Hyperacusis and other Inner Ear Disorders are improving after irradiation with Photobiostimulating Laser.

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INTRODUCTION
Several theories about pathophysiological mechanisms involved in hyperacusis as an inner ear disease, have since long been discussed and described in literature. Authors1,2 discuss errors in regulating processes of amplification of hearing cells. Other theories about the disorder are based upon central sound processing at a subcortical level. There are also discussions about the role of specific substances that could activate neurotransmitters that could increase both nervous system cell activity and sound perception.

Recently, several studies and research reports on Photobiostimulation and especially Low Level Laser Therapy (LLLT)1,4 have opened a new window for treatment where cellular metabolism and other molecular mechanisms, involving ATP as a neurotransmitter5, provide grounds for a new medical paradigm and new therapies. Up to now, chronic and neuropathic pain have for many years been disorders successfully treated with Laser Therapy.

Regarding chronic hyperacusis, in a study Zazzio2 reported obvious and undeniable improvements in pain thresholds for all patients who were treated with a multi-therapy protocol which was based upon laser therapy.

METHOD AND MATERIALS
A retrospective chart review from March 2011 to October 2012 identified patients with a diagnosis of Hyperacusis treated by Laser Therapy. Our prospective study on 58 patients who were suffering from hyperacusis and several other inner ear disorders such as Morbus Ménière and tinnitus were conducted using laser therapy5,4, based upon photobiostimulation effects. Patients (only 1) with some psychopathology condition were discarded.

The UCL (Un-Comfort Levels) were measured for audiofrequencies (pure tones) ranging from 125Hz to 8kHz. The group of 57 patients’ ages varied from 18 to 81 years with an average of 47.4 years and a median of 45 years. There were 31males and 26 females.

Therapy Protocol
Two types of semiconductor lasers emitting 650nm and 808nm light wavelength (red and infra-red light irradiation) were used. The standard protocol for all patients was at the beginning of therapy 12 sessions, twice a week.

RESULTS
The objective of our study was to confirm photobiological effects and some molecular mechanisms formulated by Tiina Karu6 and other photobiomodulation researchers7. Time ago blood irradiation therapy has been used for many healing process.

Irradiation of blood promotes the improvement of the rheological properties of blood6 (Mi et al, 2004), increasing the fluidity and activating functions of transport and also activates other indeterminate anti-infective immunity mechanisms, reduce the level of C reactive protein and produce an increase in the content of immunoglobulin’s IgA, IgM, IgG in blood serum.

Many of the disorders of the inner ear, sudden hearing loss, dizziness, hyperacusis, etc., are the result of a possible vascular alteration and/or degradation of endocochlear homeostasis. Multiple proteins and other molecules, connexins, fibrocytes and genes are involved in the vascularization of the “stria vascularis” and spiral ligament and also in the ion homeostasis by the cochlear fluids and recycling the K-.

CONCLUSIONS
The results confirm that hyperacusis as a disorder more susceptible to a dysfunction of cochlear condition than of other known neurophysiological processes. After therapy all patients had an improvement or a total recovery both on their hyperacusis and often also on other inner ear disorders such as tinnitus, Ménière’s disease or vertigo. We confirm most of patients recovery normal levels of noise/sound tolerance or UCL’s (Un-Comfort Levels) after light irradiation. We are absolutely sure that photo-biological effects and Laser Photo-Therapy (LPT), involved in the cochlear homeostasis, opens a new approach for the management of hyperacusis and other inner ear disorders. Future studies will assess the long-term benefits of LLLT for the treatment of inner ear diseases.

REFERENCES

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Dynamic Range
AUDITORY Index before/after THERAPY

Patients Disease Distribution

Single Patient @ Severe Hyperacusis before LLLT

Mean UCL Left Ear

Common avg. improvement per Ear

Number of Patients - Before Laser Therapy

Number of Patients - After Laser Therapy

Level Laser Therapy of Spanish Patients with Hyperacusis (Madrid, Spain), only 1 female.

Index variables PTA, mean UCL, mean DR and percentage of patients suffering from hyperacusis. All of them showed an improvement on hyperacusis levels after LLLT. The PTA (Pure Tone Average) was in average 5 dB lower after LLLT. Average UCL (Un-Comfort Level) levels were on average 16 dB higher after LLLT. The DR (Dynamic Range) augmented 20 dBHL in average and the POH (Percentage of Observations regarded as Hyperacusis) decreased by 30-50 %.

About these index variables of patients with hyperacusis all showed a difference in levels after LLLT. Our report data shows that all observed changes are statistically significant, implying improvements in certain hearing parameters, noise/tinnitus reduction, fullness inner ear pressure and other vestibular symptoms of patients treated with laser photo-therapy or light irradiation.