

# Hyperacusis

## A Tensor Tympani Syndrome case

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### Abstract

The Tensor Tympani Syndrome (TTS) is a slightly well known disorder. The abnormal activity of the tensile muscle of the eardrum (TTS) usually occur as a result of an environment where there is a risk for exposition to sudden and unexpected loud noise or for acoustic shock injury (ASI).

Here, we present a case study in which the main symptoms were hyperacusis and a little bit of disturbing Tinnitus. Perception of these symptoms occurred after exposure (by accident) in the patient's own factory where a severe loud sound was caused by an exploding tyre.

Both the tinnitus and hyperacusis symptoms were disturbing and firing anxiety in the person who was affected up to 7 months after the event. The patient lived 250 km from our Clinic Centre. Regarding those circumstances we planned the therapy around a domestic protocol.

We have found successful treatment results after some time of irradiation with a low level light therapy (LLLT) based domestic protocol.

### Introduction

A review of the literature reflects the difficulties encountered when clinically treating a subject who is complaining about hyperacusis.

Do different types of hyperacusis exist? <sup>1,2</sup>

It seems like the activation of the limbic and autonomic nervous systems are involved when emotional reactions of the hyperacusis (anxiety, fear and depression) are produced.

Since long, proposed treatments are based upon acoustic stimulation with a progressive introduction of sound (tinnitus retraining therapy TRT) <sup>3</sup>. Noise generators and hearing aids can in severe cases also be fitted for masking. The role of some drugs involved in the metabolism of the serotonin opens up for new approaches in the management of hyperacusis.

Recently, some researches and laser therapists have published <sup>4,5</sup> articles about low level laser irradiation producing substantial improvements on tolerance to loud sounds for almost all hyperacusis patients, even as soon as after eight laser therapy sessions.

With all these issues involved in hyperacusis, the questions are:

- Is it a symptom of a peripheral disorder?
- Is Hyperacusis a pre-state of other cochlear dysfunctions? (i.e. Ménière, Tinnitus, SSNHL).
- Is there a cure for Hyperacusis? (frequently asked by medical staff /patients /others)

Hyperacusis could be based upon several potential mechanism which are not connected to each other. Disorders into both the auditory central and peripheral systems are considered as potential key points to discover and understand the physiopathology of hyperacusis and its symptoms.

Nevertheless, for patients, hypersensitivity for loud sounds produces links between the auditory central system and other areas of the brain involved in anxiety and fear conditions.

From our clinical experience<sup>7</sup>, hyperacusis is most likely a cochlear disorder involving afferent auditory dysfunction and then we therefore focus the treatment on the inner ear, using laser light irradiation and simultaneously re-balancing minerals and oligo elements as a supplement to the diet if a patient has a weak health or an unbalanced metabolism that could depend on lacking minerals.

### Methods and Materials

According to our background and our last five years working with Laser Photo-Therapy (LPT), the success rate after using laser therapy and its general impact on improvement rate for inner ear conditions, has for cochlear disorders lead to a new foundation that affected our therapeutic approach for susceptible inner ear dysfunctions.

In our clinical centre, LPT is usually applied 2 or 3 times per week (photo 1) but, in this specific case, the distance between the home of the patient and our clinic was a treatment limiting factor.

The patient was treated with laser light irradiation of the inner ear with a dose of Low Level Laser Light. A domestic laser device of 650 nm wavelength was used to irradiate via the ear canal with a laser light power output of 5 mW, 0.6 Joules/cm<sup>2</sup>/minute of irradiance.

Each day the patient applied a total dose of 12 -15 joules.

For this treatment we used a commercial medical laser (CE mark pen-device) trade mark of Tinnitool from Dismark GmbH (Maur-Switzerland).

Photos 2, 3 and 4 show this simple device for domestic irradiation therapy.

Several tests and controls were used to evaluate the improvements of the patient. Mainly THI (Tinnitus Handicap Inventory), Hyperacusis Questionnaire, Auditory control of UCLs (UnComfortable Loudness Levels), Dynamic Range and Annoyance VAS Questionnaire were the clinical tools used for the evaluation tests and measurements.

### Results

The patient had a recovery of the threshold levels of Loud Discomfort Level (no hyperacusis) as well as no tinnitus annoyance. An impaired treble was on both ears considerably improved. Audiometric data before and after therapy is shown in the figures below.



Photo 1. Usual laser irradiation in our Clinic Centre.



Photo 3 and 4. Spot of Laser light irradiation and Kit device.

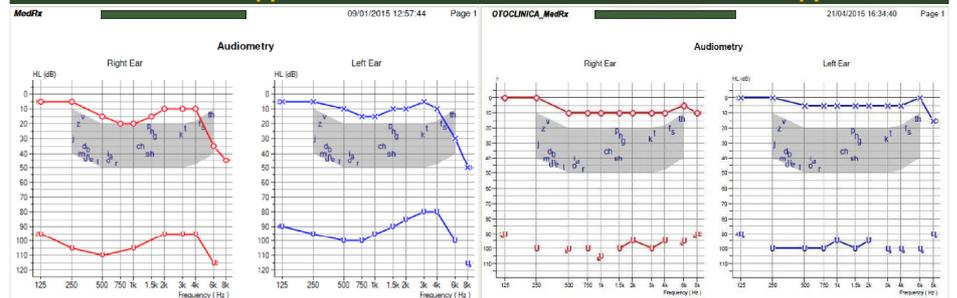


Photo 2. Domestic Laser device attached to the ear.

#### Before Therapy

#### Audiometric Test

#### After Therapy



### Discussion

Many of the disorders of the inner ear: sudden hearing loss, dizziness, hyperacusis, etc., are possibly the results of vascular alteration and/or degradation of the endocochlear homeostasis. Multiple proteins and molecules: connexins, fibrocytes and genes, are involved in the vascularisation of the "stria vascularis" and the spiral ganglion and all of them are fundamental in the ion homeostasis by the cochlear fluids and recycling of K<sup>+</sup>.

It is known that the photo-biological effects observed on a cellular level differ from one another <sup>6</sup> (Karu T.) depending on the type of laser, its wavelength, power output, fluence or dose per unit of the surface, creep or pattern of the doses etcetera. From our experience, lasers of semiconductor diode type, emitting light in the visible red and infrared spectrum, are producing a positive influence on the treatment of vascular disorders, ischemic arteriole disease, activation of microcirculation as well as on tissue regeneration and reparation. This background of cell regeneration, caused by laser light irradiation, is well known and published by several authors from different Russian Medical Groups and other photobiomodulation researchers <sup>4,5</sup>.

As a cochlear dysfunction, Hyperacusis is treated with Laser Photo-Therapy in all present cases of patients with a recovery on their LDLs. We have never observed any adverse effect or any impaired hearing capacity.

### Conclusions

The approach to cochlear disorders using the technique of irradiation with LPT (Laser Photo-Therapy) in the treatment of hyperacusis, is a very effective alternative to the current TRT & CBT.

A simple medical laser pen-device can be an effective tool for home treatment of some auditory disorders.

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### References

1. Barbara Goldstein et al. Tinnitus – Hyperacusis and the Loudness Discomfort Level Test. A Preliminary Report. Intl Tinnitus Journal 2, 83-89 (1996).
2. David M Baguley. Hyperacusis. Journal of the Royal Society of Medicine, Volume 96 December 2003:582-585, Section of Otolaryngology.
3. Jastreboff PJ, Jastreboff MM. Tinnitus retraining therapy (TRT) as a method for treatment of tinnitus and hyperacusis patients. J Am Acad Audiol 2000; 11: 162-177.
4. Jan Tunér & Lars Hode. The New Lasertherapy Handbook. Prima Books AB. printed Sweden. 2010. ISBN 13978-91-976478-2-3
5. Zazzio M. Pain threshold improvement for chronic hyperacusis patients, a prospective clinical study. Photomed Laser Surg. 2010 Jun. 28(3):371-7
6. T. Karu. Mitochondrial Mechanisms of Photobiomodulation in Context of New Data About Multiple Roles of ATP. Photomedicine and Laser Surgery, Volume 28, Number 2, 2010, 159-160
7. Graffelman, J., Prosper, J. The Analysis of Audiometric Measurements before and after Low-Level Laser Therapy of Spanish Patients with Hyperacusis. Report from Department of Statistics and Operations Research Universitat Politècnica de Catalunya. April 2013. Av. Diagonal 647, 08028 Barcelona, Spain. Contact email: jan.graffelman@upc.edu