

ORIGINAL RESEARCH

THE EFFICACY OF TINNITUS RETRAINING THERAPY (TRT) FOR TINNITUS RELIEF

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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.

Materials and 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 differences between pre- and post-treatment were statistically significant for tinnitus loudness, annoyance, and effect on life. The results suggest that benefit may be obtained from a substantially simplified form of TRT. TRT improved

self-perceived disability induced by chronic tinnitus for a long time after the end of therapy.

Keywords: Habituation - hyperacusis - neurophysiologic model - tinnitus - Tinnitus Retraining Therapy - treatment.

INTRODUCTION

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. Tinnitus retraining therapy (TRT) is a method for treating tinnitus and decreased sound tolerance, based on the neurophysiological model of tinnitus. This model postulates involvement of the limbic and autonomic nervous systems in all cases of clinically significant tinnitus and points out the importance of both conscious and subconscious connections, which are governed by principles of conditioned reflexes.^[1,2]

The treatments for tinnitus is based on the concept of extinction of these reflexes, labeled as habituation. TRT aims at inducing changes in the mechanisms responsible for transferring signal from the auditory system to the limbic and autonomic nervous systems, and through this, remove signal-induced reactions without attempting to directly attenuate the tinnitus evoked reactions. As such, TRT is effective for any type of tinnitus regardless of its etiology. TRT consists of: (1) counseling based on the neurophysiological model of tinnitus, and (2) sound therapy (with or without instrumentation). The role of sound therapy is to decrease the strength of the tinnitus signal. It is crucial to assess and treat tinnitus, decreased sound tolerance, and hearing loss simultaneously. Results from various groups have shown that TRT can be an effective method of treatment.^[3-5]

MATERIALS & METHODS

Subjects and Sample Size

Data were collected from a series of 42 consecutive patients (23 males and 19 females) who were referred from the ENT OPD to the tinnitus clinic during 2020–2021. The selection criteria were that each patient: (1) completed the self-assessment questionnaires, (2) attended at least two therapy sessions and continued the treatment for at least 3 months, and (3) exhibited mild to severe tinnitus handicap based on the Tinnitus Handicap Inventory (THI) total score prior to treatment (total THI score ≥ 18).^[6] These patients were treated according to our tinnitus clinic policies and procedures and were not recruited simply to take part in a trial.

Procedures

In the assessment session prior to application of the simplified form of TRT, a general medical history was obtained and otoscopy and pure-tone audiometry were performed. Audiometric thresholds were measured in a sound-attenuating room following the British Society of Audiology recommended procedure.^[7] Loudness Discomfort Levels (LDLs) were measured at 0.25, 0.5, 1, 2, 4, 6 and 8 kHz, following the protocol described by Jastreboff and

Hazell.^[8] Decreased sound tolerance (DST) was considered as present when average LDLs were 90 dB HL or lower and the patient complained about the loudness of environmental sounds.

In the first simplified TRT session, all patients received general information and directive counseling on tinnitus. This counseling was based on explanation of the nature of tinnitus and how to manage it. Its aims were: (1) to reassure patients that the annoyance from tinnitus would gradually reduce with the passage of time following the natural process of habituation; (2) to inform them that reduction in annoyance and distress caused by the tinnitus would promote habituation to the tinnitus and reduction of the tinnitus itself; (3) in cases of tinnitus combined with hearing loss to explain that if they could not hear properly, this was most likely because of their hearing loss and not the tinnitus; and (4) to advise them to avoid silence by using sound enrichment.^[8,9]

Sound therapy for simplified TRT was almost the same as for TRT. The specific treatment strategy that was applied to patients in the different categories described by Jastreboff,^[10] (excluding patients in category 0, who did not form part of the study) is detailed below:

(a) Patients with bothersome tinnitus, but no hearing loss, and no DST were advised about sound enrichment, but WSGs were not offered unless requested. This is the way in which the sound therapy for simplified TRT differs from that for TRT; the latter recommends usage of bilateral WSGs for at least 8 hours per day for patients in this category. In simplified TRT, if the patient asked for WSGs, then bilateral WSGs (Viennatone, Silent Star) were fitted with the same procedure as for TRT, using completely open fittings (Oticon Comfort Tips or skeleton open molds). As for TRT, the patient was instructed to set the volume so that both the tinnitus and the noise generated by the device could be heard.

(b) Patients with tinnitus and hearing loss were advised about sound enrichment and were fitted with digital hearing aids (HAs). This was similar to TRT except that patients were not given the option of combination devices (a combination of a HA and a broadband noise generator), whereas this would be an option for TRT.

(c) Patients exhibiting DST, with tinnitus and with or without hearing loss were advised to use bilateral WSGs and instructed to set the volume of the WSGs at a level that avoided discomfort while making the WSG noise audible in the presence of background environmental noises (instructions were to increase the volume in noisy environments). Initially, the therapy was focused on the DST, and after the patient showed improvement in DST, the tinnitus was addressed more directly. This was similar to TRT.

WSGs and HAs were fitted free under the National Health Service, but patients had to buy the SGs from the supplier. It was explained to patients that WSGs and SGs might facilitate tinnitus habituation by decreasing the strength of the tinnitus signal. It was also explained that HAs may help: (1) to reduce the effort of hearing, and (2) to amplify background noises and facilitate tinnitus habituation by decreasing the strength of the tinnitus signal. However, patients needed to decide for themselves whether or not to proceed with sound therapy of any form.

A single specialist (the first author) administered the treatment. He was clinically certified as an audiologist and had special expertise in tinnitus rehabilitation. Each patient was seen at 2–7 clinical appointments over a period of 3–23 months. The follow up appointments were arranged as required at 1 month, 2 month, 3 month, and 6 month intervals. The outcome

measurement questionnaires were completed at the beginning of each session. The scores achieved in the last session were compared with the pretreatment scores. Patients received about 1 to 3.5 hours of counseling. This excludes the assessment session, which usually took about 45 minutes for measurement of pure tone audiometry and LDLs, taking a case history, and obtaining the baseline questionnaires.

This study was a clinical audit approved by the Clinical Governance department at Ealing PCT and it was designed to assess the Ealing PCT Audiology Department performance. This study also was performed in accordance with the Helsinki declaration on medical ethics issues.

Outcome measures

Two self-report outcome measures were used: the THI and the Visual Analog Scale (VAS) of tinnitus loudness, annoyance and effect on life.^[11] The THI has 25 items, and response choices are "no" (0 points), "sometimes" (2 points) and "yes" (4 points). The overall score ranges from 0 to 100. Scores from 0–16 show no handicap (data from patients exhibiting no handicap were excluded from the current report), scores from 18–36 show mild handicap, scores from 38–56 indicate moderate handicap, and scores from 58–100 show severe handicap.^[6]

VAS scores are ratings on a scale from 0 to 10. The VAS score for loudness of tinnitus was assessed by asking the patient to rate the loudness of tinnitus during their waking hours over the last month (It was explained that 0 corresponds to no tinnitus being heard and 10 is as loud as gunfire). The VAS score for annoyance induced by the tinnitus was assessed by asking the patient to rate their subjective perception of annoyance on average during the last month (It was explained that 0 corresponds to no annoyance and 10 is the most annoying thing which can possibly happen). The VAS score for the impact of tinnitus on their life was assessed by asking the patient to rate the effect of tinnitus on their life during the last month (It was explained that 0 corresponds to no effect and 10 is as big as an earthquake).

RESULTS

Table 1: Patients' Descriptions of the Quality of Their Tinnitus

Quality of tinnitus	Number of patients	Percentage (approximate)
Buzzing noise	8	19%
High pitch noise	5	12%
Hissing noise	5	12%
Whistle	5	12%
Waterfall and grinding wheel	4	10%
Ringling	1	2%
White noise	1	2%
Strong wind	1	2%
Airplane taking off	1	2%
Bubbles and clicks	1	2%
Beep	1	2%
Humming noise	1	2%

Not able to describe	8	19%
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Table 2: Means and Standard Deviations (SDS) of the THI and VAS Scores Before and After 3–23 Months of Simplified TRT

THI	VAS Loudness		VAS Annoyance		VAS Effect on life			
	Mean	SD	Mean	SD	Mean	SD		
Pre	60.0	18.9	6.2	1.7	6.5	2.0	6.0	2.1
Post	15.3	11.2	4.6	1.5	2.9	1.9	2.1	1.6

Table 3: means (SDS in parentheses) of the decline in THI and VAS scores for patients who used and did not use SGS and HAS

	THI	VAS loudness	VAS annoyance	VAS effect on life
Used SC	55.6 (20)	1.9 (2.1)	3.6 (2.5)	4.5 (2.4)
Did not use SG	34.9 (18)	1.2 (2.1)	3.6 (2.7)	3.4 (2.2)
Used HAs	45.6 (24)	1.2 (2.0)	3.8 (2.7)	4.2 (2.2)
Did not use HAs	43.4 (19)	2.0 (2.5)	3.4 (1.9)	4.1 (2.5)

Statistical analysis:

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was considered to be statistically significant.

DISCUSSION

Jastreboff PJ, Jastreboff MM et al presented a different view on tinnitus. This model postulates involvement of the limbic and autonomic nervous systems in all cases of clinically significant tinnitus and points out the importance of both conscious and subconscious connections, which are governed by principles of conditioned reflexes. The treatments for tinnitus is based on the concept of extinction of these reflexes, labeled as habituation. TRT aims at inducing changes in the mechanisms responsible for transferring signal. As such, TRT is effective for any type of tinnitus regardless of its etiology. TRT consists of: (1) counseling based on the neurophysiological model of tinnitus, and (2) sound therapy (with or without instrumentation). The main role of counseling is to reclassify tinnitus into the category of neutral stimuli.

Phillips JS et al did randomised controlled trials of TRT versus no treatment in adult patients with tinnitus. 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. To conclude, a single, low-quality randomised controlled trial suggests that TRT is much more effective as a treatment for patients with tinnitus than tinnitus masking.

Jastreboff PJ, Jastreboff MM et al evaluated tinnitus retraining therapy (TRT) as a method for treatment of tinnitus and hyperacusis. The aim of this paper is to provide information about the neurophysiologic model of tinnitus and Tinnitus Retraining Therapy (TRT). With this overview of the model and therapy, professionals may discern with this basic foundation of knowledge whether they wish to pursue learning and subsequently implement TRT in their practice. This paper provides an overview only and was insufficient for the implementation of TRT.

Henry JA et al did clinical trial to compare tinnitus masking and tinnitus retraining therapy. 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. 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.

Westin VZ compared acceptance and commitment therapy versus tinnitus retraining therapy in the treatment of tinnitus in a randomised controlled trial. The ACT treatment consisted of 10 weekly 60 min sessions. The TRT treatment consisted of one 150 min session, one 30 min follow-up and continued daily use of wearable sound generators for a recommended period of at least 8 h/day for 18 months. The results were mediated by tinnitus acceptance. The results suggest that ACT can reduce tinnitus distress and impact in a group of normal hearing tinnitus patients.

Herraiz C et al demonstrated the efficacy of tinnitus retraining therapy (TRT) for tinnitus relief compared to a waiting list group and a partially treated group. 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 ($p < 0.05$). 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.

Henry JA et al did comparison of tinnitus masking and tinnitus retraining therapy. Tinnitus retraining therapy has been used clinically for over 12 years and has received considerable international attention. Although these methods are distinctive in their basic approach to tinnitus management, certain aspects of treatment appear similar. These aspects of treatment have created considerable confusion and controversy, especially regarding the use of "sound therapy" as a basic component of treatment. It is the objective of this article to clarify the major differences that exist between these two forms of treatment.

Forti S et al saw if results of tinnitus retraining therapy maintained over time. 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. 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.

Hatanaka A et al studied pros and cons of tinnitus retraining therapy. 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 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.

Aazh H et al in a retrospective study simplified form of tinnitus retraining therapy in adults. 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. 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). 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. The results suggest that benefit may be obtained from a substantially simplified form of TRT.

CONCLUSION

The differences between pre- and post-treatment were statistically significant for tinnitus loudness, annoyance, and effect on life. The results suggest that benefit may be obtained from a substantially simplified form of TRT. TRT improved self-perceived disability induced by chronic tinnitus for a long time after the end of therapy.

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REFERENCES

1. Jastreboff PJ, Jastreboff MM. Tinnitus retraining therapy: a different view on tinnitus. *Orl.* 2006;68(1):23-30.
2. Phillips JS, McFerran D. Tinnitus retraining therapy (TRT) for tinnitus. *Cochrane database of systematic reviews.* 2010(3).
3. Jastreboff PJ, Jastreboff MM. Tinnitus retraining therapy (TRT) as a method for treatment of tinnitus and hyperacusis patients. *Journal of the American Academy of Audiology.* 2000 Mar;11(03):162-77.
4. Jastreboff PJ. Tinnitus retraining therapy. *Textbook of tinnitus.* 2011:575-96.
5. Henry JA, Schechter MA, Zaugg TL, Griest S, Jastreboff PJ, Vernon JA, Kaelin C, Meikle MB, Lyons KS, Stewart BJ. Clinical trial to compare tinnitus masking and tinnitus retraining therapy. *Acta Oto-Laryngologica.* 2006 Jan 1;126(sup556):64-9.
6. Westin VZ, Schulin M, Hesser H, Karlsson M, Noe RZ, Olofsson U, Stalby M, Wisung G, Andersson G. Acceptance and commitment therapy versus tinnitus retraining therapy in the treatment of tinnitus: a randomised controlled trial. *Behaviour research and therapy.* 2011 Nov 1;49(11):737-47.
7. Herraiz C, Hernandez FJ, Plaza G, Santos GD. Long-term clinical trial of tinnitus retraining therapy. *Otolaryngology–Head and Neck Surgery.* 2005 Nov;133(5):774-9.
8. Henry JA, Schechter MA, Nagler SM, Fausti SA. Comparison of tinnitus masking and tinnitus retraining therapy. *Journal of the American Academy of Audiology.* 2002 Nov;13(10):559-81.
9. Forti S, Costanzo S, Crocetti A, Pignataro L, Del Bo L, Ambrosetti U. Are Results of Tinnitus Retraining Therapy Maintained over Time?. *Audiology and Neurotology.* 2009;14(5):286-9.
10. Hatanaka A, Ariizumi Y, Kitamura K. Pros and cons of tinnitus retraining therapy. *Actaoto-laryngologica.* 2008 Jan 1;128(4):365-8.
11. Aazh H, Moore BC, Glasberg BR. Simplified form of tinnitus retraining therapy in adults: a retrospective study. *BMC Ear, Nose and Throat Disorders.* 2008 Dec;8(1):1-7.