

Low Level Laser Therapy In Treatment Of Tinnitus.

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الخلاصة

هنالك دراسات عديدة اجريت باستخدام الليزر ذو القدرة الواطنة في علاج طنين الاذن هدف هذه الدراسة لتقدير مدى فعالية 2 واط ليزر باستخدام الدايدود ليزر في علاج حالات طنين الاذن تم في هذه الدراسة اختيار 19 مريض يعانون من طنين الاذن غير المستجيب للعلاج لفترة طويلة حيث تم علاجهم بالليزر 2 واط بطول موجي 790-805 نانوميتر لمدة 7.5 دقيقة ثلاث مرات بالاسبوع وقد سجلت شدة ودرجة ازعاج الطنين قبل وبعد العلاج النتائج قدرت بتغيير شدة ومدة الازعاج وقد اعطت نتائج تحسن نسبة 57.8% ويبدو ذلك مشجعا باستخدام الليزر في طنين الاذن المستعصى علاجيا.

Abstract

Many studies have been conducted regarding using low power laser in treating patients suffering from tinnitus. The aim of this study is to evaluate the effectiveness of 2Watt laser irradiation in the treatment of tinnitus(subjective tinnitus of sensor- neural in origin).

A new procedure is used in this study by selecting 19 patients suffering from tinnitus who have not responded to medical therapy for a long period of time. Those treated by low level laser therapy have the irradiation toward cochlea, 27 ears in 19 patients with unilateral or bilateral tinnitus , 2 Watt laser with wavelength of 790-805 nm is applied toward cochlea for 7.5 minuetes three times per week .

A questionnaire is administered by asking patients to score their symptoms on a percentage scale before and after laser irradiation. A decrease of one scale regarding the loudness, duration of tinnitus and degree of annoyance of tinnitus is accepted to represent any improvement.

The results are estimated by the change of loudness, duration and degree of annoyance due to tinnitus. 57.8% of patients have demonstrated improvement in their tinnitus. It is concluded that laser therapy seemed to be worth trying on patients with intractable tinnitus.

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Introduction

Tinnitus is often described as subjective or objective. This categorization is sometimes inconsistent with classification such as 'pathological', 'temporary', 'extra-auditory 'or 'associated tinnitus'. The great majority of the tinnitus sufferers have subjective tinnitus and generally when the word 'tinnitus' is used, it implies subjective tinnitus, which only is audible by the patient. Instead of classifying tinnitus as 'subjective' or 'objective tinnitus', 'genuine tinnitus', could be used and replace the term 'subjective tinnitus'. Objective tinnitus which is a sound sensations created by an acoustical source within the body, should rather be described by the condition causing this sensation and not be described as tinnitus. Tinnitus can consequently be defined as "a sound sensation in the absence of an internal or external acoustical source or electrical stimulation (1,2,3,4) .

Aim of the study

The aim of the study is to evaluate the effectiveness of laser therapy in reducing tinnitus. In the evaluation of the efficiency of laser therapy, changes in the frequency and intensity of tinnitus are used, as well as subjective criteria such as percentage scaling.

Tinnitus:-

General Definitions of Tinnitus

Tinnitus can be defined as a sound sensation in the absence of an external acoustical source or electrical stimulation. One could also suggest that the definition should include "the absence of an internal acoustical source", otherwise all sound that is created by the body could be regarded as tinnitus, and not only sound arising from non-physiological sources, e.g. muscular fasciculation or a bruit in an abnormal vessel. Furthermore, tinnitus could also be regarded as the discomfort caused by auditory perceptions that have no external or internal acoustical source or which originate from internal physical sources, such as circulation, digestion and respiration of muscle activity. Tinnitus is generally classified as either objective or subjective. Objective tinnitus is a response to an actual sound that is produced within the body. These sounds are measurable and may even be audible to other people. Subjective tinnitus, on the other hand, is only perceived by the sufferer and the problems

for the patients who have a subjective symptom differ from those having symptoms that can be measured. If auditory hallucinations are excluded tinnitus may be described as genuine tinnitus. It has been suggested that only subjective tinnitus should be regarded as tinnitus and the term 'objective tinnitus' should not be used and, instead, the origin of the sound should be described ^(5,6,7).

Epidemiology

Tinnitus is a common symptom occurring in 10-15% of the general population at some time in their lives, and in 10-20% of these cases tinnitus is severe enough to cause a significant impairment of daily life ^(8,9). Often tinnitus is related to an auditory dysfunction and most of the tinnitus patients suffer hearing loss ^(8,10,11,12). In both Sweden and in the United States, males seek help more often, at a younger age, and with greater hearing impairment than females ^(12,13). Tinnitus in females has a more complex characterization and lower pitch than in males ⁽¹⁴⁾.

Medical Evaluation

In obtaining complete histories of tinnitus patients, several etiologic factors are prominent. These are classified as otologic, cardiovascular, metabolic, neurologic, pharmacologic, dental, and psychological factors.

Examination and Tests

After obtaining a complete history on the tinnitus patient, a thorough medical evaluation is conducted. All patients should have blood pressure recordings from both arms, and routine studies should include audiometric evaluation (e.g., air, bone, speech discrimination). Laboratory studies should include hematocrit test. If a patient presents with a straightforward and simple etiologic cause (e.g., bilateral high-frequency hearing loss secondary to acoustic trauma), the laboratory workup is complete at this point. With any suggestion of medical or metabolic abnormalities, however blood chemistries, thyroid studies, a lipid battery, and other appropriate tests should be undertaken. With unilateral hearing loss, additional audiologic and radiologic studies may be necessary to exclude posterior cranial fossa tumors ⁽¹⁵⁾.

Unilateral tinnitus also presents a different problem, and posterior fossa lesions must be excluded. The diagnostic workup for the unilateral tinnitus is similar to that for unilateral hearing loss. Only if there is an unambiguous cause of the unilateral symptom can a full workup be ignored.

Low-level-laser-therapy (LLLT) of tinnitus

Since the beginning of the 1980's low power lasers have become increasingly popular as an additional treatment possibility in many professions, such as physiotherapists but not so much in traditional medicine and dentistry. In spite of more than 100 positive double blind studies there remains a skeptical attitude. In dentistry alone, more than 90% of the published studies show positive results. It is true that several studies have failed to show any result, but it is not uncommon for such studies to contain serious flaw. And it is not to be expected that any dosage or any wavelength of low level laser will produce a biological response. Low level lasers are generally in the visible & near visible range of the spectrum. The most common types are HeNe (633 nm), InGaAlP (630-685 nm), GaAlAs (780-870 nm) and GaAs (904 nm). Power output in the beginning ranged from 1-10 mW. With the advent of less expensive diodes the power has increased considerably and GaAlAs lasers are now available with power of even 4 000 mW (4 Watt). Increased dosage and power density have proven to be important and the clinical results have consequently been improved. Suitable dosage varies depending on the condition and the depth of the target tissue, but generally 4-20 J/cm² are applied. Red laser light is optimal for superficial conditions such as mucosa and skin whereas infrared is better for pain and deeper lying conditions because of its superior penetration.

Patients and Methods

In the treatment of patients with subjective tinnitus (sensori-neural origin), 19 patients, 16 males and 3 females, were selected whose age ranged between 22-67 years. All patients complain from tinnitus and sensori-neural hearing loss.

The study was conducted from October to December 2007 at Center of ENT, Hearing & Speech Unit and Al-Sadder hospital in Najaf.

Detailed history was taken from the patients by special questionnaire form including name, age, sex, tel. number, address ,occupation ,duration of tinnitus, lateralization, mode of tinnitus, aggravating factors, medical history, drug history, and family history.

All patients are assessed clinically by otoscopic examination of ears and audio logical assesm

Table (2.1) Times Age Group of Patients

No. of patients	20-30 years	30-40 years	40-50 years	50-60 years	60-70 years
19	1	3	4	7	4

Table (2.2) Site of Tinnitus

Site	No. of patients(ear)s
Bilateral	8
Rt.ear	4
Lt.ear	7

Questionnaire chart

Patient name :

Age:

Sex:

Occupation:

Tel No. :

Tinnitus:

Duration

Onset

Lateralization

Mode

Aggravating factors

Associated hearing disorders

Medical history

Blood pressure

D.M

Cervical spine disorders

Drug history

Medical examination

Hearing tests

Medical Laser System

The laser system used was diode laser (K-laser 4) as shown in figure(2.1).

The diode laser incorporates a class 4 GaALAS(Gallium Aluminum Arsenide)diode laser emitting at wave length range of 790-805nm (near infrared) with a power output 4watt at the source ,It can be operated at modulated continuous mode.

The aiming beam is visible diode 630-650nm (red beam) with a power of 2.5mw.

The delivery system is the fibro optic, with hand piece

Table (2.3) (Klaser- 4 specifications)

Operating voltage	100-240 Vac 50-60 hz
Current	0.7 A max
Insulation class	2 with type B applied part
Laser system class	IV
Aiming beam power	2.5 mw max
Aiming beam wavelength	635-650nm
IR laser	Ga Al As Diode
Wavelength 1	790-805
Wavelength 2	-
Source CW power	4 W max cw At the source
Optic fibre CW power	3.5 W max cw
Kind of laser emission	Modulated cw
Modulation frequency	1-20.000 hz
Duty cycle	50%
Optical fibre laser coupling	3 mm diameter
Spot size	8 mm diameter
Interface	graphic

Dose Parameter

Diode laser IR(790-805nm) is with power setting of 2 watt , frequency of 3 Hz, time 150 sec, and the energy density of 150 Joule /cm2(modulated continoues mode).

The therapy lasts about 7.5 minutes for each ear.

Procedures

Patients were in a sitting position with their eyes protected by suitable eye goggle.

The irradiation points include:

1. External auditory meatus as shown in figure (2.2).
2. mastoid process as shown in figure(2.3).
3. Temporomandibular joint as shown in figure (2.4).

Each point is irradiated by a continuous beam (noncontact mode) of 150J/cm², frequency modulation of 3Hz; duration of irradiation is 2.5 minutes in each point.

Attendance was scheduled so that the first series of 8 procedures in a total 3 times a week for 3 weeks .In the interval of 4weeks a further course of therapy follows usually consisting of 5-6 therapy, twice a week for 2 weeks.



Results

Of the 19 patients initially evaluated, 16 (84%) are males & 3(16%) are females, patients age range from 22 to 67 years.

The study displays that LLLT reduces tinnitus among (57.8%) of the patients. (31.57%) had their tinnitus reduced by more than 50%, (26.7%) had their tinnitus reduced by up to 50%, and (42%) had no effect.

Some patients experience improving in the hearing after laser therapy.

Table (3.1) Effect of Therapy

No effect	42%
Less than 50% relief	26.7%
More than 50% relief	31.57%

Discussion

The finding of the present study suggests that LLLT may be a viable option for tinnitus. Improvement of tinnitus loudness, duration & annoyance occur in 57.8% of patients.

Ali Koloylioglyls preliminary showed in 2006 that 48.8% had less loudness, 57.5% had less duration after LLLT of patients with tinnitus.

Miroslav Prochaza & A. Hahn⁽¹⁶⁾ also conducted a laser treatment study on tinnitus symptoms. They showed that 36% had their tinnitus reduced by more than 50%, 19% had their tinnitus reduced up to 50%. Wilden⁽¹⁷⁾ has applied a different method where the dose has been increased considerably. A set consisting of one HeNe laser and three powerful GaAlAs lasers is used, covering a large area over and around the ear, in the non-contact mode. Doses between 3.000 and 5.000 J are given each session. Laser is applied as a monotherapy. More than 800 patients have been treated with this concept and positive effects are reported. Yosak Shiomi⁽⁵⁾ in 1997 displayed, in his study, that tinnitus therapy with laser, had a positive effect on more than half of the patients in the study. 55% of the patients in the study had a diminished effect from laser treatment.

Hahn⁽¹⁸⁾ showed, in his study, that there was an improvement of tinnitus symptoms for 50.8% of laser treated chronic patients suffering from tinnitus for more than 10 years.

Conclusions

LLLT appears to be successful in controlling tinnitus in some patients. The procedure is simple and without serious complications. Further long-term studies are needed to determine whether the benefits of LLLT persist over time and to assess the potential benefits of LLLT in patients with severe tinnitus. Nevertheless, the bulk of published work up to date supports the use of LLLT for treating tinnitus. Compared with conventional methods of treatment, LLLT proved to be not only more effective but also economical. The added advantage of absence of side effects, non-invasive nature of therapy ensured good patient acceptance of treatment modality.

Recommendations

The use of laser in otorhinolaryngology is both interesting and promising, so training of ENT specialists on laser techniques and procedures by attachments with specialized centers and with laser institute is recommended.

Since only few surgical lasers are available in our hospitals, we recommend providing hospitals with new and more advanced laser system.

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