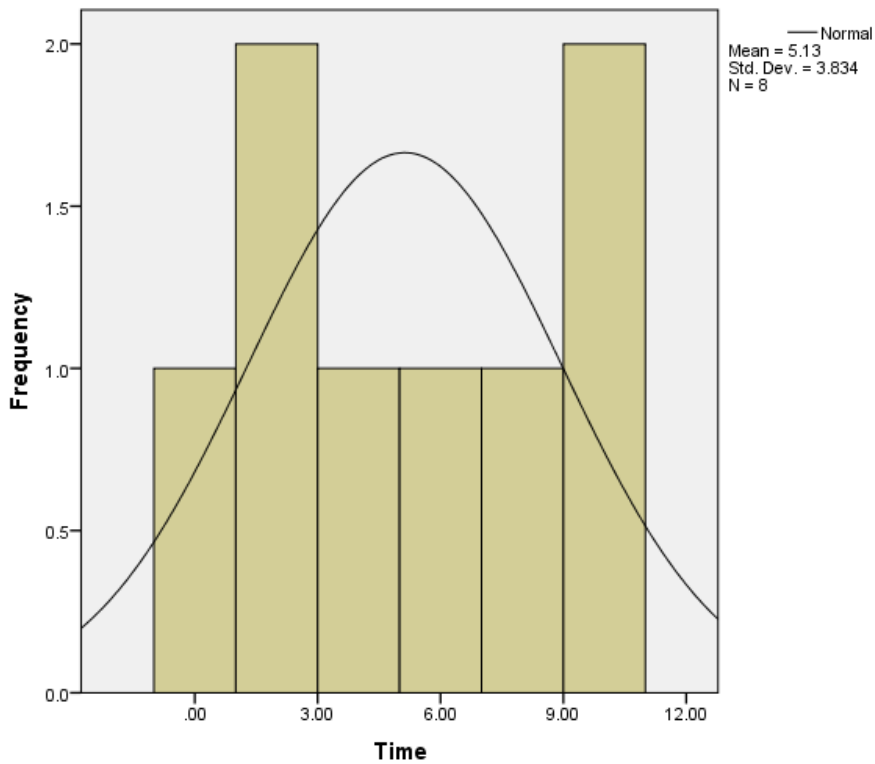


Figure 3.10: Show the obvious reduction of pain degree with increase the number of session with Diode laser

Analysis Planning

- All statistical procedures performed using SPSS 23.0 Statistical Software Program (SPSS,Inc.,USA).
- Using one way ANOVA to Compare between Sessions in Degree of pain and Duration of pain during treatment by laser.

.With Sample size =8 patients -

3.2-Discussion

This study has been made to conduct the effects of (Diode laser solase-976) on the treatment of Trigeminal Neuralgia and its associated symptoms and to highlight the use of laser to treat such cases which have been threatening patients comfort for long years

and to provide alternatives for the treatment of Trigeminal Neuralgia rather than the regularly used old methods .

The highest rate of occurrence for the Trigeminal Neuralgia was found on adults at the age of 50 years old affecting both genders, with highest range among female patients , although it may effect younger patients including children's .

3.2.1-Medical Management was the first choice and the goal of pharmacological therapy is to reduce pain ,although most of them were originally used for the treatment of epilepsy, Carbamazepine (Tegretol) 200-1200 mg/day is regarded as the most effective medical treatment that provided partial pain relief up to 80% but , as any drug it had side effects like dizziness, drowsiness , forgetfulness and nausea , and over time the higher doses or greater number of medications intake has affected the liver , kidneys and others vital organs .

3.2.2-Surgical choice was indicated in those patients with TN despite the use of Medications , thus at least two trials of medication should be performed and carefully evaluated before more invasive techniques are instituted , also those who are intolerant to the adverse effects of medications and who previous procedures has failed are considered as indicators for the surgical treatment .

Many Surgical options such as Microvascular Decompression (**MVD**) was the most invasive of all surgical options to treat TN,mainly who are younger than 70 years and at low risk for complications during G.A, a procedure that required a small opening to be made behind the year then the surgeon places a soft cushion between the nerve and the blood vessels , the pain-free intervals last on average 1.5-2 years and other researches proved that it recurred with 20% of cases within 10 years . many risks were faced such as CSF leak , venous sinus occlusion , brain swelling and nerve damage , hearing loss , double vision , paralysis has occurred .

Another option like **Balloon Compression** is made under G.A into which a cannula is inserted through a puncture in the cheek and guided into an opening in the base of the skull, then a soft catheter with balloon tip is threaded through the cannula to allow the balloon to squeeze the nerve against the edge of the dura and petrous bone.

3.2.3- Alcohol Injection has been applied as the Alcohol bathes the ganglion and affects the demyelinated fiber, still its success rate is low and its recurrence rates are around 50% at 1year .

3.2.4- Radiofrequency is another surgical technique into which a small electrical current is passed through a needle positioned to the tingling area of TN pain which eventually causes intentional nerve destruction , still many patients has complained of facial sensory symptoms caused by partial trigeminal nerve injury. 7.7% developed increased facial paresthesia or numbness lasted longer than 6 months.

Many people has tried a **Complementary and Alternative Medications (CAM)** that depends on several things including , the patient state of health , knowledge of the practitioner , and every person responded differently , still it carried potential risks and complications , these options included , Acupuncture , Homeopathy , Nutritional Therapy , Electrical Nerve Stimulation , Vitamin B-12 Injections , Vitamin Therapy .

But as any other treatment, the primary complications of surgery included, troublesome sensory loss over the face or the dysethetic syndrome of anesthesia dolorosa.

According to Dalessio, 25-50% of patents eventually stoprespondinig to drug therapy and requires some form of alternative treatment.

This study has also revealed the effect of (Diode laser solase-976) for treating the Trigeminal Neuralgia on a specified order and manner

Using organized parameters with suitable doses and number of treatment sessions in order to give a stand of view for those who seek a modern quality for treatment of such cases.

This research was conducted on patients diagnosed with trigeminal neuralgia, and will be treated by (Diode laser solase-976) a total of eligible 8 patients was enrolled in this study 4 males (50%) and 4 females (50%), ages was of the participating patients was ranged from 42 years to 70 years, All 8 patient was frequently on the drugs (Tegretol& Neurontin) that was known for them.

Just Half (50.0%) out of the eight patients had undergone surgical treatment for the treatment of TN with no obvious success rate and 62.5 has received a previous laser therapy, But After the start of the first(Diode laser solase-976) therapy, all of the eight patient has dramatically improved at a level of (100%), and none of them (0%) faced any side effect of(Diode laser solase-976)therapy.

Mean of the pain duration of the laser treatment measured by seconds drops rapidly from (492 s) at the 1st(Diode laser solase-976)therapy session and (78 s) at the 2nd (Diode laser solase-976)therapy, then continued to decrease slightly through the remaining 10 sessions until it has reached zero (0.0s) at the twelfth session.

And in Conclusion The present study has confirmed that, 8 patients at 5th decade of age, with no gender predilection which are diagnosed with TN has received treatment via (Diode laser solase-976)therapy at Health and Beauty Medical Polyclinic (2018) . And it has been found that most of the facial pain 75% occurred unilaterally , but following the(Diode laser solase-976)therapy the trigeminal neuralgia has completely disappeared with no side effects and there Quality of life became much better .

Previous Study in Treatment of TN by Laser

-In one study done by Hooman Ebrahimi et al, Published online 2017.

30 patients divided into 2 groups of cases and controls (n=15) by double blind randomized controlled clinical trial. All patients received 100 mg carbamazepine at baseline and another 100 mg after 2 days for pain control .low level laser therapy (LLLT) was also performed in addition to pharmaceutical therapy. Treatment was continued for 9 sessions (3 days a week)... The intensity of pain was measured and compared in the 2 groups using visual analog scale (VAS) in 3 periods.

The severity of pain was lower at the end of treatment in the case compared to the control group so this difference was statistically significant (P=0.003) At the end of treatment pain intensity dropped in the intervention group from 6/8 to 1/2 and control group from 6/6 to 2/7.

-Falaki,et al, J Dent Res Dent Clin Dent Prospects in 2014

Evaluated the efficacy of low intensity laser radiation in the treatment trigeminal neuralgia compared with placebo irradiation or medicinal and surgical treatment modalities, which used a single wavelength light source. Laser radiation and monochromatic light alter cell and tissue function.

This study revealed the low level laser therapy could be considered in treatment of trigeminal neuralgia. Laser causes pain relief without any side effects.

Laser relief the acute and chronic pain without any side effects, especially in patients suffering from neuralgia tolerated to drug therapy.

- Another study done by Pinheiro et al, J Clin Laser Med Surg in1998 used of LLLT on the treatment of several disorders of the oral and maxillofacial region. Two hundred and five female and 36 male patients ages between 7 and 81 years old (average 38.9 years

old), suffering from disorders of the maxillofacial region, were treated with 632.8, 670, and 830 nm diode lasers at the Laser Center of the Universidade Federal de Pernambuco, Recife, Brazil (UFPE). Most treatment consisted of a series of 12 applications (twice a week) and in 15 cases a second series was applied. Evaluated that LLLT is an effective tool and is beneficial for the treatment of many disorders of the maxillofacial region.

- JBWalker et al, The clinical journal of pain 1987 used low power He-Ne laser (1 mW, 632.5 nm, 20 Hz) in patients with chronic pain. He treated 26 patients with trigeminal neuralgia, post-herpetic neuralgia, sciatica, and osteoarthritis. He irradiated the affected sites 30 to 90 seconds three days per week for 10 consecutive weeks. Nineteen patients revealed significant reduction in frequency and also intensity of their pain after the treatment duration.

-Drs.Leonard Vernon and Rafael Hasbun ,MD

Present two case report of trigeminal neuralgia pain successfully treated with low-level laser therapy (LLLT), 808nm diodes/200mw wavelength 6J/Pm once per day for five consecutive days, followed by a two –day interval. The number of applications was 20, The patients were completely symptoms –free from pain by the 12th treatment session.

3.3-Conclusion

The present study has confirmed that there were 8 patients with Trigeminal neuralgia have received treatment operations done using laser at Health and beauty medical polyclinic Khartoum state (2018).

This thesis can be concluded as :

In our research, all of the patients received 12 sessions of laser treatment , which made them feeling better without any side effects , and reduce the degree and duration of pain.

3.4-Recommendation

1-This research need to expanded globally

2-We hope, Health ministry of Sudan contributes to apply international protocol of (Diode laser solase-976) therapy in treatment the Trigeminal Neuralgia

3-For future researches, we suggest cooperation from all staff in the health care centers

This study needs more patient and more time to evaluate the efficiency of this treatment with(Diode laser solase-976)therapy, we advise to follow up the patients for the next 2 years.

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Annexes

Arabic questionnaire

استبيان لتحليل آلام العصب الثلاثي التوائم

اسم المريض : _____
العمر : _____ الجنس _____ العنوان _____
الوضع العام : _____

1. هل لديك ألم في الوجه : دائماً () أحياناً () نادراً () لا ()
2. عندما يكون لديك ألم ، هل هو في الغالب في وجهك (أي الجبين ، العين ، الخد ، الأنف ، الفك العلوي / السفلي ، الأسنان ، الشفاه ، إلخ)؟ دائماً () أحياناً () نادر () لا ()
- هل لديك ألم فقط على جانب واحد من وجهك؟ دائماً () أحياناً () نادراً () لا ()3.
4. عندما يكون لديك ألم ، هل هو عميق في الأذن؟ دائماً () أحياناً () نادراً () لا ()
5. عندما يكون لديك ألم، هل هو في الغالب في الجزء الخلفي من الحلق أو اللسان ، بالقرب من منطقة اللوزتين؟ دائماً () أحياناً () نادراً () لا ()
6. هل الألم كلياً أو موجزاً في الغالب (من ثوان إلى دقائق) وأحاسيس غير متوقعة (كهربائية ، صدمة ، طعن ، وخز شديد)؟ دائماً () أحياناً () نادراً () لا ()
7. هل مر بك ألم مستمر في الوجه مسبقاً (على سبيل المثال ، ألم ، حرق ، الخفقان ، لاذع)؟ دائماً () أحياناً () نادراً () لا ()
8. هل لديك ألم دائم في الوجه (ألم ، حرق ، خفقان ، لاذع) يدم لأكثر من نصف ساعات الاستيقاظ؟ دائماً () أحياناً () نادراً () لا ()
9. هل يمكن أن يبدأ الألم بشيء يلمس وجهك (على سبيل المثال ، عن طريق تناول الطعام، غسل وجهك، حلقك، تنظيف أسنانك، رياح)؟ دائماً () أحياناً () نادراً () لا ()
- هل لديك أي خدر مستمر في الوجه ؟ دائماً () أحياناً () نادراً () لا ()10.
- هل سبق لك تناول الدواء لمثل هذه الشكوى؟ الحالي () السابق () أبداً ()11.
12. هل سبق أن تناولت :

(carbamazepine), Neurontin®(gabapentin), Lioresal® (baclofen), Treleptal®
(oxcarbazepine), Topamax®
(topiramate), Zonegran® (zonisamide), or any other anticonvulsant medication

أو أي مضادات أخرى لتخفيف الألم؟ دائماً () أحياناً () نادراً () لا ()

13. هل تعرف الأدوية التي تناولتها؟ نعم () لا ()

14. هل لديك ورم أو مرض التصلب المتعدد في وجهك؟ نعم () لا ()

15. هل خضعت للعلاج الجراحي؟ إذا نعم متى؟ نعم () لا ()

هل تخضع لعلاج الليزر؟ دائماً () أحياناً () نادراً () لا () 16.

هل شعرت بتحسن بعد أول جلسة علاج بالليزر؟ نعم () لا () 17.

هل لديك أي آثار جانبية بعد العلاج بالليزر؟ نعم () لا () 18.

أثناء العلاج بالليزر (VAS)

*:

0 = لا يوجد ألم

1 2 3 = ألم خفيف

4 5 6 = ألم متوسط

7 8 9 = ألم شديد

10 = غير محتمل

اليوم	التاريخ	عدد الجلسات	تواتر الألم	مدة الألم	* النتيجة	(Diode laser solase-976)therapy الآثار الجانبية ل

English questionnaire

Questionnaire for Analysis The Trigeminal Neuralgia Pain

Patient name:

Age: _____ Gender: _____ Adress: _____

General Situation:

1. Do you have facial pain? Always () Sometimes () rare () no()

2. When you have pain, is it predominantly in your face (i.e., forehead, eye,cheek, nose, upper/lower jaw, teeth, lips, etc)? Always () Sometimes () rare () no()

3. Do you have pain just on one side of your face? Always () Sometimes () rare () no()

4. When you have pain, is it predominantly deep in your ear? Always () Sometimes () rare () no()

5. When you have pain, is it predominantly in the back of your throat or tongue, near the area of your tonsil? Always () Sometimes () rare () no()

6. Is your pain either entirely or mostly brief (seconds to minutes) and unpredictable sensations (electrical, shocking, stabbing, shooting)? Always () Sometimes () rare () no()

7. Do you have any constant background facial pain (e.g., aching, burning, throbbing, stinging)? Always () Sometimes () rare () no ()

8. Do you have constant background facial pain (aching, burning, throbbing, stinging) for more than half of your waking hours? Always () Sometimes () rare () no ()

9. Can your pain start by something touching your face (for example, by eating, washing your face, shaving, brushing teeth, wind)? Always () Sometimes () rare () no ()

10. Do you have any constant facial numbness? Always () Sometimes () rare () no ()

11. Have you ever taken medication for such complain? Current () former () never ()

12. Have you ever taken Tegretol® (carbamazepine), Neurontin® (gabapentin), Lioresal® (baclofen), Treleptal® (oxcarbazepine), Topamax® (topiramate), Zonegran® (zonisamide), or any other anticonvulsant medication for your pain? Always () Sometimes () rare () no ()

13. Do you know the drugs you have taken? Yes () no ()

14. Do you have tumor or multiple sclerosis in your face? yes () no ()

15. Have you done surgical treatment? If yes when? yes () no ()

16. Do you undergo laser treatment? always () sometimes () rare () no ()

17. Do you feel better after the first laser treatment? yes () no ()

18. Do you have any side effect after treatment by laser? yes () no ()

Map site



Consent

Permission was taken from both Military hospital, where patients are firstly diagnosed with trigeminal neuralgia, and from the referral clinic which is Health and beauty medical polyclinic where patients are treated by laser.

Patients were assured of the confidentiality and anonymity of the information they pronounce and were explained the importance and use of this research.