The Role of LLLT in Treatment of Tinnitus

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Abstract

Comprehensive laser rehabilitation therapy of tinnitus has proven successful and beneficial for treatment of this widespread civilization disease. Its long-term results are convincing, bringing significant relief to 36 per cent of patients and even leaving remarkable 26 per cent of patients without any symptoms (see Miroslav Prochazka, Ales Hahn: Comprehensive Laser Rehabilitation Therapy of Tinnitus: Long-Term Double Blind Study on a Group of 200 Patients in 3 Years, Laser Partner No. 51/2002). With the results mentioned above we can really speak about a breakthrough. This study brings an additional overview of the role of LLLT (Low Level Laser Therapy) in the treatment. Our results enable us to pinpoint laser as the leading element in the overall therapy of tinnitus.

Introduction

Tinnitus is an auditory perception appearing without an objective sonic source from the outer environment. Tinnitus can be subjective (heard only by the patient) and objective (sound can be even heard also by others). Our study, however, deals with patients suffering from subjective tinnitus only. According to literature, fifteen per cent of entire population have experienced at least a tinnitus episode some time, its incidence and severity rising with age up to approx. eighty-five per cent of population older than 60.

Our clinic has been treating tinnitus for more than 5 years. We have published three studies on this particular issue, and we are of the opinion that our results are being followed in several countries (Brasil, Cyprus, Sweden, Switzerland, Slovakia, Turkey, Japan, Germany etc.) and implemented in numerous clinics with significant results. Studies published by these clinics show results which are almost identical with our experience.

Our last study on a group of 200 patients in the course of three years was finalized in February 2002 and published in June 2002. Since there have always been efforts to evaluate an exact role of LLLT in treatment of tinnitus, apart from medication and physiotherapeutic manipulation of neck vertebra as an integral part of the comprehensive therapy, we have decided to create a separate group of patients to be treated only with laser. This was only possible thanks to our vast experience and long involvement in tinnitus treatments.

Materials and methods
Our group consisted of 72 patients, 49 males, 23 females, age ranging between 16 to 92 years. The age and sex is given in Table 1.

<table>
<thead>
<tr>
<th>SEX / AGE</th>
<th>16 - 20</th>
<th>21 - 30</th>
<th>31 - 40</th>
<th>41 - 50</th>
<th>51 - 60</th>
<th>61 +</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Female</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>14</td>
<td>19</td>
<td>22</td>
</tr>
</tbody>
</table>

Prior to the application of LLLT, all the patients underwent the following pre-therapy examination:

1. Anamnesis (aimed especially at the fact whether tinnitus was caused by an acoustic trauma, as well as at genetic predisposition)
2. Subjective evaluation of suffering
3. Clinical examination (otoneurology, axial skeleton, nystagm, blood pressure)
4. Technical examination (audiogram, x-ray of neck vertebra, ENG, tinnitometry)
5. Laboratory testing

Audiograms were taken in all the patients prior to the therapy. After the therapy audiograms were taken in 62.5 per cent, i.e. 45 patients, showing a slight improvement. Audiogram provides only for numeric range of perception of frequency of sounds, however it does not give us an objective evaluation of quality of hearing. Furthermore, the patients do not see the main improvement in a wider range of frequency of sounds, this remains usually on a similar level, but the main benefit is the absence of the additional burdening sound caused by tinnitus. Therefore the patients can better analyze sounds in general, their hearing is “refreshed” as they usually describe the result of the therapy.

Typical audiograms of patients with tinnitus before and after therapy shown on Picture 1.
MAESTRO/CCM device (manufactured by MediCom, Prague) was used for the study, with an infrared laser probe (830 nm) and power output 300 mW. The following application dosages and frequency modulations were applied on the following points:

1. **meatus acusticus externus** - in the direction of the axis of the auditory duct - continuous beam 50 J/cm² followed by 25 J/cm², frequency modulation of 5 Hz (Picture 2),

2. **processus mastoideus** - directed on the center, the vector of the beam in the direction of counter-lateral orbit, continuous beam 90 J/cm², followed by 45 J/cm² with 5 Hz pulse frequency (Picture 3).

We strictly appeal to maintain the direction of the vector of aiming the beam - in fact the target structure of the helix is a shape of several square millimeters.
At the beginning, attendance was scheduled to 10 procedures in total, twice a week. Having completed the first series, patients returned after 2 - 3 months for another two series, each consisting of 5 - 6 therapies, once a week.

**Evaluation**

Level of subjective complaints was evaluated according to three scales:

- **Percentage scale** - complaints evaluated 100 per cent at the beginning of therapy (Blue), according to the level of relief decreased (Green) to 80, 70 etc. per cent, possible acceleration of problems (Red) goes up to 110, 120 etc. per cent, no tinnitus equals 0 per cent.

- **Five-grade scale** - analogous to pain scales, reaching from Gr. I = No tinnitus to Gr. 5 = tinnitus interfering all activities

<table>
<thead>
<tr>
<th>Grade I</th>
<th>No tinnitus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade II</td>
<td>No interfering sound perceived during the day, only in evenings, causing no discomfort</td>
</tr>
<tr>
<td>Grade III</td>
<td>Interfering sound perceived during the day, interrupting drowse only</td>
</tr>
</tbody>
</table>


In order to simplify the effect of therapy as much as possible the results were divided in four groups:

1. Patients with no effect of comprehensive therapy
2. Less than 50 per cent relief
3. More than 50 per cent relief
4. No more tinnitus, patient free of the disease.

This evaluation is identical with our previous study, and it enabled us to compare easily the results of both studies.

Results

The results obtained are shown in Table 2.

<table>
<thead>
<tr>
<th>Result</th>
<th>Patients</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No effect</td>
<td>15</td>
<td>20.8</td>
</tr>
<tr>
<td>Less than 50 % relief</td>
<td>19</td>
<td>26.4</td>
</tr>
<tr>
<td>More than 50 % relief</td>
<td>22</td>
<td>30.6</td>
</tr>
<tr>
<td>No more tinnitus</td>
<td>16</td>
<td>22.2</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100</td>
</tr>
</tbody>
</table>

It was interesting to compare our latest results (LLLT only) with those of our previous studies, i. e. our study made in 1998, long-term study between 1999 - 2001, and the initial study aimed at LLLT only. Comparison is contained in Table 3.
<table>
<thead>
<tr>
<th>Result</th>
<th>1998</th>
<th>1999 - 2001</th>
<th>LLLT only</th>
</tr>
</thead>
<tbody>
<tr>
<td>No effect</td>
<td>19.4 %</td>
<td>16.0 %</td>
<td>20.8 %</td>
</tr>
<tr>
<td>Less than 50 % relief</td>
<td>19.4 %</td>
<td>15.0 %</td>
<td>26.4 %</td>
</tr>
<tr>
<td>More than 50 % relief</td>
<td>35.5 %</td>
<td>43.0 %</td>
<td>30.6 %</td>
</tr>
<tr>
<td>No more tinnitus</td>
<td>25.8 %</td>
<td>26.0 %</td>
<td>22.2 %</td>
</tr>
</tbody>
</table>

**Discussion**

Hippocratic Oath orders us to treat patients to the best of our knowledge and ability. Since our long-term experience in comprehensive treatment of tinnitus has been based on the triad of physiotherapeutic manipulation, medication, and LLLT, we were at a loss whether we would not harm our patients in a way, giving them only a part of the treatment, mere LLLT. We have to declare, that we have selected patients during the introductory examination, sorting out patients whose x-ray indicated a possibility of tinnitus caused by vertebral blockades. On the other hand, this selection led to a more pure evaluation of the role of LLLT in the treatment of tinnitus, leaving out both a possible cause and a corresponding treatment.

We have been positively surprised that in general the ratio of individual four groups remained similar. The number of patients with no effect of LLLT slightly increased (by 4.8 per cent when compared to the long-term study, by 1.4 per cent in comparison to the original study of 1998). This is obviously caused by the absence of medication and physiotherapy, showing their supportive effect.

In the group evaluating improvement as less than 50 per cent the leading role of LLLT can be evidenced best. More than one-fourth of all patients (26.4) report improvement after therapy performed with LLLT only, which is a result better than those in both previous studies (19.4 and 15.0). Impressive results have also been obtained in the last two groups, when we imagine more than one half of all patients reporting significant and/or total relief of tinnitus (30.6 + 22.2 = 52.8 per cent).

**Conclusion**

22.2 per cent patients suffering from tinnitus never more after treatment with therapeutic laser is a great success of LLLT. It only confirms the leading role of LLLT within comprehensive laser rehabilitation therapy of tinnitus. On the other hand we must stress the necessity to apply the two remaining parts of our therapeutic triad as well, since medication and physiotherapeutic manipulation are integral parts of the general care of our patients, and we should not deprive the suffering of the means and methods capable of bringing them more relief, which we are aware of.
Literature and references

- Hubacek, J.: Experience with the Use of LLLT in ENT Medicine, Laser Partner 22/2000, Prague 2000
- Declaration von Helsinki des Weltarztsbundes, Pharm. ind. 52, 1990, 12, 1497 - 1498.