LOW LEVEL OF LASER THERAPY (LLLT) OF LASER DIODE 820NM IN THE TREATMENT TRIGEMINAL NEURALGIA

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Abstract

Twenty-six patients were complaining of trigeminal neuralgia (TN) for more than 2 years. All patients had been submitted to drug therapy with or without other treatment measurements. All patients were from AL-Najaf Al-Ashraf or nearby rural area. They were all treated by laser diode 820nm 1,5 KHz, 2 minutes to the triggered zone, 96 J/cm2 flounce, and 100m W output. The time between tow sequence sessions was 4 days. The results were very promising. The statistic analysis revealed the significant values between 1KHz and 5KHz and significant values in recurrence rate toward the long duration time. No side effects were recorded. All patients were treated in laser dental research unit, Dentistry College, Kufa University.

Introduction

The trigeminal neuralgia (TN) is the 5th cranial nerve. It contain general somatic sensory fibers and special visceral motor fibers. The T.N. has 4 nuclei (N), the spinal N. in the medulla, mesoncephalic N, in midbrain, superior sensor N, and superior motor N. in the pons. The T, N. emerge in the junction of pons and middle cerebella pedicle as big sensory and small motor root.
The T.N. divided into 3 branches:

A/ Ophthalmic division T1
B/ Maxillary division T2
C/ Mandibular division T3[1].

Trigeminal neuralgia (Tic Douloureux):

T.N. is a characteristic symptom rather than disease entity of unknown etiology affecting women more than men 2:1 or 3:4[2]. Usually fifty years of age and older. However, under fifty years of age can occur but one should think of another associated disease as multiple sclerosis with T.N.[3]. T.N. characterized by brief attacks of proxy small severe sharp pain within the distribution of T,N, or its branches[4]. Each attack continue for few seconds to less than one minute. It is a chronic reparative disease[5]. It repeats itself from few times per day to once every few months and usually

affects one side. The diagnosis is purely clinical mainly on the history as neurological examination is usually negative[6]. Trigeminal neuralgia (TN), or tic douloureux (also known as prosopalgia), causes episodes of intense pain in the eyes, lips, nose, scalp, forehead, and jaw, with the majority of cases being unilateral (>95%)[7]. The pain is typically in the distribution of the second and third divisions of the trigeminal nerve. Talking, facial movement, cold temperature, and other common activities can trigger the pain[8]. Because of the significant numbers of people taking their own lives when they cannot find effective treatments, T N is considered by many to be among the most painful conditions and is often labeled the "suicide disease"[9].

The mechanism of pain production remains controversial. One theory suggests that peripheral injury or disease of the trigeminal nerve increases afferent firing in the nerve. Failure of central inhibitory mechanisms may be involved as well. Some authors have hypothesized that trigeminal neuralgia has a peripheral cause as well as a central pathogenesis. They speculate that chronic irritation of the trigeminal nerve apparently leads to both a failure of segmental inhibition in the trigeminal nucleus, and ectopic action potentials in the trigeminal nerve. In 90-95% of cases, no lesion was identified, and the etiology is labeled idiopathic by default[10]. Some authors have speculated that, like Bell's Palsy, a neurotropic virus may be the causative agent and the proximity of the two nerves may give cause to further support this theory. Ch'ien and Halsey reported two cases of concomitant trigeminal sensory neuropathy and Bell's Palsy[11]. Although the exact pathogenesis is unknown, it is, however, generally accepted that focal demyelination in the root of the trigeminal nerve is involved[12]. Of course, any injury to the trigeminal nerve may also cause the condition. Trigeminal Neuropathy or Post-Traumatic TN may develop following cranio-facial trauma (such as from a car accident), dental trauma, or sinus trauma[13,14].

Treatment

The 1st line treatment is usually anticonvalscent therapy by carbamazepine with initial dose of 100-200mg/day and then increase dose gradually. With a major anti-depressant as amitrepty- line in a dose of 25mg, TDS[15]. Failure of this medical therapy we can use injection of the course of the T. N. with instillation of alcohol[16]. Trigeminal branch evulsion (retrogasserian) per continuous trigeminal radiofrequency, thermo- coagulation, glycerol rhizotomy and neurovascular decompression[17]. Recently, researches on T.N. show that is caused by breakdown in the insolation mechanism of the nerve.[18]

More recently, there has been an increased use of stereotactic gamma knife radiosurgery, which entails the delivery of a focused beam of radiotherapy to the proximal trigeminal nerve. First used in 1951, it has been more widely used since the mid-1990s and reports of 70-80% of patients describing freedom from pain in the short term have been reported although up to 50% may relapse[19].

Laser and T.N.

Low level laser therapy (LLLT), is a new line of treatment. The laser effect is based on the photo-bio stimulation to the tissue.

Each laser has specific wavelength. The diode laser works with 820nm near infra-red has ability to penetrate the skin more than 2-3 mm[20]. This laser effects on

the cell component. These effects generally are significant and are too widespread to be easily dismissed. Although the effects of LILR on cell function have been repeatedly demonstrated, to this date there has been no elaboration of the precise mechanisms by which these effects are produced. There has been speculation that the respiratory chain components of the mitochondria, the cytochromes and the prophyrins-might be the primary photo absorbers in the visible and near-IR wavelengths[21,22]. It has been suggested that LILR may activate the enzymes in the electron-transport chain directly alter cellular signaling, or increase production of ATP, followed by the augmentation of DNA synthesis and cell proliferation.

The action spectrum of LLLT for wavelengths from 300 to 900 nm measured by the synthesis rate of nucleic acids in HeLa cell cultures has been determined. The action spectra reveal maxima in the synthesis of DNA and RNA at 400, 630, 680, 760, and 820 nm[23]. However, the direct activation of enzymes as the basis for increased DNA synthesis and consequent therapeutic effects has not been verified yet. The final effects is high mitotic energy makes the cell growth faster than normal.

Low level laser (LLLT) therapy has also used for the treatment of nerve injuries. Clinical studies of the effects of LLLT on injured nerves have revealed an increase in nerve function and improved capacity for myelin production[24]. LLLT has been shown to be effective for promoting axonal growth in injured nerves in animal model[25,26].

LLLT acts on the prostaglandin (PG) synthesis, increasing the change of PGG2 and PGH2 into PG12 (it is also called prostacyclin, or epoprostenol). The latter is the main product of the arachidonic acid into the endothelial cells and into the smooth muscular cells of vessel walls and has a vaso-dilating and anti-inflammatory action that the pain one of them[27]. The study by Hagiwara which find the LLLT induced analgesic effects in rat by enhancing peripheral endogenous opioids production in addition to the mentioned mechanisms in which was the LLLT produced an analgesic effect in inflamed peripheral tissue which was transiently antagonized by naloxone, β-endorphin precursor mRNA expression increased[28].

Pain relieving effects had been get with large dosage of LLLT. Inhibition effect rather than stimulation that will be appeared[29].

In addition to above, pain relieving effect of LLLT acts by inhibiting cyclooxygenase interrupting the conversion of arachenoidic acid into prostaglandin and also increases the production of β-endorphin[30]. Sato study improved the LLLT of 830nm 40mW inhibited nociceptive signals at peripheral nerves[31].

Materials and methods

Twenty-six patients were taken in our study on AL-Najaf city and nearby area (rural areas). All cases were diagnosis clinically for 2 years at least, any case diagnosed within less than 2 years was omitted from the study. Any patient submitted to the study should have at least full chance of medical therapy with or without other measurement (just to prove it is a chronic intractable case).

Patients were given sessions of laser in the dental laser research unit/ Dentistry College/ Kufa University. The laser diode 820nm-Omega co. United Kingdom was used in this study. The laser parameters were 2minutes, output 100 Mw, flounce 96 J/Cm. 1 KHz and 5 KHz

frequencies respectively. The first 13 patients were treated with 1 KHz and the second 13 patients were treated 5 KHz with same laser parameters.

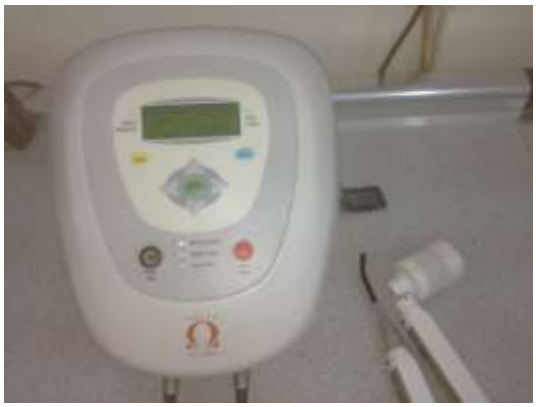

Figure 1 Laser Diode Omega Company

Results

Table 1. Sex distribution

Sex	No.	Percentage
Male	8	30.7%
Female	18	69.3%
Total	26	100%

Table 2. Age distribution

Age	No.	Percentage %
Below 50	0	0%
50-59	8	30.7%
60-69	14	53,8%
70 and above	4	15.4%

Table 3. Resident

Resident	No.	Percentage %
Najaf (urban)	16	61.5%
Rural area	10	38.5%
Total	26	100%

Table 4. Time of the disease

Time of the disease years	No.	Percentage%
Less than 2	0	0%
2-3	10	38.5%
3-4	12	46,15%
More than 4	4	15.3%

Mahdi Table 5. Mode of treatment of Medicine Carbamazepine for the whole period

Time of treatment	No.	%
Less than 2 years	0	0
2-3 years	10	38.5
2-4 years	12	46.12
More than 4 years	4	15.3

Mahdi Table 6. Other Mode of treatment

Mode of treatment	No. Of treatment	No.	%
Trigeminal injection alcohol	Not done	8	30.7
	1 time	14	53.85
	2 time	4	15.3
	more	0	0
Electrical therapy	0	0	0
Micro vascular		0	0
Decompression (craniectomy)		1	3.85

Mahdi Table 7. Diode Frequency

No. of FREQUENCY Hz	No. of patients	%
1 K	13	50
5K	13	50

Mahdi Table 8. Site of Application

Site / App. frequency	Maxillary		Mandibular	
	No.	%	No.	%
1 KHz	6	23.07	7	26.92
5 KHz	6	23.07	7	26.92

Mahdi Table 9. Clinical response and P-value

Method	Good response		Poor response		P-value
	No.	%	No.	%	
1 KHz	9	69.2	4	30.7	Chi square = 0.17 P-value>0.05
5 KHz	8	61.5	5	38.5	

The good response has a significant response toward the 1 KHz more than 5 KHz.

Mahdi Table 10. Recurrence and time recurrence of 1 KHz, 5KHz and mean values

frequency	3 months		6 months		P-value
	No	%	No	%	
1KHz	Sever	2	0	0	Chi square = 1.05 P-value>0.05
		1		2	
		5.3			
	Mild	0		15.3	
		0		9	
	No recurrence	1		69.2	
		1			
		4			
		2.7			
5HKz	Sever	3	0	0	Chi square = 1.71 P-value>0.05
		2		2	
		3			
	Mild	0		15.3	
		0		8	
	No recurrence	1		61.6	
		0			
		6			
		7.7			

Both frequencies has significant value between 3 and 6 months, that means the recurrent rates increase with time.

Mahdi Table 11. Side effects of application

Frequency	Side effects
1KHz	No
5KHz	No

All the patients were submitted to laser sessions 4 days interval. The pain disappeared immediately after first session. The pain retain in some patients after 3-5 hours but mild.

Discussion

T.N. is a common chronic disease, we took 26 cases on TN all patients were from Al-Najaf city and nearby rural areas. The study shows no significances in epidemiology regarding the residence. Statistically the study showed that disease is more common among the elder as goes with most studies. All cases were diagnosed at least for 2 years with full coarse of anti-convalescent therapy (carbamazepine) with no good response, I.E. we were dealing with difficult resistance cases. Any case without the above features was omitted from the study and any case that disappeared during the following up was also cancelled from the study. Sever pain was

developed with two patients not treated to the scheduled treatment time. Those patients were not joint with total patient included in this study.

We used two frequencies of low-level diode 820nm laser therapy 1KHz and 5Khz respectively. Both two frequencies show good results more than 60% with no side effect and low recurrence rate. However, 1khz frequency needed less session and LLLT has been shown to effect many sub-cellular and cellular processes and, although the exact mechanism have not been well defined, it is believed that light is absorbed by mitochondrial chromophores leading to an increase in adenosine triphosphate (ATP), reactive oxygen species and/or cyclic AMP production, and consequent gene transcription via activation of transcription factors. Despite the many case reports, the use of LLLT remains controversial[21,22,23]. As a final result, the cells are activated and build up the broken part of insulation mechanism if effected nerve[24]. The penetration depth of the diode laser (820nm) from the outer surface of the skin is more than 2-3mm[25]. Beneath distance cells will be not effected. This fact can explain that any spots pain which was treated by diode laser is not cured, that explained why some patients get fair and poor response. The 5KHz frequency is less effective than 1 KHz.

Conclusion

1. Laser can be a promising method of treatment of TN with almost no side effect s and low recurrence rate.
2. It needs intelligent cooperative patients are ready for long follow up.
3. 1KHz frequency laser therapy gives better results than 5KHz.
4. Further studies are advised to this field specially, the frequency parameter.

Author disclosure Statement

No competing financial interests exist.

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