

# Tinnitus and the experimental treatment of it with triggerpoint injections

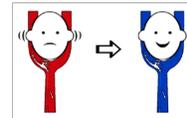
Marja Estola MD,ENT

Honkajarjun sairaala, korvatautien poliklinikka

Honkajarju 4 55800 Imatra

[marja.estola@imatra.fi](mailto:marja.estola@imatra.fi)

02061 73228



## Abstract

The connection of tinnitus and muscular tension was investigated. The study was planned to search a possibility to treat tinnitus by treating muscular tension, the coincidence of these two was found during muscle tension treatments.

178 tinnitus patients were treated during 1991-1993 in Imatra Honkajarju hospital for tinnitus. They were asked to take part in an open treatment study. 39 patients served as controls. Hearing was measured with audiometer and tinnitus was homed-in with audiometer after patient description of the tinnitus type. Tinnitus was classified by sound/ ear, not by the patients with tinnitus. Thus a patient with bilateral tinnitus was classified as 2 tinnitus cases, one tinnitus in right ear, another in left ear. Thus more tinnitus measurements than patients with tinnitus were achieved. Tinnitus was treated with cold spray stretching and trigger point injection with lidocain 1% local anesthetic. The number of tinnitus treatment settings varied from 1 to 56, the time between treatments was from 4 to 40 days. A high pitched ringing sound was most common: 51 cases in right ear and 58 cases in left ear in the treatment group and 10 cases in right and 11 cases in left ear in the control group.

Results: Tinnitus changed statistically during the treatments. Before the first treatment the medium tinnitus in right ear was 47.2 dB, and 30 minutes after treatment it was 42dB,  $p < 0.01$ . The medium left ear tinnitus, changed likewise from 47.5 dB to 43.4 dB,  $p < 0.001$ . Same phenomenon occurred in every treatment. Part of tinnitus changes took place during the post-treatment days and part of the effect occurred after a week from the treatment. After the first treatment a temporary relief of tinnitus occurred in 51% of the right ear tinnitus and 44% of the left ear tinnitus. Because a part of patients had bilateral relief of tinnitus and others had no effect, could be assumed, that one third of patients had benefit from the treatment. Women had different tinnitus than men; male patients reported more ringing tinnitus and female had a broader spectrum of tinnitus sounds. Women had more benefit from the treatment.

Conclusion: Muscular tension affects tinnitus sounds and tinnitus can be generated from tense muscles from the area around ear and neck. Tinnitus can be treated by relieving muscular tension in trigger points in these areas. Autonomic nerves may play a part in this phenomenon.

## Summary

This was known about the subject:

Tinnitus is a common symptom and it correlates often with hearing problems and other aural disorders

There are many ways to measure tinnitus, the measurements are usually repeatable

Trigger-points are hyperirritable spots in the tissues. They are locally tender, if compressed, and able to refer pain and autonomic phenomena

These facts were found in this study:

Tinnitus can be classified as one-ear symptom, not just one- patient symptom

A part of tinnitus symptoms are manageable by treating muscular tension with trigger point injections. The same reaction (change of tinnitus) follows the treatment, if tinnitus reappears later.

Tinnitus is modified by things, that rise human irritability. Muscular tension, stress, coffee, temperature changes and alcohol are possible causes. The fluctuation of tinnitus can be explained by the influence of autonomic nervous system.

The female tinnitus differs statistically from the male tinnitus. The male suffer mostly from ringing tinnitus and the female have chirping tinnitus. Trigger point injections influence more to chirping and humming tinnitus than to ringing tinnitus, thus the female tinnitus benefited more from the treatment.

## Results

### Anamnesic results

The number of tinnitus sounds/ place	Right ear		Left ear		Head	
	Treatment	Controls	Treatment	Controls	Treatment	Controls
One sound	100	23	121	28	10	3
Two sounds	15	3	25	2	1	0
Three sounds	6	0	4	1	2	0
Four or more sounds	1	0	2	0	0	0

### The description of T1 sound/ sex

	Right ear		Left ear		Female	
	Male	Female	Male	Female	Number	%
Ringing	43	65.2	18	22.5	48	59.3
Chirping	12	18.2	21	26.3	14	17.3
Whooosing	9	13.6	15	18.8	13	16
Humming	0	0	12	15	0	0
Other	2	3	13	16.3	6	7.3
Undefined	0	0	1	1.3	0	0
TOTAL	66	80	81	100		

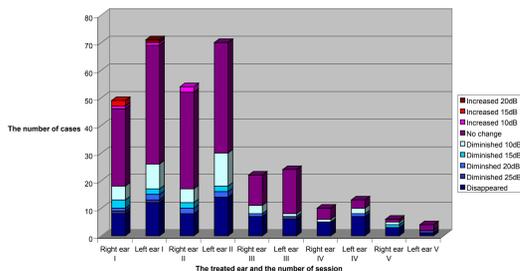
### Pretreatment measurements

The mean hearing of the speech level did not differ and was 24 dB in the right side and 25 dB in the left side. The maximum decrease of hearing was at 6000 Hz frequency, mean hearing 51 dB in right and 52 dB left. The mean tinnitus volumes of the treatment group were 43 dB / 4450 Hz in the right ear and 46 dB / 3774 Hz left ear. The mean tinnitus volumes of the control group were 47 dB/ 5375 Hz in the right ear and 33 dB / 3230 Hz in the left ear.

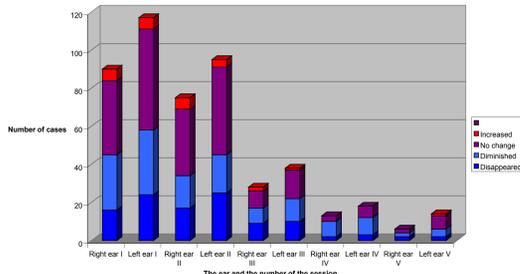
### The treatment results during treatment sessions

The change of tinnitus during the treatment sessions are presented in figure 1 and 2.

The change of the measured tinnitus during treatments, both ears 30 minutes after treatment

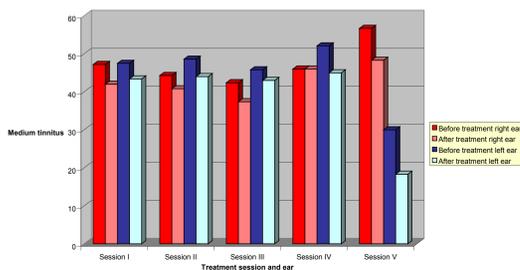


The change of tinnitus during the treatments, both ears late changes



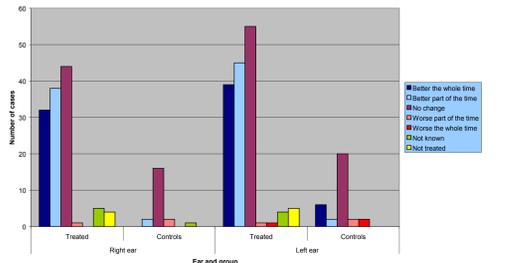
The mean tinnitus was achieved by adding the absolute volumes of tinnitus together and dividing the sum by the number of tinnitus cases having tinnitus in that ear. The mean tinnitus cases had to have a measurement before the treatment and 30 minutes after the treatment. If tinnitus disappeared, the case was left out from this figure, because the missing tinnitus could not be marked 0 dB. A statistically significant change in the mean tinnitus was achieved in 30 minutes. The mean tinnitus in the right ear was 47.2 dB before the treatment and 42.0 dB after the treatment ( $p < 0.01$ ). The mean tinnitus of the left ear was 47.5 dB before the treatment and 43.4 dB after the treatment ( $p < 0.001$ ). The tinnitus changes were similar during following treatment sessions but after the third treatment no statistically significant changes were achieved because the patient numbers were so small. Figure 3.

The measured medium tinnitus before and after treatment session



The effect of the treatment varied and the figure 3 presents the duration of the treatment after treatment sessions. The duration of tinnitus changes was estimated half a year after the last treatment. The tinnitus changes of the treatment group and the control group differed statistically significantly (figure 4).

The estimated time of tinnitus change after treatment, half a year



The patients were divided into 3 groups: the responders, the non-responders and controls. The tinnitus type of the groups was different. The responders described their tinnitus type more humming or chirping. The non-responders had more ringing type tinnitus. The controls were a mixture of the other two groups. In closer analyzes the tinnitus type correlated to the female gender and the gender itself explained the outcome of the treatment. The male patients had more ringing type tinnitus and the female patients had a larger scale of tinnitus types. Because ringing tinnitus responded less than chirping or humming, the greater success with female patients could be explained to the more favourable type of tinnitus sounds among the female patients.

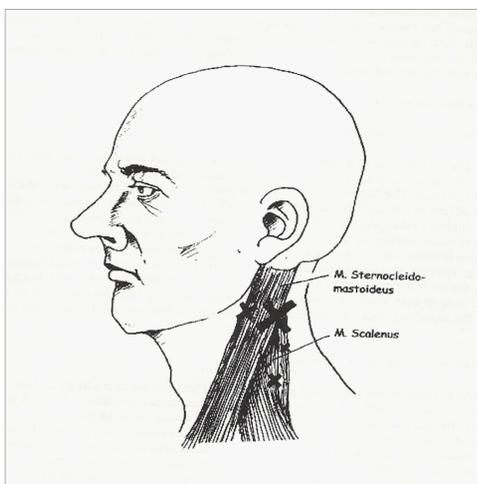


Fig 5. The most important injected points, side view

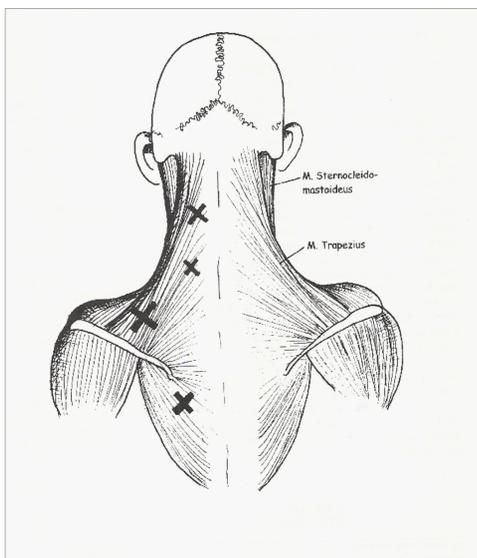


Fig 6. The most important injected points, back view

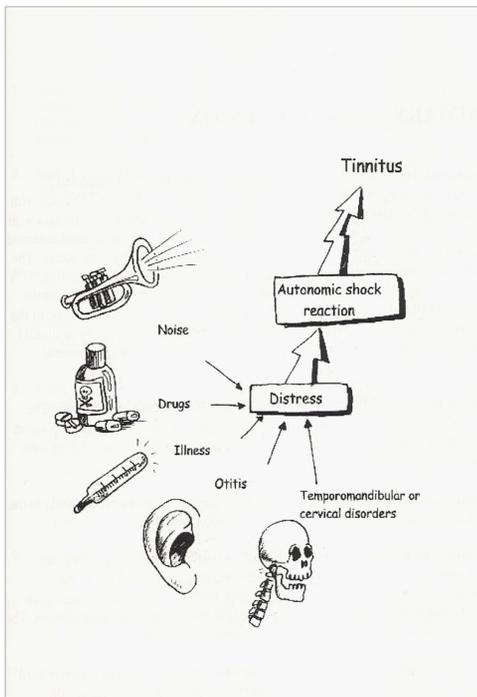


Fig 7. The possible generation of tinnitus.

## Literature

- Stephens S. Historical aspects of tinnitus. In Hazell J (ed) Tinnitus Edinburgh London Melbourne New York: Churchill Livingstone 1987; 1-19
- Stouffer J, Tyler R Characterization of tinnitus in tinnitus patients. Journal of Speech and Hearing Disorders 1990; 55:439-453
- Vernon J. Assessment of tinnitus patient. In Hazell J (ed) Tinnitus Edinburgh London Melbourne New York: Churchill Livingstone 1987; 71-95
- Klockhoff I, Lindblom U. (Dichloride)-a critical analysis of symptoms and therapeutic effects. Acta Otolaryngologica 1967; 63:347-365
- Tyler R. The psychophysical measurements of tinnitus. Evidence for Limbic System Links and Neural Plasticity. Neurology 1998; 50:114-120
- Jacobsson G, Ahmad B, Moran J, Newman C, Wharton J, Tepley N. Auditory evoked field (M100-M200) measurement in tinnitus and normal groups. In Aran J-M, Dauman R (eds) Tinnitus 91 Amsterdam/ New York: Kugler Publications 1992; 317-322
- Shiomi Y, Nagamine F, Fujiki N Tinnitus Remission by Lidocaine demonstrated by Auditory-evoked Magnetoencephalogram. Acta Otolaryngol (Stockh) 1997; 117:31-34
- Axelsson A. Causes of tinnitus. In Aran J-M, Dauman R (eds) Tinnitus 91 Amsterdam/ New York Kugler Publications 1992; 275-277
- Kempf H, Roller R, Multradi L Correlation between inner ear disorders and temporal joint diseases. HNO 1993; Jan 417-10
- Rubinstein B, Osterberg T, Roenhardt U, Johansson U. Tinnitus and craniomandibular disorders in elderly population. In Aran J-M, Dauman R (eds) Tinnitus 91 Amsterdam/ New York Kugler Publications 1992; 259-260
- Bjorne A. Tinnitus aureum as an effect of increased tension in the lateral pterygoid muscle. Otolaryngology Head and Neck Surgery 1991; Sept 109-558
- Krausová V, Krejčová H, Novotný Z. Otolaryngologic Symptomatology bei dem Cervicocranialsyndrom vor und nach der Manipulationstherapie. Manuelle Medizin 1968; 6:25-31
- Brügel F, Schorn K. Zervicaler Tinnitus nach HWS-behandlung. Laryng Rhin Otolaryng 1991; 70:321-325
- Hülse M. Die zervikogene Hörstörung. HNO 1994; 42:604-613
- Travell J, Simons D. Background and Principles. In Travell JG, Simons DG (eds) Myofascial Pain and Dysfunction The Trigger Point Manual. The Upper Extremities. Baltimore,Md, USA: Williams and Wilkins 1983:3-44
- Han S, Harrison P. Myofascial Pain Syndrome and Trigger-Point Management. Regional Anesthesia 1997; 22:89-101
- Mc Nulty W, Gevirtz R, Hubbard D. Needle electromyographic evaluation of trigger point response to a psychological stress. Psychophysiology 1994; 31:313-316
- Rahko T, Karma P, Pitkärjärvi T. The prevalence of handicapping hearing loss in a middle-aged population in Finland. Archives of Otolaryngology 1988; 245: 57-59
- Graham J. Tinnitus in children with hearing loss in Evered D, Lawrenson G (eds) Tinnitus. London: Ciba Foundation by Pitman Books Ltd 1981:172-192
- Tyler R. The psychophysical measurements of tinnitus. In Aran J-M, Dauman R, (eds) Tinnitus 91 Amsterdam/ New York Kugler Publications 1992; 17-26
- Axelsson A, Ringdahl A. Tinnitus- a study of its prevalence and characteristics. British Journal of Audiology 1998; 23:53-62
- van den Abbeele T, Focht B. Tinnitus matching. Technological features. In Aran J-M, Dauman R (eds) Tinnitus 91 Amsterdam/ New York Kugler Publications 1992; 57-59
- Berliner K, Cunningham J. Tinnitus suppression in cochlear implantation. In Hazell J (ed) Tinnitus. Edinburgh London Melbourne New York: Churchill Livingstone 1987; 118-130
- Hazell J. Measurement of tinnitus in humans in Evered D, Lawrenson G (eds) Tinnitus London: Pitman Books Ltd 1981:35-53
- Mekkie M, Griest S. Asymmetry in tinnitus perceptions. Factors that may account for the higher prevalence of left-sided tinnitus In Aran J-M, Dauman R, (eds) Tinnitus 91 Amsterdam/ New York Kugler Publications 1992; 231-237
- Duckert L, Ries T Placebo effect in tinnitus management Otolaryngology Head and Neck Surgery 1984; 92:697-699
- Wyant G Chronic Pain Syndromes and their Treatment II Trigger Points. Canadian Journal of Anesthesia. 1979; 26:216-219.
- Eriksson M, Gustafsson S, Axelsson A. Tinnitus and trigger points: a randomized crossover study. In Reich GE, Vernon JA (eds) Proceedings of the Fifth International Tinnitus Seminar 1995. Portland OR USA: American Tinnitus Association, 1996:81-83
- Ferber-Viart C, Soulier N, Dubreuil C. Cochleovestibular Afferent Pathways of Trapezius Muscle Responses to Clicks in Human. Acta Otolaryngologica (Stockh) 1998; 118:6-10
- Colebatch J, Halmagyi G. Myogenic potentials generated by click-evoked by vestibuloocular reflex. Journal of Neurology, Neurosurgery & Psychiatry 1994; 57:190-197
- Cooper B, Cooper D, Lucente F. Electromyography of Masticatory Muscles in Craniomandibular Disorders. Laryngoscope 1991; 101:150-157.
- Brown, R, Penny J, Henley C, Hodges K, Kupetz S, Glenn D and Jobe P Otolitic drugs and noise In: Evered D, Lawrenson G, (eds) Tinnitus. London: Pitman Books Ltd 1981:151-171
- Vastamäki M. Reflektorinen sympaattinen dystrofia. Tunnistaja ajoissa suhteettoman kipeän huonolikkeisen turvonneen käden sairaus. Suomen Lääkärilehli 43/2003; 4365

## The Material and methods

The study group consisted of 108 female and 74 male, aged 18-84 years mean age 60.4 years. The control group consisted of 39 people, 21 female and 18 male, aged 30-77 years, mean age 60.0 years. I did a normal otorhinolaryngological study for the patients. The hearing was measured by audiology technician with audiometer. Tinnitus was measured by homing-in the right tone with audiometer after the patient had described the type of tinnitus. Sometimes masking tones were used, if tinnitus was not a narrow-band type. When the tinnitus type was found, the loudness was measured going up and down the volume until the same loudness was found. If tinnitus sounds differed from ear to ear, both ears were measured separately and also tinnitus sensed outside the ears (for instance in the skull) was measured separately. If 2 different tinnitus sound was sensed in the same place, they were both measured and the louder one marked T1 (tinnitus 1) and milder T2 (tinnitus 2). So the most measured patients had 6 tinnitus sound measured, 2 in the left ear, 2 in the right ear and 2 sensed in the skull.

I palpated the neck area by hands and the side with more trigger points in the muscles was classified having more tension. Trigger-points were first searched and then I stretched with the Fluori-Methane-cold spray (Gebauer Company, Cleveland Ohio) the muscles in the whole neck area, also the contralateral side in case of unilateral tinnitus. The stretching was accomplished to one muscle at a time. After spraying with the cold spray on the way of muscle fibres, the muscle was stretched and then the muscle was warmed with a warm moist towel. After stretching and warming was completed, I injected lidocain 1 % solution (Lidocain Orion Finland) to the palpable still hard tender muscular points. The retreatment was performed after 1 to 3 weeks, and after that if needed. Usually at least 2 treatment setting were accomplished and, if it was impossible, the patient was dropped out from the study. The exception was 3 patients, whose tinnitus disappeared after the first session. 100 patients were treated twice, 32 patients 3 times, 19 patients 4 times ja 5 patients were treated 6 times or more.

The medium interval between the first and second treatment was 19.2 days and between the second and the third treatment 62.2 days. The number of injected trigger points varied. During the first treatment session the medium number of injected points was 4.9 injections/ patient, during the second treatment session 7 injections/ patient. The mostly injected trigger points are shown in Fig. 5 and Fig. 6. The medium amount of Lidocain 1 % used during the first treatment session was 1.8 ml, during the second treatment 2.8 ml.

## The statistics

Tinnitus was measured before the treatment and 30 minutes after the treatment and also about six months after the last treatment session. If the left ear and right ear tinnitus sounds were different, the measurement was done from both ears, but if they were identical, only one side was measured. If a patient had left-sided tinnitus, it was recorded 1 sound in the left ear, 0 sound in the right ear. Bilateral tinnitus cases were recorded: 1 sound in the right ear, 1 sound in the left ear. The recording system helped to analyze those cases, when the tinnitus in one ear disappeared, but the tinnitus in the other ear did not. Patients were interviewed before the treatment sessions and after the treatment sessions were all done. The measurements and answers were analyzed with the SPSS. Chi-square analysis was used in the comparison between the treatment and control groups and the responders and non-responders. The Student's t-test was used for the paired data. In searching the outcome variables, logistic regression was used with chi-square analysis.

## Discussion

In other tinnitus studies the phenomenon has been characterized by the patients suffering from tinnitus. We reported the tinnitus in the right ear or the tinnitus in the left ear and their fluctuations. If we had used the traditional way of reporting tinnitus, only part of the fluctuations could have been reported. In some cases one ear responded to the treatment and other did not. Some of the tinnitus sounds could be measured, others were hard to characterize. Because of our different way to report tinnitus, we had more tinnitus, than we had patients. The difference makes hard to do comparisons to other studies.

Tinnitus was more common in the left ear, and the most common description of tinnitus was ringing. The male tinnitus was more often ringing and female had equal number of ringing and chirping. A similar difference of tinnitus character between the sexes was found also by Stouffer.

The treatment was done with Fluori-Methane vapocoolant spray and lidocain injections. Lidocain is known to suppress tinnitus, if administered intravenously. The treatment results of this study can not, however, explain by lidocain itself. The possible accidental intravenous administration was avoided by controlling repeatedly the place of the needle. The amount of lidocain was also small to cause the treatment effects by itself even if it had been injected intravenously. I have used saline injections to patients, allergic to lidocain, with similar treatment responses. The injection sites are more tender with saline, but otherwise reactions are identical. The duration of the treatment results was longer than was described with lidocain and it exceeded the lidocain clearance. The time interval after injection, before the treatment results appeared, did not match the profile of intravenous lidocain. In intravenous administration the time lag was minutes and it might be over after 30 minutes. We, on the contrary, observed several cases an interval of days, or even a week, before the tinnitus was changing.

Dr Hülse found neural connections from the autonomic part of the cervical muscles to the auditory nuclei. Probably the tinnitus, that is produced by muscular tension, is generated by autonomic nervous system disorders and it uses these nervous connections from the cervical area to nucleus cochlearis. Colebach et al demonstrated sound evoked potentials, from the musculus sternocleidomastoideus.

The treatment of tinnitus by needling trigger points, is usable and easy way to treat this symptom. The treatment was well tolerated, and when it was given early after tinnitus had emerged, it cured tinnitus from some patients at least for years. However, not everyone gets benefit from it. Maybe there is an optimal time to treat, after that tinnitus is organizing itself into the neural network, maybe using autonomic nerves. After the optimal time, the curing of tinnitus is no longer possible. We were able to give relieve the tinnitus of a quite many patient after that period, but the treatments need to be redone over and over again.

In figure 7 is my own theory of tinnitus generation, based on this study. The etiology of tinnitus seems to vary from one individual to another. Noise, drugs and muscular tension can act as triggers of tinnitus. The tinnitus, caused by muscular tension, acts like CRPS (complex regional pain syndrome), which is an autonomic nervous system maintained pain disorder, mostly in the limbs. In CRPS some, at first a minor, accident in a limb, can start a cascade causing a very troublesome pain disorder. The patient must have natural sensitivity and abnormal sympathetic reflex. If the first minor accident is properly treated, the reflex arch is not generated. In my own study, tinnitus could be best managed with early treatment. Tinnitus are often linked with autonomic phenomena, the change of cutaneous sensation, swelling in the ipsilateral side and hyperacusis. If autonomic nerves a generating tinnitus, the phenomenon can be explained with its co-morbidities. If a minor accident happens to a person, who has a sensitive autonomic nervous system, the nerves react. The autonomic reflexes start to modify the accident and cause tinnitus by irritating the cochlear nucleus. When the accident is promptly managed by blocking the sympathetic nerves, this reflex arc is reversed and chronic tinnitus is not generated. If this seems to be true in other studies as well, and CRPS type of reaction is generating tinnitus, we should change of our way to treat tinnitus. Now we teach the patients how to tolerate their tinnitus and not to listen it. Maybe in the future we take the patients to emergency policlinics and cure the tinnitus in the beginning.