Ear Hear. 2011 Mar-Apr;32(2):145-55.

Effect of tinnitus retraining therapy on the loudness and annoyance of tinnitus: a controlled trial.

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Abstract

OBJECTIVES: Subjective tinnitus is the sensation of hearing a sound in the absence of an external stimulus. Although an estimated 30 million Americans experience chronic tinnitus, only a small percentage are significantly bothered by the sensation. However, this population is currently in need of effective therapy that reduces the impact of tinnitus. Tinnitus retraining therapy has been promoted as an effective intervention for treating chronic bothersome tinnitus from any etiology. The aim of this study was to compare the effect of tinnitus retraining therapy on the loudness and annoyance of tinnitus with a control group.

DESIGN: Subjects with subjective, stable, bothersome, chronic tinnitus, and normal to near-normal hearing in the speech frequencies (average pure-tone thresholds for 0.5, 1, 2, and 4 kHz ≤ 30 dB HL) were recruited to participate in a study for the effect of tinnitus retraining therapy (TRT) on the loudness and annoyance of their tinnitus. Participants were assigned to either the TRT arm or a control arm, with assignment balanced between groups by tinnitus severity. After baseline evaluation, participants received acoustic stimulation devices and 3 mos of individual counseling. An integrated computerized test battery of questionnaires and psychophysical procedures were used to evaluate participants at 6, 12, and 18 mos after enrollment. The primary outcome measure was the change in total score on the tinnitus handicap inventory. Secondary outcome measures were change in global tinnitus impact on a tinnitus experience questionnaire, subjective tinnitus loudness rating, and tinnitus loudness objectively measured using a psychophysical matching procedure.

RESULTS: Both TRT and general counseling without additional sound therapy are effective in reducing the annoyance and impact of tinnitus. The largest effect on overall tinnitus handicap was observed in the TRT participants, with an effect size of 1.13. However, a clinically significant effect was also observed in the control group, with an effect size of 0.78.

CONCLUSIONS: Individuals with moderate to severe tinnitus, without hearing loss in the speech frequency range, benefit from treatment with either TRT or general counseling. The global improvement in tinnitus handicap with TRT accrues over an 18-mo period and seems to be a robust and clinically significant effect.

PMID: 20890204 [PubMed - in process]

Long-Term Results from Tinnitus Retraining Therapy

Bauer and Brozoski (2011) reported on 43 participants with tinnitus who were enrolled in one of two groups. The tinnitus retraining therapy (TRT) group originally had 21 participants and the control group originally had 22 participants. Eleven participants dropped out of the study, leaving 16 participants in each group. The two groups were balanced for gender, moderate-to-severe tinnitus severity (based on the tinnitus handicap inventory, THI), and Beck Depression Inventory (BDI) scores. No significant audiometric differences were present across the two groups upon entering the study and all participants had essentially normal hearing through the speech frequencies.

The TRT group received directive counseling and sound therapy. The control group received only general tinnitus counseling. Both groups were given sophisticated sound generators and custom open, ear molds. Both groups had similar patterns of sound device use.

After 12 to 18 months, both groups demonstrated improvements in their THI scores. For participants in the TRT group, early habituation to their tinnitus likely occurred, rather than a change in the tinnitus sensation. The TRT group demonstrated more robust and clinically significant reductions in their THI scores and in their overall rating of tinnitus awareness. The authors note that TRT does appear to offer real-although-moderate improvement in tinnitus suffering for adults with moderate-to-severe tinnitus, in the absence of hyperacusis, significant hearing loss and/or depression.

For More Information, References, and Recommendations:

Bauer CA, Brozoski TJ. (2011) Effect of Tinnitus Retraining Therapy on the Loudness and Annoyance of Tinnitus: A Controlled Trial.*Ear & Hearing* 32(2):145-155.

Voorlopige resultaten (2010)

Hoorkliniek IntoEars, Tilburg-Eindhoven, Nederland

C. Habets

In de oudste vestiging van IntoEars, gestart in het MMC Eindhoven zijn er sinds juli 2007 tot 16 februari 2010 770 cliënten binnengekomen, waarvan 85 met ernstige tinnitusklachten. Daarvan zijn er 61 voorzien van hoortoestellen, met counseling door de bc. audioloog. 58 hiervan geven aan dat de klachten zijn verminderd. 3 cliënten dragen de toestellen maar zijn doorverwezen naar het Audiologisch Centrum of de medisch psycholoog in het MMC ziekenhuis voor verdere begeleiding. Van de 24 die geen hoortoestel dragen zijn er 15 doorgestuurd naar het AC Eindhoven of de medisch psycholoog in het MMC. De overblijvende 9 wilden geen verdere doorverwijzing. De succesratio met hoortoestellen en counseling is dus 68,2 %. Van de successen bij de doorverwijzingen naar het AC en de medisch psycholoog zijn geen cijfers beschikbaar.

In de Hoorkliniek Tilburg, die model staat voor het IntoEars concept van geïntegreerde hoorzorg zijn er sinds de start op 16 november 2009 tot 16 februari 2010 148 hulpvragen binnengekomen. Daarbij waren er 48 met tinnitus als belangrijkste klacht. De resultaten bij deze klanten zijn gemeten met de Tinnitus Handicap Inventory (THI). Bij 45 (94%) cliënten was er een verbetering van de score na 3 maanden. Bij deze klanten zijn de principes van de TRT toegepast.

Vanaf augustus 2010 is er met een verbeterde aanpak gestart en thans wordt er strikt volgens het protocol van Jastreboff gewerkt. Resultaten worden momenteel door een afstuderend audiologe aan de Fontys Paramedische Hogeschool, volgens de methoden van Jastreboff in beeld gebracht.

Tinnitus Retraining Therapy (TRT): outcomes after one-year treatment

Stavros Korres, Aikaterini Mountricha, Dimitrios Balatsouras, Nikolaos Maroudias, Maria Riga, Ioannis Xenelis

Greece 2010

Klik hier:

http://www.tinnitusjournal.com/audiencia_pdf.asp?aid2=72&nomeArquivo=v16n1a11.pdf

J Med Dent Sci. 2010 Mar;57(1):45-53.

Clinical prognostic factors for tinnitus retraining therapy with a sound generator in tinnitus patients.

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Abstract

OBJECTIVES: The purpose of the present study is to find out the clinical characteristics which determine candidates for tinnitus retraining therapy (TRT) with a sound generator (SG) as well as the prognosis of this treatment.
METHOD: This study enrolled 270 serious tinnitus patients who visited this institute between January 2004 and December 2008 in the TRT program. The relationships among compliance, efficacy, clinical characteristics, and affinity for SG were evaluated retrospectively.
RESULTS: The persistence rate at one month was 61.5%. The shorter duration and higher pitch of tinnitus were significant independent predictors of compliance. Six months after the initiation of TRT, 65.2% subjects demonstrated significant relief from tinnitus. The Kaplan-Meier method demonstrated that the overall efficacy rate at 18 months was 86.5%. The lower loudness of tinnitus, recognition of tinnitus attenuation by a sound generator, and patient's positive attitude toward TRT were significant variables for predicting favorable results.
CONCLUSION: The patients with lower loudness of tinnitus were suitable for TRT with a SG.

PMID: 20437765 [PubMed - indexed for MEDLINE]

Eur Arch Otorhinolaryngol. 2010 Jan;267(1):51-6.

Personal experience with tinnitus retraining therapy.

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Abstract

We present the results of tinnitus retraining therapy (TRT) in a group of patients suffering from tinnitus and/or hyperacusia. Based on the scores from a specific questionnaire and the Tinnitus Handicap Inventory (THI), the patients were classified into five categories and began therapy according to Jastreboff's criteria. Depending on the individual case, therapy envisaged counselling sessions, ambient sound enrichment, sound generators and hearing aids. At the end of the 18-month period, therapeutic success was observed in 79% of the patients. The initial numerical values of the scale of the symptoms and the THI seem predictive of treatment outcome. The use of instruments (sound generators) increases the success rate, but the study also demonstrates the effectiveness of counselling and ambient sound enrichment. Failures mainly involved patients with hypacusia who refused to wear hearing aids, as this influenced the effectiveness of ambient sound enrichment and counselling. Paralleling the data in the literature, the results demonstrate the effectiveness of TRT, which cannot be attributed to a placebo effect given the extended duration of treatment.

PMID: 19543742 [PubMed - in process]

Cochrane Database Syst Rev. 2010 Mar 17;(3):CD007330.

Tinnitus Retraining Therapy (TRT) for tinnitus.

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Source

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Abstract

BACKGROUND:

Tinnitus is described as the perception of sound or noise in the absence of real acoustic stimulation. Although an outright cure for tinnitus remains elusive, various management strategies have been developed to help to lessen the impact of the symptom. Following the publication of a neurophysiological model of tinnitus, Tinnitus Retraining Therapy (TRT) was developed. Using a combination of directive counselling and sound therapy in a strict framework, this is one of the most commonly used treatment modalities for tinnitus. Many studies refer to the use of TRT where in fact a modified version of this therapy is actually being implemented. It is therefore important to confirm the use of authentic TRT when reviewing any study that reports its use.

OBJECTIVES:

To assess the efficacy of TRT in the treatment of tinnitus.

SEARCH STRATEGY:

The search included the Cochrane ENT Group Trials Register, the Cochrane Central Register of Controlled Trials (CENTRAL), PubMed, EMBASE and reference lists of identified publications. The date of the most recent search was 26 August 2009.

SELECTION CRITERIA:

Randomised controlled trials of TRT versus no treatment, or other forms of treatment, in adult patients with tinnitus.

DATA COLLECTION AND ANALYSIS:

Both authors critically appraised the retrieved studies for risk of bias and extracted data independently. Where necessary, we contacted the original study authors for further information.

MAIN RESULTS:

Only one trial (123 participants) was included in the review. Several excluded trials did not follow the strict protocol for TRT, evaluating instead a modified form of TRT. The included trial showed TRT to be more effective than a tinnitus masking (TM) approach. In this study outcome data for tinnitus severity were presented using three instruments (Tinnitus Handicap Inventory (THI), Tinnitus Handicap Questionnaire (THQ), Tinnitus Severity Index (TSI)) for patients in three groups (participants' tinnitus being a 'moderate problem', big problem' or 'very big problem').At 18 months, improvements for the three groups in the three scores (TRT versus TM) were respectively: 'moderate problem' - THI: 18.2 versus 4.6, THQ: 489 versus 178, TSI 7.5 versus 1.6; 'big problem' - THI: 29.2 versus 16.7, THQ: 799 versus 256, TSI: 12.1 versus 6.7; and 'very big problem' - THI: 50.4 versus 10.3, THQ; 1118 versus 300, TSI: 19.7 versus 4.8.

AUTHORS' CONCLUSIONS:

A single, low-quality randomised controlled trial suggests that TRT is much more effective as a treatment for patients with tinnitus than tinnitus masking.

Lin Chung Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2010 May;24(10):442-6.

Analysis and comparison of the masking and TRT for patients with subjective tinnitus.

[Article in Chinese]

Yang H, Zheng Y, Zhang Z, Lan J, Chen S, Liang X, Chen L.

Source

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Abstract

OBJECTIVE:

To compare the effect of tinnitus masking and tinnitus retraining therapy (TRT) in patients with subjective tinnitus, and to analyze the effect of TRT within the positive or negative group of tinnitus masking test.

METHOD:

The 217 patients from January, 2006 to April, 2008 in our hospital, were performed with the determination of tinnitus including pitch matching, intensity matching, Feldmann masking curve and residual inhibition test with TinniTest. Of which 143 cases were positive and 74 were negative in tinnitus masking. The follow-up was 6 months and 10 cases were lost. 207 patients were divided into two groups for prospective study: 69 cases in tinnitus masking group and 138 cases in TRT group, The curative effect was evaluated according to tinnitus handicap inventory (THI) and Subjective Visual Tinnitus Scale (SVTS).

RESULT:

Both masking treatment and TRT were effective for cases with tinnitus, there was significan difference of the score of THI and SVTS of tinnitus between pretherapy and posttherapy ($P < 0.01$). TRT therapy was more effective than masking therapy, there was significant difference of the THI score between TRT and masking group,but there was no significant difference of of the SVTS between them. TRT therapy was suitable for the patients with both positive effect and negative effect of masking test, and there was no significant difference between them.

CONCLUSION:

Both TRT and masking therapy are the most important therapy for tinnitus patients, but TRT is much more effective than masking therapy in some aspects.

PMID:

PubMed - in process

Audiol Neurootol. 2010;15(2):69-80. Epub 2009 Aug 4.

Long-term improvement in tinnitus after modified tinnitus retraining therapy enhanced by a variety of psychological approaches.

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Abstract

This work evaluates an enhanced tinnitus retraining therapy (TRT) for patients with chronic tinnitus based on different group therapeutic interventions in a day hospital setting. Therapy for chronic tinnitus is intended to improve the way patients cope with tinnitus by learning how to reduce tinnitus-induced impairments. Short-term and long-term changes in stress variables and tinnitus-related distress were investigated using 3 psychometric instruments. Patients received 7 consecutive days of a multidisciplinary therapy at the Charité University Hospital in Berlin. The data were assessed before and after therapy, either immediately or after 3, 6 or 12 months. As a control, we used scores of tinnitus patients from the waiting list, and compared these to the scores of the therapy group 3 months after the end of treatment. The main factors of the modified TRT were Jacobson's progressive muscle relaxation, physiotherapy, education via lectures and training of selective attention, as well as changes of appraisal, mental attitude and behavior towards tinnitus. The therapy resulted in a significant reduction in both short-term and long-term tinnitus-related distress and psychometric stress variables, with the latter being more reduced in patients with higher initial scores. Moreover, our study revealed differences in psychometric parameters concerning duration of tinnitus, age and gender, which may explain the different outcomes of therapy. The outpatient setting enables the patients to test, practice and transfer strategies into their everyday life.

PMID: 19657182 [PubMed - indexed for MEDLINE]

Audiol Neurootol. 2009;14(5):286-9. Epub 2009 Apr 15.

Are results of tinnitus retraining therapy maintained over time? 18-month follow-up after completion of therapy.

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Abstract

Tinnitus retraining therapy (TRT) is a useful treatment for tinnitus. The aim of this study was to evaluate the results obtained after 18 months of TRT as well as 18 months after completion of therapy, i.e. 36 months after initiation of TRT. Forty-five subjects suffering from an idiopathic tinnitus with or without hyperacusis for at least 6 months were recruited. There were significant improvements during therapy ($p < 0.001$) and the mean Tinnitus Handicap Inventory (THI) was lowered by more than 20 points. These improvements persisted 18 months after treatment completion. Furthermore, the percentage of patients reporting the disappearance of their difficulties in various activities (relaxation, concentration, sleep, social relations and work) increased continuously after treatment completion. TRT improved self-perceived disability induced by chronic tinnitus for a long time after the end of therapy.

PMID: 19372645 [PubMed - indexed for MEDLINE]

Auris Nasus Larynx. 2009 Oct;36(5):536-40. Epub 2009 Mar 6.

Association between tinnitus retraining therapy and a tinnitus control instrument.

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Abstract

OBJECTIVE: Tinnitus retraining therapy (TRT), which is an adaptation therapy for tinnitus based on the neurophysiological model proposed by Jastreboff in 1990,consists of directive counseling and acoustic therapy with a tinnitus control instrument (TCI) or other devices. For the past 5 years, our hospital has administered TRT characterized by the use of a TCI.

METHOD: In this study, we reviewed the clinical course of patients with tinnitus who presented to our outpatient clinic for tinnitus and hearing loss during the 3-year period from April 2004 to March 2007 and underwent TRT with a TCI. Among 188 patients with tinnitus (105 males and 83 females), 88 patients (51 males and 37 females, excluding dropouts) who purchased a TCI and continued therapy were included in the study.

RESULTS: Significant improvement in Tinnitus Handicap Inventory (THI) and Visual Analogue Scale (VAS) scores was found as early as 1 month of treatment and later compared with those on initial examination, suggesting that TRT with a TCI may be an effective treatment for tinnitus. Among the noises generated by the TCI, the sound pressure output from the TCI was set at just below tinnitus loudness level both of the first adjustment and the second adjustment. Speech noise and white noise were frequently selected, whereas high-frequency noise and pink noise were infrequently selected. Speech noise was most frequently selected at the first adjustment, and the number of patients selecting white noise increased at the second adjustment. The results that we compared the two also revealed that the mean hearing level and tinnitus loudness levels were higher in the white noise group than in the speech noise group, which suggested that the inner ear disorder was more harder in the white noise group. Both the THI score and VAS grade improved after 1 month of treatment in the speech noise group, whereas improvement in these parameters was observed in the white noise group after 6 months of treatment. These results suggest that it took much longer the patients in the white noise group to improve.

CONCLUSION: : Significant improvement in THI and VAS scores was found as early as 1 month of treatment and later compared with those on initial examination, suggesting that TRT with a TCI may be an effective treatment for tinnitus. It resulted that many patients chose the speech noise or the white noise. And also it was indicated that noise generators set at just below mixing point with tinnitus are more effective. In this study, however, speech noise was often selected probably because of the reduced output at high frequencies and the level of comfort. As white noise produces greater sound volume, patients tended to switch from other therapeutic sound to white noise at the second adjustment. These findings may help administer acoustic therapy in the future.

PMID: 19269119 [PubMed - indexed for MEDLINE]

Acta Otolaryngol Suppl. 2009 Jun;(562):40-5.

Estimation of factors influencing the results of tinnitus retraining therapy.

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Abstract

CONCLUSION: The factors of tinnitus loudness and Tinnitus Handicap Inventory (THI) score in tinnitus patients have the potential to relate to therapeutic results of tinnitus retraining therapy (TRT).
OBJECTIVES: To confirm what factors in tinnitus influence the results of TRT.
PATIENTS AND METHODS: Twelve factors were investigated in 53 patients with tinnitus, examining the relationship between these factors and the results of TRT. A THI score was determined before and 6 months after TRT introduction (pre- and post-TRT). Moreover, the change of THI score from pre- to post-TRT (delta THI) was referred to as the therapeutic effect of TRT. Based on the 12 factors, subjects were respectively divided into two groups, comparing delta THI between groups.
RESULTS: Two groups of greater tinnitus loudness and higher THI score showed significant increases in delta THI, indicating that two factors of tinnitus loudness and THI score were related to the therapeutic effect of TRT.

PMID: 19848238 [PubMed - indexed for MEDLINE]

Acta Otolaryngol. 2008 Apr;128(4):365-8.

Pros and cons of tinnitus retraining therapy.

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Source

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Abstract

CONCLUSIONS:

A significant reduction in the Tinnitus Handicap Inventory (THI) was obtained as early as 1 month after implementation of tinnitus retraining therapy (TRT). Over half of our patients either could not tolerate the tinnitus control instrument (TCI) or obtained a poor result in the TRT trial. Candidates for TRT should thus be restricted to patients who can use the TCI.

OBJECTIVES:

TRT has been regarded as a promising therapy for tinnitus, although there have been very few studies to determine which patients are most likely to benefit from TRT. The aim of the present study was to demonstrate TRT's pros and cons based on our experience.

SUBJECTS AND METHODS:

The subjects were 217 patients with intractable tinnitus. Of those, 84 tolerated TRT and 79 were followed for 6 months. The remaining subjects did not undergo TRT. Japanese translations of the THI and visual analogue scale of annoyance caused by tinnitus (VAS) were administered to evaluate the effect of TRT.

RESULTS:

The average THI score at the beginning of the treatment was 48.8, but it was 36.3 ($p<0.01$) 1 month after starting the treatment and 28.3 ($p<0.005$) after 6 months.

Open-field treatment of hyperacusis

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http://www.elsevier.es/sites/default/files/elsevier/pdf/102/102v60n01a13133053pdf001_2.pdf

BMC Ear Nose Throat Disord. 2008 Nov 3;8:7.

Simplified form of tinnitus retraining therapy in adults: a retrospective study.

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Abstract

BACKGROUND: Since the first description of tinnitus retraining therapy (TRT), clinicians have modified and customised the method of TRT in order to suit their practice and their patients. A simplified form of TRT is used at Ealing Primary Care Trust Audiology Department. Simplified TRT is different from TRT in the type and (shorter) duration of the counseling but is similar to TRT in the application of sound therapy except for patients exhibiting tinnitus with no hearing loss and no decreased sound tolerance (wearable sound generators were not mandatory or recommended here, whereas they are for TRT). The main goal of this retrospective study was to assess the efficacy of simplified TRT.

METHODS: Data were collected from a series of 42 consecutive patients who underwent simplified TRT for a period of 3 to 23 months. Perceived tinnitus handicap was measured by the Tinnitus Handicap Inventory (THI) and perceived tinnitus loudness, annoyance and the effect of tinnitus on life were assessed through the Visual Analog Scale (VAS).

RESULTS: The mean THI and VAS scores were significantly decreased after 3 to 23 months of treatment. The mean decline of the THI score was 45 (SD = 22) and the difference between pre- and post-treatment scores was statistically significant. The mean decline of the VAS scores was 1.6 (SD = 2.1) for tinnitus loudness, 3.6 (SD = 2.6) for annoyance, and 3.9 (SD = 2.3) for effect on life. The differences between pre- and post-treatment VAS scores were statistically significant for tinnitus loudness, annoyance, and effect on life. The decline of THI scores was not significantly correlated with age and duration of tinnitus.

CONCLUSION: The results suggest that benefit may be obtained from a substantially simplified form of TRT.

PMID: 18980672 [PubMed]PMCID: PMC2605434Free PMC Article

Rev Laryngol Otol Rhinol (Bord). 2007;128(3):145-8.

TRT: results after one year treatment.

[Article in French]

Madeira G, Montmirail Ch, Decat M, Gersdorff M.

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Abstract

INTRODUCTION: Tinnitus Retraining Therapy (TRT) (which aims to induce changes in the mechanisms responsible for transferring signals from the auditory system to the limbic and autonomic systems) is a method for treating Tinnitus and decreased sound tolerance. An individualised explanation of Jastreboff's neurophysiological model allows greater insight and motivation on the part of the patient. Previous studies have demonstrated that daytime TRT is effective. As sleep forms a significant component of the distress associated with Tinnitus however, we hypothesised that night-time TRT could represent a useful tool in the treatment of this disabling condition.
MATERIAL AND METHODS: 46 patients were studied (30 male, 16 female). Patients were selected from an ENT outpatient clinic. Patients with significant psychological disability were excluded. Patients were reviewed twice by their doctor and 5 times by a therapist over 12 months. Treatment consisted of 8 hours nighttime white noise stimulation, at progressively increasing intensity. Although several objective assessments of response were undertaken, patients' subjective testimonies were considered a more accurate signal of success.
RESULTS: In total, 80% of patients had a satisfactory response after 1 year of treatment. 20% had no response. Patients were subcategorised according to Jastreboff's categories as follows: 1. Tinnitus (n = 6), 100% improved; 2. Tinnitus with hearing loss (n = 16); 62% improved; 3. Hyperacusis (with or without Tinnitus) (n = 16), 88.5% improved; 4. Hyperacusis (with or without Tinnitus, exacerbated by noise) (n = 8), 75% improved.
CONCLUSION: Tinnitus is a symptom rather than an illness, and TRT gives patients greater control, allowing re-integration of normal perception. Night-time TRT is an effective treatment for Tinnitus and decreased sound tolerance. It has the potential advantage over day-time TRT of rapidly improving sleep and decreasing use of sedative hypnotics, a secondary effect noted in the personal testimonies of our cohort of patients. Further studies are needed to confirm this advantage, in view of the significant risks associated with long-term use of benzodiazepines. When investigating therapies for Tinnitus, it is necessary to measure success in terms of quality of life, as it is to this that the patient attaches the most importance.

PMID: 18323325 [PubMed - indexed for MEDLINE]

Int J Audiol. 2007 May;46(5):217-22.

Results of TRT after eighteen months: our experience.

Baracca GN, Forti S, Crocetti A, Fagnani E, Scotti A, Del Bo L, Ambrosetti U.

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Abstract

The aim of this study was to evaluate the efficacy of TRT in patients suffering from tinnitus. The tinnitus disorder affects about 10-15% of the population and, in one person out of a hundred, it is a disabling disorder. TRT treatment is based on Jastreboff's neurophysiological model. TRT consists of two parts: counselling, and sound therapy by means of dedicated hearing aids and sound generators. It proved to be useful to reduce the symptoms related to tinnitus. Jastreboff's structured interviews were proposed to a sample of 51 patients with tinnitus belonging to the I-II-III-IV classes according to Jastreboff. These patients were treated for 18 months. Sixty-eight percent of patients reported a reduction in the symptoms related to tinnitus, such as sleep disturbance, problems in concentration, and inability to relax. A percentage (64.7%) of patients thought that their quality of life was improved. Patients who had suffered from tinnitus for less than one year achieved significantly better results than patients who had suffered for a longer period of time. TRT is an effective tool in the treatment of tinnitus.

PMID: 17487669 [PubMed - indexed for MEDLINE]

Audiol Neurootol. 2006;11(5):276-86. Epub 2006 May 23.

A modified version of tinnitus retraining therapy: observing long-term outcome and predictors.

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Abstract

Tinnitus retraining therapy (TRT) in Germany includes not only directive counseling and sound therapy but also stress management and facultative psychotherapeutic treatment. The aim of the present study was to investigate the impact of this modified version of TRT on certain tinnitus-related aspects of distress and variables that may predict treatment outcome. Clinical data from 92 patients undergoing outpatient TRT in the Charité Tinnitus Centre were evaluated retrospectively over 1 year. Treatment outcome was defined by changes in specific areas of tinnitus-related distress and assessed by the Tinnitus Questionnaire. Changes in audiometric frequency and loudness of tinnitus were examined by regular audiometric testing. The overall Tinnitus Questionnaire score was significantly reduced after 1 year. Severely affected tinnitus sufferers (decompensated tinnitus) profited more than less affected patients (compensated tinnitus). In cases of indicated psychotherapy, improvement was significant for the patients who took advantage of psychotherapeutic treatment during TRT but was not significant for those who interrupted or dismissed an indicated psychotherapy. Changes in tinnitus-specific areas of distress were most pronounced in the scales for emotional and cognitive distress and intrusiveness. Significant changes in sleep disturbances, auditory perceptual difficulties and somatic complaints were observed in patients with decompensated tinnitus. In patients with chronic tinnitus, modified TRT may lead to significant subjective improvement in certain tinnitus-related symptoms like emotional and cognitive distress and intrusiveness. Particularly patients suffering from severe tinnitus distress take advantage of therapy. Careful psychotherapeutic diagnostics and therapies and, if necessary, motivation to make use of psychotherapy seem to be essential preconditions for therapeutic success in patients with severe psychosomatic comorbidity.

PMID: 16717441 [PubMed - indexed for MEDLINE]

J Am Acad Audiol. 2006 Feb;17(2):104-32.

Outcomes of clinical trial: tinnitus masking versus tinnitus retraining therapy.

Henry JA, Schechter MA, Zaugg TL, Griest S, Jastreboff PJ, Vernon JA, Kaelin C, Meikle MB, Lyons KS, Stewart BJ.

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Abstract

A controlled clinical study was conducted to evaluate prospectively the clinical efficacy of tinnitus masking (TM) and tinnitus retraining therapy (TRT) in military veterans having clinically significant tinnitus. Qualifying patients were placed into the two groups in an alternating manner (to avoid selection bias), and treatment was administered at 0, 3, 6, 12, and 18 months. Outcomes of treatment were evaluated using three self-administered tinnitus questionnaires (Tinnitus Handicap Inventory, Tinnitus Handicap Questionnaire, Tinnitus Severity Index) and the verbally administered TRT interview forms. Findings are presented from the three written questionnaires, and from two of the interview questions (percentage time aware of, and annoyed by, tinnitus). Outcomes were analyzed on an intent-to-treat basis, using a multilevel modeling approach. Of the 123 patients enrolled, 118 were included in the analysis. Both groups showed significant declines (improvements) on these measures, with the TRT decline being significantly greater than for TM. The greater declines in TRT compared to TM occurred most strongly in patients who began treatment with a "very big" tinnitus problem. When patients began treatment with a "moderate" tinnitus problem, the benefits of TRT compared to TM were more modest.

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Clinical trial to compare tinnitus masking and tinnitus retraining therapy.

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Abstract

CONCLUSION: Both tinnitus masking (TM) and tinnitus retraining therapy (TRT) can be effective therapies for amelioration of tinnitus. TM may be more effective for patients in the short term, but with continued treatment TRT may produce the greatest effects.

OBJECTIVES: Although TM and TRT have been used for many years, research has not documented definitively the efficacy of these methods. The present study was a controlled clinical trial to prospectively evaluate the clinical efficacy of these two methods for US military veterans with severe tinnitus.

SUBJECTS AND METHODS: Over 800 veterans were screened to ensure that enrolled patients had tinnitus of sufficient severity to justify 18 months of individualized treatment. Qualifying patients (n=123) were placed quasi-randomly (alternating placement) into treatment with either TM or TRT. Treatment was administered at 0, 3, 6, 12, and 18 months. Outcomes of treatment were evaluated primarily using three self-administered tinnitus questionnaires (Tinnitus Handicap Inventory, Tinnitus Handicap Questionnaire, Tinnitus Severity Index).

RESULTS: Findings are presented from the three written questionnaires with respect to three categories of patients: describing tinnitus as a 'moderate,' 'big,' and 'very big' problem at baseline. Based on effect sizes, both groups showed considerable improvement overall. In general, TM effects remained fairly constant over time while TRT effects improved incrementally. For the patients with a 'moderate' and 'big' problem, TM provided the greatest benefit at 3 and 6 months; benefit to these TRT patients was slightly greater at 12 months, and much greater at 18 months. For patients with a 'very big' problem, TM provided the greatest benefit at 3 months. For these latter patients, results were about the same between groups at 6 months, and improvement for TRT was much greater at 12 months, with further gains at 18 months.

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Otolaryngol Head Neck Surg. 2005 Nov;133(5):774-9.

Long-term clinical trial of tinnitus retraining therapy.

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Abstract

OBJECTIVE: To demonstrate the efficacy of tinnitus retraining therapy (TRT) for tinnitus relief compared to a waiting list group and a partially treated group (patients that refused prosthesis adaptation).

STUDY DESIGN: Prospective non-randomised clinical assay (n = 158). Visual analogue scale (VAS) for intensity and the Tinnitus Handicap Inventory (THI) were evaluated at 12-month period.

RESULTS: Eighty two percent of the patients that followed TRT improved their tinnitus according to their self-evaluation. THI score was reduced from 48% to 32% and VAS decreased from 6.6 to 5.3 after one year ($p < 0.05$). TRT patients showed a higher improvement on their tinnitus, THI and VAS scores when compared with the waiting list patients and with patients that refused prosthesis adaptation when recommended ($p < 0.05$).

CONCLUSIONS: TRT improved tinnitus in 82% of the subjects and statistically reduced THI and VAS scores after 12 months. TRT has shown to be more effective than a waiting list group and partially treated patients.

EBM RATING: B-2.

PMID: 16274808 [PubMed - indexed for MEDLINE]

Bratisl Lek Listy. 2005;106(2):79-82.

Tinnitus retraining therapy -- the experiences in Slovakia.

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Abstract

Since Mai 1999 Tinnitus Retraining Therapy (TRT) according to Jastreboff has been used in the management of 55 patients with tinnitus of various origin. Tinnitus isn't a disease, it is only a symptom. Therefore we needed to do an exact examination of the patient. We needed to apply causal therapy whenever it was possible. After six months of continuous therapy more than 50% patients reported improvement of tinnitus or it has disappeared. Concomitantly, we found hyperacusis, hypersensitivity to loud sounds. We could not assert that it was the cause or the consequence of the tinnitus. Considering these findings, it would appear TRT can be useful for extending the possibilities of tinnitus treatment. (Tab. 5, Fig. 1, Ref. 13.)

PMID: 16026138 [PubMed - indexed for MEDLINE]

Otolaryngol Pol. 2004;58(6):1117-20.

Results of treatment tinnitus patients using TRT in ENT Rehabilition Center in Poznań.

[Article in Polish]

Szymiec E, Nowak K, Banaszewski J, Szyfter W.

Klinika Laryngologii i Onkologii Laryngologicznej AM im. Karola Marcinkowskiego w Poznaniu.

Abstract

The authors describe results of treatment tinnitus patients using TRT method. Since 4 years over 2000 patients were diagnosed and part of them were treated on basis neurophysiological model. In details the authors inform about method TRT and estimated results of audiological examination and treatment.

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Implementation of habituation theory to pulsatile somato-sounds (tinnitus): the heart valve prosthesis sound model.

[Article in Spanish]

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Source

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Abstract

OBJECTIVES:
To evaluate the habituation process to mechanical heart valve prosthesis sound as a model to understand the pulsatile tinnitus or somatosound perception changes.

STUDY DESIGN:
Transversal descriptive. Patients: One hundred and fifty patients referred to a University Hospital for one or two mechanical heart valve implantation.

OUTCOME MEASURES:
Questionnaire sent by mail for prosthesis sound loudness and interference in quality of life evaluation. Detection of factors related to habituation process development.

RESULTS:
Eighty three percent of the patients perceived their prosthesis sound continuously, while only a 17% showed high levels of annoyance. No significative differences in prosthesis type and localization were described. Anxiety was the most important factor for loudness increase. The average of visual analogical scales on sound loudness and annoyance showed mild values (3.7 and 1.9 respectively).

CONCLUSIONS:
Extensive medical counselling or tinnitus retraining therapy (TRT) program for most severe cases, are proposed for pulsatile tinnitus management when etiological treatment cannot be available.

Shifts in loudness discomfort level in tinnitus patients with and without hyperacusis

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Hyperacusis

Disorders of loudness perception, for long a clinical enigma, can represent a serious challenge to the patient. In this paper I review what is known of hyperacusis—the mechanisms and approaches to treatment. I begin with definitions, because even basic terminology still varies in this under-researched area.

Hyperacusis has been defined as 'unusual tolerance to ordinary environmental sounds'[1] and, more pejoratively, as 'consistently exaggerated or inappropriate responses to sounds that are neither threatening nor uncomfortably loud to a typical person'.[2] Common to both is the implication that the experience can be evoked by sounds of low intensity and that sounds in general, rather than specific sounds, are problematic. This is less true of *phonophobia* (fear of sound) and the recently proposed *misophonia* (dislike of sound),[3] both of which carry a suggestion that the intolerance may be specific to certain sounds with emotional associations. In neurology, phonophobia tends to be used specifically for the loudness intolerance reported by some patients with migraine.[4] For the wider types of hearing hypersensitivity, therefore, the term hyperacusis is preferable. *Loudness recruitment*[5,6] describes an experience commonly associated with cochlear hearing loss and specifically with dysfunction of the outer hair cells of the organ of Corti: with a rising sound level, the perceived loudness increases faster than normal.[6] This phenomenon may be distinguished from hyperacusis if the individual perceives sound of moderate intensity as uncommonly loud (recruitment) or sound of low intensity as uncomfortably loud (hyperacusis) but the two experiences are not mutually exclusive. Loudness recruitment does not, however, vary with mood.

Prevalence, incidence and quantification of handicap

Back of robust epidemiological data is a major shortcoming of the published work on hyperacusis. Fabijanska *et al.*[7] undertook a postal questionnaire of tinnitus in Poland which included an unspecified question on hyperacusis. Of the 10 349 respondents, 15.2% reported hyperacusis (12.5% of males, 17.6% of females). Regional differences were also reported. A weakness of this report is the lack of specificity.

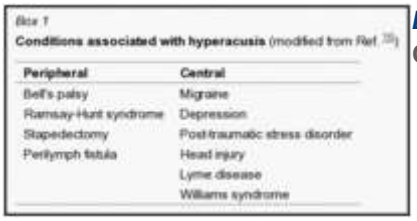
More recently Andersson and co-workers[8] investigated the prevalence of hyperacusis in the adult Swedish population. Two methods were used—an internet study, wherein visitors to the website of a Swedish broadsheet newspaper were invited to complete a web-based questionnaire; and a postal population study. Of 1167 individuals who clicked upon the web banner 595 responded, a response rate of 52%. The point prevalence of hyperacusis in this group was 9%. The postal group comprised 987 individuals of whom 589 responded (response rate 60%) and the point prevalence was 8%. Participants were not asked if they had ever sought a medical opinion regarding their hyperacusis. Incidence data for hyperacusis do not seem to have been reported anywhere.

A coincidence of tinnitus complaint and of experiences of hyperacusis has been widely noted. Among patients attending tinnitus clinics with a primary complaint of tinnitus the prevalence of hyperacusis is about 40%;[9-11] and in patients with a primary complaint of hyperacusis the prevalence of tinnitus has been reported as 86%.[12] The apparent link has led to speculation about common mechanisms.[13] Until recently it has not been possible to quantify the handicap associated with hyperacusis, but two instruments have now been published for this purpose. Khalfa *et al.*[14] describe data from a self-report

hyperacusis questionnaire with 14 items 'normalized' on 201 individuals who had answered a recruitment advertisement. Principal component analysis indicated that three factors accounted for 48% of the variance—attentional, social and emotional. With a 27-item questionnaire examined in 226 patients with hyperacusis Nelting *et al.*[15] reached similar conclusions: 51% of the variance was accounted for by cognitive reactions, actional/somatic behaviour and emotional factors. This latter questionnaire is at present available only in German and neither has been shown to be sensitive to treatment effects, but such instruments do represent a step forward.

Aetiologies

In the great majority of cases, no underlying medical condition can be found. The conditions in which hyperacusis has been reported as a symptom have been reviewed by Katzenell and Segal,[16] and those identified are listed in Box 1. It should be noted, however, that of the peripheral conditions identified, several involve facial nerve dysfunction. Since the facial nerve innervates the stapedial reflex, which is a mechanism for reducing the perceived intensity of impulse sound, these conditions may reduce the efficacy of that reflex and hence increase the perceived intensity of sound. As such this does not meet a strict definition of hyperacusis.



Box 1

Conditions associated with hyperacusis (modified from Ref. [16])

Peripheral	Central
Bell's palsy	Migraine
Ramsay-Hunt syndrome	Depression
Stapedectomy	Post-traumatic stress disorder
Perilymph fistula	Head injury
	Lyme disease
	Williams syndrome

What of the central conditions? Lyme disease is a systemic infection with the tick-borne spirochaeta *Borrelia burgdorferi* which targets specific body organs including the peripheral and central nervous systems.[17] Some caution must be exercised in interpreting reports of hyperacusis because facial palsy can be a feature, hence stapedial reflex dysfunction as described above. There are, however, reports of hyperacusis in Lyme disease without facial nerve dysfunction.[18]

Williams syndrome is a disorder characterized by deficits in conceptual reasoning, problem solving, motor control, arithmetic ability and spatial cognition,[19] with an incidence of 1 in 20 000 live births. As many as 90% of individuals with this syndrome report hyperacusis,[2] and a proposed mechanism is 5-hydroxytryptamine (5-HT) dysfunction[20]—see next section. Other conditions in which hyperacusis has been reported are middle cerebral aneurysm[21] and migrainous cerebral infarction.[22] A case series of hyperacusis in multiple sclerosis has been reported,[23] though the association is unusual.

Although most cases of hyperacusis are non-syndromic—i.e. do not reflect an underlying medical disorder— medical assessment is desirable.

Mechanisms

Hyperacusis has several potential mechanisms which are not mutually exclusive; as with tinnitus,[24] the patient population is likely to be heterogeneous. The high prevalence of hyperacusis in Williams syndrome led Marriage and Barnes[20] to consider the mechanism in that condition and the extent to which it might be generalized to other individuals. Their suggestion that 5-HT might be implicated was based partly on the clinical observation that hyperacusis tends to occur in other conditions where 5-HT function is thought to be disturbed—namely, migraine, depression and post-traumatic stress disorder.[16,25] 5-HT does appear to have a role in modulating auditory gain and the determination of significance of sound.[26,27] However, there is no evidence that 5-HT disturbance contributes to hyperacusis of non-syndromic[28] types. Moreover, even in Williams syndrome the excessive auditory gain may be explained partly by the high incidence of otitis media with effusion and the associated conductive hearing loss.

Sahley and Nodar[29] considered the observation that hyperacusis (and tinnitus) appear to increase in extent at times of tiredness, anxiety or stress. They hypothesize that, during stress, endogenous dynorphins are released into the synaptic region beneath inner hair cells. This might potentiate the neurotransmitter glutamate, causing sound to be perceived with excessive loudness. The model

applies both to externally generated and to internally generated (tinnitus) sound, but empirical evidence in support has not yet been forthcoming.
Another potential mechanism is auditory efferent dysfunction. An auditory efferent system is common to all mammals, and in humans consists of both a lateral and a medial system. In the lateral system, whose function remains unclear, the pathways originate around the lateral superior olive and terminate on the primary afferent dendrite beneath the inner hair cell. In the medial system they begin medially with the superior olivary complex and terminate on the base of outer hair cells, and functions of the system appear to include modulation of auditory gain[30] and the behavioural response to sound (manifest in anatomical links with the reticular formation). Medial auditory dysfunction might contribute to both hyperacusis and tinnitus; thus, disturbance of the ability to modulate central gain might result in persistent sensitivity despite exposure to noise of moderate to high intensity. There is evidence against any such role, however, in that patients who have undergone vestibular nerve section (usually for symptoms of vertigo refractory to other treatments) do not complain of increased tinnitus or of loudness intolerance[31] and psychoacoustic testing of such patients reveals no decrement in auditory performance.[32]
For patients, hypersensitivity of hearing may evoke anxiety and even fear. This can be true for specific sounds or for sound in general. The links between the central auditory system and areas of the brain implicated in anxiety and fear are now under close scrutiny. Specifically, anatomical and functional links between the central auditory system and the amygdalae have been identified[33] (the amygdalae being an essential element of fear conditioning).[34] Such processes have been described as integral to the development of tinnitus-related distress, and also to the fear and anxiety component of hyperacusis. In view of the evidence that the central auditory system has a role in setting auditory gain, the possibility of some central hyperexcitability should be considered. Jastreboff and Hazell[35] discussed this as a potential mechanism for hyperacusis. The experience of hyperacusis in patients with no apparent dysfunction or involvement of the peripheral auditory apparatus is circumstantial evidence in favour of this mechanism. Jastreboff and Hazell further speculate that such central hyperexcitability (manifest as hyperacusis) may represent a precursive state of troublesome tinnitus.

Therapy

For many patients, the first reaction to hyperacusis is to protect themselves with ear plugs, muffs or other devices. There is, however, reason to believe that such strategies to decrease the intensity of sound entering the auditory system may further increase the central gain, exacerbating rather than improving the hyperacusis. In the past, patients had little choice but to resort to hearing protection devices since hyperacusis was not widely regarded as a genuine symptom. For tinnitus, tinnitus retraining therapy (TRT) was introduced in 1993,[35] and with minor modifications this has been advocated also for hyperacusis. After audiological and medical evaluation, the protocol[11] requires classification of the patient according to the tinnitus and hyperacusis state, and then 'directive counselling' about the auditory system, about mechanisms of tinnitus and hyperacusis and about the distress associated with them. Binaural sound therapy, from ear-level wide-band generators, is undertaken even when the symptoms are unilateral. Treatment is based on the notion of desensitization, and the sound intensity is increased from a low level gradually over time. No randomized controlled trials have been done on retraining therapy for hyperacusis; they would be hard to design in view of the twin elements of counselling and sound therapy. Several observational studies[36,37] have pointed to improvements in loudness tolerance, but the nature of training to do TRT (attendance at an examined course run by the originators) raises concerns about objectivity. Nevertheless, the approach taken by TRT practitioners—promoting understanding and insight and the use of low-level, non-threatening, wide-band noise—seems based on common sense.
For the psychological distress associated with tinnitus, cognitive-behavioural therapy (CBT) has been identified as the treatment of choice,[38] and this seems a reasonable strategy to counter the anxiety and stress associated with hyperacusis, together with information counselling, relaxation therapy and sound therapy. No evidence as to the efficacy of such an approach is yet available, and at present CBT therapists in the UK show little interest in tinnitus or hyperacusis. There is at present some tension between advocates of retraining therapy and advocates of psychological therapy, but the

differences between the two are not great. Patients would probably benefit if the insights from both could be brought to bear.

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Tinnitus retraining therapy for patients with tinnitus and decreased sound tolerance.

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Abstract

Our experience has revealed the following: (1) TRT is applicable for all types of tinnitus, as well as for decreased sound tolerance, with significant improvement of tinnitus occurring in over 80% of the cases, and at least equal success rate for decreased sound tolerance. (2) TRT can provide cure for decreased sound tolerance. (3) TRT does not require frequent clinic visits and has no side effects; however, (4) Special training of health providers involved in this treatment is required for this treatment to be effective.

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DECREASED SOUND TOLERANCE: predisposing factors, triggers and outcomes after TRT

HYPERSENSITIVITY OF HEARING

(Hyperacusis, misophonia, phonophobia)

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Continuous and loud noise is a source of irritation to most people. However some people have especially sensitive hearing and are unable to tolerate ordinary levels of noise. This can occur in people with normal hearing, or in those with a hearing loss. There are different components which can contribute to sensitive hearing hyperacusis, phonophobia and misophonia recruitment. Our knowledge based on the Jastreboff model and desensitization techniques developed in the 1980s now allows effective treatment of hyperacusis and misophonia.

The mechanisms of hyperacusis, misophonia, phonophobia and recruitment.
Hyperacusis is due to an alteration in the *central processing* of sound in the auditory pathways where there is an abnormally strong reaction from exposure to moderate sound levels. The cochlea is often completely normal, although patients frequently wrongly believe it is irreversibly damaged. Traditional teaching involved only an understanding of 'recruitment' , the result of cochlea damage. Since all people with hyperacusis can be helped by a behavioural approach with 'sound' therapy, it has become clear that the symptoms cannot be the result of irreversible ear damage. Another reason for sound sensitivity is *misophonia*. This means a dislike of being exposed to a certain sound. Here the auditory pathways may be functioning normally, but there is an abnormally strong reaction of the limbic (emotional system) and autonomic nervous system (body control system) to which the auditory system is intimately connected.

Sometimes because of the belief that it will damage the ear, or makes symptoms (sensitivity, or tinnitus) worse. If this dislike is very strong we may call it '*phonophobia'* literally - fear of sound. Often normal environmental sounds like traffic, kitchen sounds, doors closing, or even loud speech, cannot be tolerated, even though under any circumstances they cannot be damaging to anyone. In *misophonia and phonophobia* certain complex sounds produce discomfort, on the basis of their meaning or association, while other sounds which are enjoyed (such as music) can be tolerated at much higher intensity levels. If there is a difference in the intensity of different sounds which produce discomfort, then it is very likely that a degree of misophonia exists. Misophonia can lead to hyperacusis (changes in central auditory processing), and a consequent persistence of abnormal loudness perception. In practice, most people with decreased sound tolerance have both hyperacusis and phonophobia / misophonia together in varying proportions.

In treating these conditions, it is important to diagnose which condition is present and which is dominant. A common widespread and largely harmless expression of misophonia is seen in the fathers of teenage children to 'modern' music being played (even in the distance) and to the dislike of music 'leaking' from the headphones of portable cassette players on public transport. In addition some sounds are inherently unpleasant, like the squeak of chalk on a slate, even though the number of decibels produced by this is very small. This is 'cultural' or species specific phonophobia!

Mechanisms of hyperacusis
The 30,000 fibres in the auditory nerve carry information about the individual frequencies of each complex sound that we hear. 1/20 of a second later, these reach the cortex of the hearing part of the brain (in the temporal lobe) where conscious perception of organized sound occurs. Until the message reaches consciousness, no sound is heard. During the passage of this coded signal, it undergoes a great deal of processing, similar to a computer, but much more complex.

Figure 1. *Nothing is heard until sound patterns generated in the cochlea, reach the cortex of the brain*

The central auditory system is first of all concerned with extracting important messages from unimportant background noise. Often the signal is relatively weak in strength, but strong in meaning. An example of this would be the detection of the quiet sound of an approaching predator by an animal living in a hostile environment. Another example would be the ability to detect the sound of one's name across a crowded room, while other names, even if spoken quite loudly would go unnoticed. In the subconscious part of the auditory system brain, an important signal is detected on the basis of previously learnt experience. This signal may then be enhanced, or suppressed by these pathways or filters. These pathways are not inert electrical cables, but complex neuronal or nerve networks. Patterns of frequencies of sound are enhanced or suppressed to varying degrees on the basis of their meaning, but nothing od significance is heard until it is matched with a pattern in auditory memory. The strength of this pattern matching dictates the loudness and intrusiveness of the sound perceived. This can be quite different from the intensity or energy of the sound in the environment outside.

In misophonia and phonophobia the connections of the auditory pathways leading from ear to brain interact strongly with the limbic and autonomic nervous systems to which they are connected. This is what creates the feeling of unpleasntness, annoyance or fear in the presence of certain sounds. Such emotions are not properties of hearing, or of the auditory pathways. The responses are set up because of experiences, or beliefs about sound which have been previously learned.

Once the aversive reaction to sound is set up in this way the limbic / autonomic response 'talks back' to the auditory system at a subconscious level, programming it for future action. This 'programming' results in a) invariable detection of the unpleasant sound – even when so quiet that others cant hear it, b) invariable limbic and autonomic reaction causing distress c) enhancement of auditory processing of this and other sounds leading to hyperacusis.

The purpose of this ability to amplify small signals and to suppress others is to facilitate the detection of potential threats in the environment and is a natural part of our defense mechanism

Figure 2 *Neuronal networks between ear and brain detect threatening sounds and activate a reflex response involving fear/annoyance, and increase of body functions, to prepare for danger*

Very often the over-sensitivity for sounds is begun by an irrational fear which nevertheless becomes a very strongly held belief. This is commonly the source of distress in those who believe that their lives are ruined by environmental noise from nearby factories,generators or low frequency sounds transmitted through the ground (which other people may be unable to hear). Because the central auditory processing mechanism is so powerful, it is possible to "train" it by constantly listening to, and monitoring small sounds. These weak sounds are then turned them into very loud intrusive and unpleasant *perceptions* which become constantly audible whether we like it or not.

Hearing tests

The standard 'pure tone audiogram' measures the quietest sound you can hear. You listen through headphones to sounds from a carefully calibrated instrument (audiometer), and respond (e.g. by pressing a button) whenever you hear a sound, however quiet. This is called the *threshold* of hearing, and measures whether you have a hearing loss. An equally important, but less frequently used test measures the upper limit of loudness tolerance (loudness discomfort levels). You should indicate when the tones become uncomfortable to the ear (before they become painful). For patients who are frightened of loud sounds this test must be done very carefully and with proper instruction by a TRT trained professional. None of the sounds from the audiometer are capable of damaging the ear, even in a sensitive individual. It is very important to have a good knowledge of the level of loud sound tolerance when diagnosing and treating decreased sound tolerance, or when fitting a sound generator

or hearing aid to any patient, whether they have hyperacusis or not.

The Limbic System, Emotional Responses and Global Hypersensitivity

Changes in emotional state, particularly mood fluctuations or anxiety can increase overall arousal and make us more able to detect potential threats in our environment. This is a normal protective mechanism. These emotional changes can also increase the apparent loudness and irritation of sounds to which we are already hypersensitive. In some people this results in a "global" hypersensitivity where all stimuli, be it vision, touch, heat, smell, taste or pain are increased greatly in their perceived intensity.

The process of developing an increased sensitivity to specific sound always involves the limbic system and autonomic nervous system. Where phonophobia or misophonia exists there is an inevitable association of fear or dislike, associated with the appearance of the sound, whenever it occurs. The attentional focus becomes filled with that sound, so that interference with concentration (on another task) occurs. These conditioned responses act like survival reflexes and have to carry a message of unpleasant emotion, in order to ensure that a response occurs. They also stimulate the autonomic nervous system to prepare us for 'flight or fight' so there may be coincident increases in heart rate, sweating, muscle tension, and other adrenaline-mediated body responses. Check Figure 2 again.

Treatment of Hyperacusis

With hearing loss

Where there is a hearing loss and a need for a hearing aid fitting, this must be done without overloading the ear with amplified sound. Nearly all hearing aids have some form of compression,which stops loud sounds entering the hearing aid from being over-amplified.

Digital and programmable hearing aids frequently make the task of appropriate hearing aid fitting easier and more appropriate. In fitting hearing aids to sensitive ears, it is often best to leave the ear canal as un-occluded as possible, particularly to begin with.

Avoidance of silence

Many people seek silence as a way to escape from the pressures of everyday life. However complete silence is not found in nature, and should be considered 'unnatural'. Consider living in a nest or animal burrow! In the relative silence of houses with doubled-glazed windows, often hermetically sealed from the outside world, the absence of sound stimulation leads to an increase in auditory gain (amplification) in the subconscious auditory pathways. The brain is always looking the best way it can for auditory signals. This process is enhanced by silence which is considered to be one of the signs of possible predator activity . The auditory filters 'open' in an attempt to monitor the external sound environment. External sounds may then increase dramatically in their perceived intensity and intrusiveness. Some people take to wearing ear plugs, perhaps at night, to avoid sounds becoming intrusive, and this simply worsens the sensitivity. When hyperacusis develops there is a great temptation to plug the ear to exclude unwelcome sounds. **This is actually making things worse,** as it encourages further increase in the amplification of sounds on their way to the auditory (hearing) cortex. When these sounds are heard in the absence of plugs, their perceived loudness is greatly increased.

The part of the treatment is always a directive counselling, or retraining approach designed to remove the need to plug or otherwise protect the ear from normal levels of environmental sound..It is understandably difficult to accept that sound which can be uncomfortable or even painful to the HEARING, can be quite harmless to the EAR. A complete understanding of the Jastreboff model is necessary for both professional and subsequently the patient. The retraining must be undertaken by professionals trained in TRT. *Hearing conservation* remains important in proven damaging noise

situations, (e.g. gunshot, discos, industrial machinery etc) and here appropriate protection with muffs or plugs is needed, but only when in these environments.

Damage is related not only to the intensity of sound, but also to the duration of exposure, so careful calculations need to be made to establish who is really at risk.

Wearable Sound Generators (WSGs)
Research in the 1980s (Hazell & Sheldrake1991) showed that the use of wide band noise applied to the ear by wearable sound generators can in help in the treatment of abnormal hypersensitivity of hearing. This is particularly true in hyperacusis, where on some occasions, particularly in young children, it is all the treatment required.

The sound from the instruments needs to be applied very gently and gradually to the ear beginning at a low level, always to both ears, and under the supervision of an audiologist with experience in this process of desensitization and with training in TRT. The effect, which in some cases may be quite dramatic, results in a 'turning down' of central auditory gain and a reduced perception of loudness for previously distressing sounds. Over a period of months, due to changes in the auditory neuronal networks, there is a permanent change in loudness discomfort, which can be demonstrated by audiometric testing of loudness discomfort levels. In patients where a severe increase of symptoms occurs, which genuinely persists after a good nights sleep, very careful use of sound therapy needs to be applied, under the guidance of an experienced professional. In severe cases there must be a gradual transition from wearing ear plugs to using WSGs. Fortunately WSGs 'turn down' the amplification of external sounds, so many people can immediately tolerate sounds which previously were distressing. Never undertake any sound therapy without proper advice. Sound tapes - e.g. pink noise, can make certain hyperacusis and phonophobic patients considerably worse. In each case carefully explanation of the mechanism of central processing must be given, so that individuals can understand and believe what has happened to them, and that the whole process is reversible with time, and the appropriate therapy.

Where misophonia (dislike) or phonophobia (fear of sound) exists, no permanent change in discomfort can be achieved without a successful behavioural programme aimed at reversing inappropriate beliefs responsible for the conditioned aversive response. This is true for any phobia (e.g. claustrophobia, arachnophobia, fear of heights etc). The whole process of desensitization can take quite a long time, commonly six months to a year, but is achievable in most cases. In rare cases where phonophobia is present alone without any hyperacusis, WSGs are not indicated.

Children
We are seeing increasing numbers of small children with hyperacusis. This may be on its own, or in association with other processing or behavioural disorders such as A.D.D., autism and Williams syndrome. In some children with hyperacusis it may be the dominant problem and respond quickly to desensitization due to the increased neural plasticity in this age group . Alternatively it may present only as a part of a wider problem, which will not respond to TRT. This does not mean that treating the decreased sound tolerance component with TRT is not worthwhile, and it frequently contributes in a positive way to the overall life quality of the child.

Zhonghua Yi Xue Za Zhi. 2002 Nov 10;82(21):1464-7.

Tinnitus retraining therapy: a clinical control study of 117 patients.

[Article in Chinese]

Wang H, Jiang S, Yang W, Han D.

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Abstract

OBJECTIVE: To investigate the clinical effects of tinnitus retraining therapy (TRT) on tinnitus.
METHODS: 225 tinnitus patients were divided into two groups. 117 patients in the TRT group were treated with TRT and drugs, and 108 patients in the control group were treated with only tinnitus masking and drugs. The TRT is consisted of four strategies: (1) tinnitus masking with low level and broad band noise; (2) deep relaxation of the whole body; (3) diversion of the attention to other things; and (4) psychological counseling and therapy. Drugs, such as vasodilator, neurotrophic drug, and sedative of the similar dose and duration of pharmacotherapy were administered to the 2 groups. Effect evaluation was conducted thrice 2, 6, and 12 months after the beginning of therapy to see if the tinnitus was attenuated or disappeared and if the patients' emotion, sleep, and work were disturbed by tinnitus.
RESULTS: The relief rate was 17.09%, 82.05%, and 88.03% in the TRT group 2, 6, and 12 months after respectively; and 2.78%, 26.85%, and 41.6% in the control group 2, 6, and 12 months after respectively (chi(2) = 12.54, 69.30, and 63.64, all $P < 0.01$).
CONCLUSION: TRT is effective in treatment of tinnitus.

PMID: 12509907 [PubMed - indexed for MEDLINE]

Arch Otolaryngol Head Neck Surg. 2002 Oct;128(10):1153-7.

Patient-based outcomes in patients with primary tinnitus undergoing tinnitus retraining therapy.

Berry JA, Gold SL, Frederick EA, Gray WC, Staecker H.

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Abstract

OBJECTIVE: To determine whether the Tinnitus Handicap Inventory (THI), a validated patient-based outcomes measure, may improve our ability to quantify impact and assess therapy for patients with tinnitus.

DESIGN: Nonrandomized, prospective analysis of 32 patients undergoing tinnitus retraining therapy (TRT). Assessment tools included comprehensive audiology, a subjective self-assessment survey of tinnitus characteristics, and the THI. Tinnitus Handicap Inventory scores were assessed at baseline and 6 months following TRT.

RESULTS: Baseline analysis revealed significant correlation between the subjective presence of hyperacusis and higher total, emotional, and catastrophic THI scores. Tinnitus Handicap Inventory scores correlated with subjective perception of overall tinnitus effect (P<.001). Mean pure-tone threshold average was 17.4 dB, and mean speech discrimination was 97.0%. There were no consistent correlations between baseline audiologic parameters and THI scores. Following 6 months of TRT, the total, emotional, functional, and catastrophic THI scores significantly improved (P<.001). Loudness discomfort levels also significantly improved (P< or =.02).

CONCLUSIONS: There is significant improvement in self-perceived disability following TRT as measured by the THI. The results confirm the utility of the THI as a patient-based outcomes measure for quantifying treatment status in patients with primary tinnitus.

PMID: 12365886 [PubMed - indexed for MEDLINE]

J R Soc Promot Health. 2002 Mar;122(1):21-3.

Tinnitus: an update.

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Abstract

Tinnitus is the perceived sensation of sound in the absence of acoustic stimulation. It is the commonest otological disorder referred to either the general practitioner or ear-nose-throat surgeon. This short review examines prevalence, aetiology, associated clinical symptoms, investigations and management. Despite current usage of a vast number of treatment modalities there remains no specific cure for the condition. However, there is currently great emphasis on tinnitus retraining therapy (TRT) in its management. The applications and results of TRT have, indeed, been encouraging--and are also briefly discussed here.

PMID: 11989138 [PubMed - indexed for MEDLINE]

Longterm follow-up study of TRT in Frankfurt

Lux-Wellenhof G*, Hellweg FC

Klik hier:

http://hno-goethestrasse.de/images/study_trt.pdf

Scand Audiol Suppl. 2001;(52):206-8.

Effects of tinnitus retraining therapy (TRT) for patients with tinnitus and subjective hearing loss versus tinnitus only.

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Abstract

The patients with tinnitus and/or hyperacusis undergoing an 18-24 month period of TRT are divided into five categories of treatment. Different types of counselling and sound therapy are used in each category. Selection of patients into a specific category depends on such factors as: hyperacusis, subjective hearing loss and long-lasting effect of noise on tinnitus. The 108 cases were evaluated After 1 year of treatment. The results of therapy of 40 patients with tinnitus and subjective hearing loss (category II) were compared with the results of therapy of patients with tinnitus only (categories 0 and I). A special questionnaire, answered before and during the treatment, was used to assess the results. Our data indicate significant improvement in about 70% of patients with tinnitus only and in about 90% of patients with tinnitus and subjective hearing loss after one year of therapy.

PMID: 11318470 [PubMed - indexed for MEDLINE]

Scand Audiol Suppl. 2001;(52):187-90.

Experiences in the treatment of patients with tinnitus and/or hyperacusis using the habituation method.

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Abstract

The purpose of this study was to summarize the results achieved by patients with tinnitus and/or hyperacusis during the Tinnitus Retraining Therapy. One hundred cases, out of 516 patients registered until January 1999 at the Tinnitus and Hyperacusis Management Clinic, Warsaw, Poland, were examined. The patients have been treated for at least 10 months but not longer than 1 year. A questionnaire specially prepared for this program was used to assess the results. In the group of 100 cases, the results after a minimum of 10 months' therapy are different in each category but they show a significant improvement in about 70% of cases.

PMID: 11318464 [PubMed - indexed for MEDLINE]

Eine Bestandsaufnahme zur Tinnitus-Retraining-Therapie

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Organization of tinnitus management in Poland.

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Abstract

Spontaneous idiopathic tinnitus is a significant interdisciplinary therapeutic problem. Based on different programs of tinnitus treatment, we organized a team of physicians, psychologists and engineers in order to establish the needs for the first Tinnitus Clinic in Poland. At the same time, together with number of clinical centres, scientific societies and non-governmental organizations, we carried out training and an information campaign throughout the country and initiated the first epidemiological studies survey about tinnitus in Poland. Over a period of 2 years we have provided care for almost 1000 patients, including them in a IS 24-month therapeutic program at the clinic. As a method of choice, Tinnitus Retraining Therapy (TRT) based on a neurophysiological model of tinnitus origin is used. We present here epidemiological data on tinnitus and hyperacusis in Poland.

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Am J Audiol. 2000 Dec;9(2):69-74.

Celebrating a decade of evaluation and treatment: the University of Maryland Tinnitus & Hyperacusis Center.

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Abstract

The University of Maryland Tinnitus & Hyperacusis Center in Baltimore was the first center in the United States dedicated to the evaluation and treatment of tinnitus and hyperacusis patients implementing an habituation-based protocol that has become known internationally as Tinnitus Retraining Therapy (TRT). A crucial feature of the model is the postulate that a number of systems in the brain are involved in the emergence of tinnitus. The cochlea and auditory periphery play only a secondary role. To facilitate the goal of habituation of the tinnitus signal, TRT implements both directive counseling to neutralize the negative emotional associations toward the tinnitus, and sound therapy to interfere with the signal. As an outgrowth of the work with tinnitus, the evaluation and treatment of hyperacusis has emerged as an increasingly important part of our program. This report describes the unique facility, staff, and services of the Center as we celebrate a decade of research and clinical management dedicated to the scientific understanding of tinnitus and hyperacusis.

PMID: 11200194 [PubMed - indexed for MEDLINE]

Changes in loudness discomfort level and sensitivity to environmental sound with habituation based therapy

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Zie: http://tinnitus.org/home/its99/Proceedings%20ITS99.pdf#page=508 vanaf pagina 499.

Around 40% of individuals with tinnitus are also reported to have hyperacusis. The prevalence of phonophobia (discomfort to specific environmental sounds) in individuals with tinnitus has not been documented. Tinnitus and hyperacusis are proposed to share a common mechanism of increased central auditory sensitivity.
Tinnitus retraining therapy (TRT), which is a form of habituation based therapy (HBT), includes a specific desensitisation programme for hyperacusis using noise generators (NGs). NGs are also used as part of a sound therapy programme in the treatment of tinnitus.
The aims of this study were three-fold:
1 To determine whether changes in tinnitus related reaction and perception were related to changes in hyperacusis and phonophobia.
2 To determine whether changes in hyperacusis and phonophobia were greater in those individuals treated with NGs than those who were not.
3 To determine whether changes in sound sensitivity occurred in distressed individuals who did not receive treatment for their tinnitus.

Changes in loudness discomfort levels (LDLs) to wide band noise (measuring hyperacusis), and in report of discomfort to environmental sound (measuring phonophobia), in 182 individuals who received 12 months of TRT (the treatment group – TG) were measured. The prevalence of hyperacusis and phonophobia fell by 6.6% and 7.7% respectively , and mean LDLs increased significantly.
Individuals who showed a greater change in tinnitus related reaction and perception experienced a greater change in LDLs, and reported fewer environmental sounds as being uncomfortably loud. Change in LDL was greater for those individuals who used noise generators.
Phonophobia was also measured in an unmatched group of 113 individuals who received no treatment for 12 months (the no treatment group – NTG). During this time the prevalence of phonophobia fell by 7.9%. However there was little change in numbers of individuals reporting sensitivity to specific environmental sounds, in comparison to the TG who showed a marked change.
The prevalence of phonophobia was similar between the TG and the NTG groups at the start of the study period.

Methods
Two independent groups of individuals were selected:
• 186 individuals referred to the RNID MRU tinnitus clinic over a three year period, 182 of whom completed one year of treatment (the treatment group-TG);
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• 113 individuals from the British Tinnitus Association (the no-treatment group – NTG).
The TG were stratified according to hearing status, and then randomly assigned to receive either:
• Directive counselling (DC) alone;
• DC plus just audible noise generators (DC + LLNG);
• DC plus noise generators at, or just below mixing point with tinnitus (DC + HLNG);

• DC plus hearing aids (DC + HA)(where hearing loss was present);
• DC plus combination instruments (DC +COMBI) (where hearing loss was present).
Individuals received five sessions of TRT in a 12- month period. Baseline LDLs, and LDLs after each TRT session were measured with wide band noise.
As there was no significant difference between left and right ears with respect to LDL, the amount of change in LDL or prevalence of hyperacusis, mean LDL for right and left ears combined was used in analyses. Individuals were classified as having hyperacusis if LDLs were less than 88.39dB SPL (for individuals with normal hearing) or 81.24dB SPL (for individuals with a hearing loss). These figures were based on data from Bentler and Pavlovic on normal LDLs for pure tones, and for tonal complexes.
Phonophobia was measured by asking patients to indicate whether they found speech, music/TV, kitchen sounds, the vacuum cleaner or traffic sounds uncomfortably loud. LDLs were not measured in the NTG, however phonophobia was measured in the same way as the TG at the start, and at the end of a 12-month period. The NTG received no treatment for their tinnitus during this time.

Results

Although individuals with hyperacusis as their main complaint were excluded, at the start of the study 20.9% (38/182) of the TG had hyperacusis. 35.2% (64/182) of the TG, and 33.6% (38/113) of the NTG reported sensitivity to at least one environmental sound.
Subjective report of discomfort to environmental sound was compared to objectively measured LDLs in the TG. LDLs exceeded the average intensity of the specific sound reported as being uncomfortably loud. The LDLs of individuals who complained of specific sounds as being uncomfortable were not significantly different from the rest of the TG. It was therefore possible that report of discomfort to specific environmental sound was more indicative of phonophobia than hyperacusis.
After 12 months of HBT the incidence ofhyperacusis in the TG was significantly lower ($X2 = 19.423$, $df = 1$, $p = <0.001$), and mean LDL increased significantly from 88.45dB to 93.17dB (MANOVA $f = 7.70$; $df = 4$; $p = <0.001$). However 14.3% (26) of the TG still experienced hyperacusis, and 27.5% (50) reported phonophobia. After 12 months the prevalence of phonophobia in the NTG was similar – 25.7% (29/113) of individuals still reported discomfort to one or more environmental sound. The reduction in number of individuals reporting phonophobia to specific sounds was greater in the TG than the NTG however.
Individuals who showed a greater mean change in questionnaire scales related to tinnitus reaction and perception experienced a greater reduction in LDL.
"Better" tinnitus was classified as a change of 40% or greater in 2 or more of the questionnaire scales loudness, annoyance, effect on life quality and percentage awareness.
"Same" was classified as a change in these scales of less than 40%, and "worse" was classified as an increase in these questionnaire scales. It is obvious that the change in LDLs was greatest for the "better" group. There was also a tendency for individuals who experienced phonophobia at the end of the 12 month period to have responded less well to TRT than those who did not.
Change in LDL was greater for those individuals who used noise generators in addition to directive counselling or amplification, even though noise generators were used at lower levels than would have been indicated for treatment of hyperacusis alone. The change in LDL appeared to be related to the device used, rather than differences in hearing status between the different groups.

Conclusions

It appears that hyperacusis and phonophobia respond well to TRT, and that the amount of change in these factors is related to changes in tinnitus reaction and perception. This finding supports the theory that tinnitus and hyperacusis share a common mechanism. If this common mechanism is indeed increased central auditory sensitivity, then a reduction in sensitivity might lead to a lessening of tinnitus detection and corresponding changes in tinnitus perception and reaction.

Noise generators in addition to directive counselling or amplification appear to be most effective in reducing auditory sensitivity. This fits with the clinical experience that NGs are an effective treatment for hyperacusis. The fact that the NTG showed little change in sensitivity to specific environmental sounds suggests that phonophobia is unlikely to resolve without treatment in individuals who are distressed by their tinnitus.