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[Intervention Review]

Tinnitus Retraining Therapy (TRT) for tinnitus

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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 methods

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.

Tinnitus Retraining Therapy (TRT) for tinnitus (Review)

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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.

PLAIN LANGUAGE SUMMARY**Tinnitus Retraining Therapy (TRT) for tinnitus**

Tinnitus is described as the perception of sound or noise in the absence of real acoustic stimulation. Tinnitus may be perceived in one or both ears, within the head or outside the body. Although various theories have been suggested, the cause is not fully understood. A wide range of treatments have been used, but none has been found effective in all patients.

A form of treatment called Tinnitus Retraining Therapy (TRT) is used in many countries to treat this symptom. This treatment comprises a form of educational counselling and sound therapy given according to a specific protocol. Only one study, involving 123 participants, matched the inclusion criteria for this review. Although this study suggested considerable benefit for TRT in the treatment of tinnitus the study quality was not good enough to draw firm conclusions. No side effects of treatment were described. Further research is required.

BACKGROUND

This is one of a number of tinnitus reviews produced by the Cochrane Ear, Nose & Throat Disorders Group, which use a standard Background. The following paragraphs ('Description of the condition') are based on earlier work in the following reviews and reproduced with permission: [Baldo 2006](#); [Bennett 2007](#); [Hilton 2004](#); [Hobson 2007](#); [Phillips 2008](#).

Description of the condition

Tinnitus can be described as the perception of sound in the absence of external acoustic stimulation. For the patient it may be trivial or it may be a debilitating condition ([Luxon 1993](#)). The quality of the perceived sound can vary enormously from simple sounds such as whistling or humming to complex sounds such as music. The patient may hear a single sound or multiple sounds. Tinnitus may be perceived in one or both ears, within the head or outside the body. The symptom may be continuous or intermittent. Tinnitus is described in most cases as subjective, meaning that it cannot be heard by anyone other than the patient. While, for the patient, this perception of noise is very real, because there is no corresponding external sound it can be considered a phantom, or false, perception. Objective tinnitus is a form of tinnitus which can be detected by an examiner, either unaided or using a listening aid such as a stethoscope or microphone in the ear canal. This is much less common and usually has a definable cause such as sound generated by blood flow in or around the ear or unusual activity of the tiny muscles within the middle ear. Tinnitus may be associated with normal hearing or any degree of hearing loss and can occur at any age.

It is important to distinguish between clinically significant and non-significant tinnitus ([Davis 2000](#)) and several different classifications have been proposed ([Dauman 1992](#); [McCombe 2001](#); [Stephens 1991](#)). Dauman, for example, makes a distinction between 'normal' (lasting less than five minutes, occurring less than once a week and experienced by most people) and 'pathological' tinnitus (lasting more than five minutes, occurring more than once a week and usually experienced by people with hearing loss).

Aetiology

Almost any form of disorder involving the outer, middle or inner ear or the auditory nerve may be associated with tinnitus ([Brummett 1980](#); [Shea 1981](#)). However, it is possible to have severe tinnitus with no evidence of any aural pathology. Conversely, tinnitus can even exist without a peripheral auditory system: unilateral tinnitus is a common presenting symptom of vestibular schwannomas (acoustic neuromas), which are rare benign tumours of the vestibulo-cochlear nerve. When these neuromas are removed by a translabyrinthine route, the cochlear nerve can be severed. Despite the effective removal of their peripheral auditory mechanisms, 60% of these patients retain their tinnitus postoperatively ([Baguley 1992](#)). This suggests the fundamental importance of the central auditory pathways in the maintenance of the symptom, irrespective of trigger.

Many environmental factors can also cause tinnitus. The most relevant and frequently reported are:

- acute acoustic trauma (AAT) (for example, explosions or gunfire) ([Christiansson 1993](#); [Chung 1980](#); [Melinek 1976](#); [Mrena 2002](#); [Tommel 1999](#));

- airbag inflation ([Saunders 1998](#)); toy pistols ([Fleischer 1999](#));
- exposure to occupational noise; 'urban noise pollution' ([Alberti 1987](#); [Axelsson 1985](#); [Chouard 2001](#); [Daniell 1998](#); [Griest 1998](#); [Kowalska 2001](#); [McShane 1988](#); [Neuberger 1992](#); [Phoon 1993](#)); and
- exposure to recreational and amplified music ([Becher 1996](#); [Chouard 2001](#); [Lee 1999](#); [Metternich 1999](#))

Pathophysiology

Over 50 years ago, Heller and Bergman demonstrated that if 'normal' people (with no known cochlear disease) were placed in a quiet enough environment, the vast majority of them would experience sounds inside their head. They concluded that tinnitus-like activity is a natural phenomenon perceived by many in a quiet enough environment ([Heller 1953](#)).

Mazurek has shown that pathologic changes in the cochlear neurotransmission, for example as a result of intensive noise exposure or ototoxic drugs, can be a factor in the development of tinnitus ([Mazurek 2007](#)).

In the 'neurophysiological model' of tinnitus ([Jastreboff 1990](#); [Jastreboff 2004](#)) it is proposed that tinnitus results from the abnormal processing of a signal generated in the auditory system. This abnormal processing occurs before the signal is perceived centrally. This may result in 'feedback', whereby the annoyance created by the tinnitus causes the individual to focus increasingly on the noise, which in turn exacerbates the annoyance and so a 'vicious cycle' develops. In this model tinnitus could therefore result from continuous firing of cochlear fibres to the brain, from hyperactivity of cochlear hair cells or from permanent damage to these cells being translated neuronally into a 'phantom' sound-like signal that the brain 'believes' it is hearing. For this reason tinnitus may be compared to chronic pain of central origin - a sort of 'auditory pain' ([Briner 1995](#); [Sullivan 1994](#)).

The relationship between the symptom of tinnitus and the activity of the prefrontal cortex and limbic system has been emphasised. The limbic system mediates emotions. It can be of great importance in understanding why the sensation of tinnitus is in many cases so distressing for the patient. It also suggests why, when symptoms are severe, tinnitus can be associated with major depression, anxiety and other psychosomatic and/or psychological disturbances, leading to a progressive deterioration of quality of life ([Lockwood 1999](#); [Sullivan 1989](#); [Sullivan 1992](#); [Sullivan 1993](#)).

Prevalence

Epidemiological data reports are few. The largest single study was undertaken in the UK by the Medical Research Council Institute of Hearing Research and was published in 2000 ([Davis 2000](#)). This longitudinal study of hearing questioned 48,313 people; 10.1% described tinnitus arising spontaneously and lasting for five or more minutes at a time and 5% described it as moderately or severely annoying. However, only 0.5% reported tinnitus having a severe effect on their life. This is another of the paradoxes of tinnitus: the symptom is very common but the majority of people who experience it are not particularly concerned by it. These figures from the UK are broadly consistent with data collected by the American Tinnitus Association (ATA) which suggests that tinnitus may be experienced by around 50 million Americans, or 17% of the US population ([ATA 2004](#)). Data also exist for Japan,

Europe and Australia ([Sindhusake 2003](#)), and estimates suggest that tinnitus affects a similar percentage of these populations, with 1% to 2% experiencing debilitating tinnitus ([Seidman 1998](#)). The Oregon Tinnitus Data Archive ([Oregon 1995](#)) contains data on the characteristics of tinnitus drawn from a sample of 1630 tinnitus patients. The age groups with the greater prevalence are those between 40 and 49 years (23.9%) and between 50 and 59 years (25.6%).

Olszewski showed in his study that the risk of tinnitus increases in patients over 55 years old who suffer from metabolic conditions and cervical spondylosis ([Olszewski 2008](#)).

Diagnosis

Firstly a patient with tinnitus may undergo a basic clinical assessment. This will include the relevant otological, general and family history, and an examination focusing on the ears, teeth and neck and scalp musculature. Referral to a specialist is likely to involve a variety of other investigations including audiological tests and radiology. Persistent, unilateral tinnitus may be due to a specific disorder of the auditory pathway and imaging of the cerebellopontine angle is important to exclude, for example, a vestibular schwannoma (acoustic neuroma) - a rare benign tumour of the cochleo-vestibular nerve. Other lesions, such as glomus tumours, meningiomas, adenomas, vascular lesions or neuro-vascular conflicts may also be detected by imaging ([Marx 1999](#); [Weissman 2000](#)).

Treatment

At present no specific therapy for tinnitus is acknowledged to be satisfactory in all patients. Many patients who complain of tinnitus, and also have a significant hearing impairment, will benefit from a hearing aid. Not only will this help their hearing disability but the severity of their tinnitus may be reduced.

A wide range of therapies have been proposed for the treatment of tinnitus symptoms. Pharmacological interventions used include cortisone ([Koester 2004](#)), vasodilators, benzodiazepines, lidocaine and spasmolytic drugs. The use of anticonvulsants in treating tinnitus is the subject of a forthcoming Cochrane Review ([Hoekstra 2009](#)). Antidepressants are commonly prescribed for tinnitus. However, two reviews ([Baldo 2006](#); [Robinson 2007](#)) showed that there is no indication that tricyclic antidepressants have a beneficial effect.

Although a number of studies have suggested that Ginkgo biloba may be of benefit in the treatment of tinnitus ([Ernst 1999](#); [Holger 1994](#); [Rejali 2004](#)), a Cochrane Review showed that there was no evidence that it is effective where tinnitus was the primary complaint ([Hilton 2004](#)).

Hyperbaric oxygen therapy (HBOT) can improve oxygen supply to the inner ear which, it is suggested, may result in an improvement in tinnitus, however a Cochrane Review found insufficient evidence to support this ([Bennett 2007](#)).

Studies have been carried out into the effect of cognitive behavioural therapy (CBT) on tinnitus ([Andersson 1999](#)). Another Cochrane Review has shown that CBT can have an effect on the qualitative aspects of tinnitus and can improve patients' ability to manage the condition ([Martinez-Devesa 2007](#)).

Other options for the management of patients with tinnitus include transcranial magnetic stimulation ([Meng 2009](#)), tinnitus masking (use of 'white noise' generators) ([Hobson 2007](#)), music therapy ([Argstatter 2008](#)), reflexology, hypnotherapy, and traditional Chinese medicine (TCM), including acupuncture ([Li 2009](#)).

Description of the intervention

Following publication of his Neurophysiological Model in 1990 ([Jastreboff 1990](#)), Jastreboff went on to generate a clinical management strategy that combined directive counselling and sound therapy to counteract the pathological positive feedback process and promote habituation to the tinnitus ([Jastreboff 1993](#)). This process was subsequently titled Tinnitus Retraining Therapy or TRT ([Hazell 1996](#)) and the technique has been extensively discussed in a book ([Jastreboff 2004](#)). TRT refers to a specific type of tinnitus therapy. 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.

How the intervention might work

Directive counselling is defined as a form of educational counselling, designed to educate patients about the auditory system and explain the mechanisms by which tinnitus is thought to arise. This form of counselling is distinct from the counselling that is administered in psychological treatments. In TRT, patients are divided into five groups (categories 0, 1, 2, 3 and 4) according to the severity of their tinnitus, the presence or absence of significant hearing impairment and the presence or absence of hyperacusis. Sound therapy is then administered in a protocol that depends on the patient's category, using hearing aids (or cochlear implants if necessary), broad band ear-level sound generators and environmental sound enrichment. The protocol for TRT recommends that patients should receive follow-up sessions at monthly intervals for the first three months and then at six, nine, 12, 18 and 24 months ([Jastreboff 2004](#)). At follow up counselling is repeated, compliance with sound therapy is checked and progress monitored.

Both Jastreboff and Hazell set up educational courses to teach the Neurophysiological Model and Tinnitus Retraining Therapy to interested healthcare professionals and have stressed that proper training is essential before undertaking this technique ([Hazell 1999](#)). Unfortunately the title Tinnitus Retraining Therapy has sometimes been used in a looser fashion to encompass almost any form of management that tries to promote habituation. The strict definition of Tinnitus Retraining Therapy has been described by its creator ([Jastreboff 1999](#); [Jastreboff 2004](#)) and this definition will be adhered to for the purposes of this review. Other forms of tinnitus management that, although possibly efficacious, do not follow the strict guidelines of Tinnitus Retraining Therapy, will not be included here but will be assessed in a separate Cochrane Review ([Phillips 2010](#)).

Why it is important to do this review

Tinnitus Retraining Therapy represents a potentially useful form of treatment for the management of patients with tinnitus. There has been no formal review of its efficacy; this Cochrane Review will hopefully provide an up-to-date, detailed analysis of the current evidence available.

OBJECTIVES

To assess the effectiveness of Tinnitus Retraining Therapy (TRT) for the treatment of subjective idiopathic tinnitus.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials.

Types of participants

Adults (> 16 years) complaining of tinnitus. We excluded studies that investigated pulsatile tinnitus or tinnitus in association with otosclerosis, Ménière's disease or tumours of the cerebellopontine angle.

Types of interventions

Studies where the patient received Tinnitus Retraining Therapy (TRT). Interventions included:

1. TRT versus placebo;
2. TRT versus no treatment;
3. TRT versus drug/other therapy.

Types of outcome measures

Primary outcome measure

Improvement in tinnitus severity and disability, measured by a validated tinnitus-specific questionnaire. Commonly used tinnitus questionnaires are listed in [Table 1](#) ([Budd 1995](#); [Erlandsson 1992](#)). Cronbach's α is a statistic used to represent internal consistency ([Kupermintz 2003](#)); a value is provided for each questionnaire.

Secondary outcome measures

1. Improvement in tinnitus perception, loudness or intensity (specific auditory disease evaluation).
2. Improvement/change in depressive symptoms or in depression scores.
3. Improvement/change in global wellbeing.

Search methods for identification of studies

We conducted systematic searches for randomised controlled trials. There were no language, publication year or publication status restrictions. The date of the last search was 26 August 2009.

Electronic searches

We searched the following databases from their inception: the Cochrane Ear, Nose and Throat Disorders Group Trials Register; the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library* Issue 3, 2009); PubMed; EMBASE; CINAHL; LILACS; KoreaMed; IndMed; PakMediNet; CAB Abstracts; Web of Science; BIOSIS Previews; CNKI; IMEMR (Index Medicus for WHO Eastern Mediterranean Region); IMSEAR (Index Medicus for WHO South-East Asia Region); UKCRN (UK Clinical Research Network Portfolio Database); mRCT (Current Controlled Trials); ClinicalTrials.gov; ICTRP (International Clinical Trials Registry Platform) and Google.

We modelled subject strategies for databases on the search strategy designed for CENTRAL. Where appropriate, we combined subject strategies with adaptations of the highly sensitive search strategy designed by the Cochrane Collaboration for identifying randomised controlled trials and controlled clinical trials (as described in *The Cochrane Handbook for Systematic Reviews of Interventions* Version 5.0.1, Box 6.4.b. ([Handbook 2008](#))). Search strategies for major databases including CENTRAL are provided in [Appendix 1](#).

Searching other resources

We scanned reference lists of identified studies for further trials. We searched PubMed, TRIPdatabase, NHS Evidence - ENT and Audiology, and Google to retrieve existing systematic reviews possibly relevant to this systematic review, in order to search their reference lists for additional trials.

Data collection and analysis

Selection of studies

The two authors independently assessed the references retrieved to identify studies which met the inclusion criteria outlined above. Where there was disagreement this was resolved by discussion. TRT refers to a specific type of tinnitus therapy, therefore both authors closely examined the techniques described in the methods section and contacted the authors of any potentially includable study to clarify the authenticity of the TRT.

Data extraction and management

We planned that data would be extracted onto standardised, pre-piloted forms. We contacted study authors where necessary for clarification.

Assessment of risk of bias in included studies

The two authors independently undertook assessment of the risk of bias of the included trials, with the following taken into consideration, as guided by *The Cochrane Handbook for Systematic Reviews of Interventions* ([Handbook 2008](#)):

- sequence generation;
- allocation concealment;
- blinding;
- incomplete outcome data;
- selective outcome reporting; and
- other sources of bias.

We used the Cochrane 'Risk of bias' tool in RevMan 5 ([RevMan 2008](#)), which involves describing each of these domains as reported in the trial and then assigning a judgement about the adequacy of each entry. This involves answering a pre-specified question whereby a judgement of 'Yes' indicates low risk of bias, 'No' indicates high risk of bias, and 'Unclear' indicates unclear or unknown risk of bias.

Data synthesis

We planned to perform statistical analysis using Review Manager 5. For dichotomous outcomes we planned to calculate a relative risk (RR). A weighted mean difference (WMD) or standardised mean difference (SMD) was to be used for continuous outcomes, as appropriate. We planned to use a fixed-effect model where non-significant heterogeneity was found between studies. If great heterogeneity in studies was found then we planned to use a

random-effects model. Had sufficient studies been included we would have used study quality in sensitivity analyses.

RESULTS

Description of studies

Results of the search

We identified a total of 335 articles and reviewed these against the inclusion criteria. TRT refers to a specific type of tinnitus therapy. Many studies had reported the use of TRT, where in fact on closer examination of the techniques used and upon clarification with the study authors, a modified form of TRT had actually been employed. Six articles, describing four unique studies, were accepted for initial inclusion and risk of bias assessment. After risk of bias appraisal and full consideration only one randomised controlled trial was ultimately included; the data from the study were reported in two separate journals ([Henry 2006](#)).

Included studies

Henry 2006

We clarified that the two articles cited ([Henry 2006](#); two references) were in fact based on the same study by contacting the main author. The study was a quasi-randomised trial comparing tinnitus masking (TM) with TRT. One hundred and twenty-three patients were recruited from a cohort of US military veterans. As the trial population was drawn from military veterans there was preponderance of male participants, with a male to female ratio of 117 to 6. The first subject entering the trial was randomly allocated to a treatment modality. Thereafter, participants were assigned to each group using a method of alternating selection.

The two treatment modalities were administered by two independent clinicians though data collection was undertaken by a third party. All patients received sound therapy, using ear level hearing aids, sound generators or combination devices. The protocol by which these devices were used to deliver sound therapy varied according to whether TM or TRT was being administered. Counselling also varied according to whether the participants were in the TM or TRT arm: those receiving TM were given informal, unstructured counselling whereas those receiving TRT were given structured educational counselling.

Outcomes were assessed using three validated tinnitus questionnaires: Tinnitus Handicap Inventory ([Newman 1996](#)), Tinnitus Handicap Questionnaire ([Kuk 1990](#)) and Tinnitus Severity Index ([Meikle 1995](#)). An interview form to standardise clinical history taking for TRT was used to ask participants to score the percentage of time they were aware of their tinnitus and the percentage of time they were annoyed by the symptom. Patients attended treatment appointments at three, six, 12 and 18 months with data collection at each of these points. As well as analysing change with regard to treatment modality, the results were studied with regard to predictor variables, comprising hearing level, tinnitus duration and perceived degree of tinnitus problem. Twelve of the initial 123 patients were lost to follow up but the statistical methods used for analysis allowed for missing data elements. Five participants, however, had missing predictor data such that they could not be included in the final analysis. Data from the remaining 118 participants were analysed using a multilevel modelling technique.

Excluded studies

The three other studies were excluded due to the use of a modified form of TRT ([Caffier 2006](#); [Goebel 1999](#); [Schmitt 2002](#)); these modified forms of TRT were not true to the format of therapy as originally proposed ([Jastreboff 1999](#)).

Risk of bias in included studies

The included study was assessed as having a high risk of bias. The authors of the study used a non-specified form of random allocation for the first patient, followed by alternation between treatment and control groups. The study was not blinded but issues regarding incomplete data were addressed appropriately and all data were presented in full. Finally, the research sample may not be representative of the general tinnitus population. The age distribution of subjects, preponderance of male subjects and history of acoustic trauma may be skewed in subjects from a veterans' hospital; this might limit general applicability of the results. No other sources of potential bias were identified.

Effects of interventions

In the included study ([Henry 2006](#)) data were presented in several different ways, looking at the different outcome measures, the predictors and their intercorrelations.

Improvement in tinnitus severity and disability, measured by a validated tinnitus-specific questionnaire

Particular attention was paid to the relationship between tinnitus questionnaire scores and how significantly participants had rated their tinnitus problem. Both tinnitus masking (TM) and Tinnitus Retraining Therapy (TRT) were shown to be effective but TM had its effect much more rapidly, demonstrating significant benefit at three months. This benefit from TM tended to stabilise and relatively little further improvement occurred with this treatment modality over the duration of the trial. In contrast, TRT showed slower onset of benefit but ultimately much greater effect. Benefit with TRT was also closely related to the degree of tinnitus problem: patients with a 'very big problem' showed much greater benefit at 18 months compared to those whose initial tinnitus problem was 'moderate' or 'big'.

For patients in the 'moderate problem' group, tinnitus severity as measured using the Tinnitus Handicap Inventory (THI) was improved by 18.2 points in the TRT group as compared to 4.6 points in the TM group at 18 months. Tinnitus severity as measured using the Tinnitus Handicap Questionnaire (THQ) was improved by 489 points in the TRT group as compared to 178 points in the TM group at 18 months. Tinnitus severity as measured using the Tinnitus Severity Index (TSI) was improved by 7.5 points in the TRT group as compared to 1.6 points in the TM group at 18 months.

For patients in the 'big problem' group, tinnitus severity as measured using the THI was improved by 29.2 points in the TRT group as compared to 16.7 points in the TM group at 18 months. Tinnitus severity as measured using the THQ was improved by 799 points in the TRT group as compared to 256 points in the TM group at 18 months. Tinnitus severity as measured using the TSI was improved by 12.1 points in the TRT group as compared to 6.7 points in the TM group at 18 months.

For patients in the 'very big problem' group, tinnitus severity as measured using the THI was improved by 50.4 points in the TRT

group as compared to 10.3 points in the TM group at 18 months.

Tinnitus severity as measured using the THQ was improved by 1118 points in the TRT group as compared to 300 points in the TM group at 18 months. Lastly, tinnitus severity as measured using the TSI was improved by 19.7 points in the TRT group as compared to 4.8 points in the TM group at 18 months.

Improvement in tinnitus perception, loudness or intensity (specific auditory disease evaluation)

These outcome measures were not addressed by the study authors.

Improvement/change in depressive symptoms or in depression scores

These outcome measures were not addressed by the study authors.

Improvement/change in global wellbeing

These outcome measures were not addressed by the study authors.

DISCUSSION

Summary of main results

The review identified only a single study examining the use of Tinnitus Retraining Therapy (TRT) as a treatment for patients with tinnitus. The included trial did have a reasonable number of participants (123) and the drop-out rate was commendably low. The outcome measures were appropriate for the study and follow-up times were adequate. However, the overall quality of this study was let down by a compromised approach to allocation. The conclusion of the trial was that TRT was beneficial in the management of tinnitus but this support for the intervention must be tempered by the limited and low quality of evidence.

Overall completeness and applicability of evidence

Despite the apparent popularity of TRT as a treatment for tinnitus, and its use throughout the world, it is unfortunate that the conclusion of this review is based on a single study. Whilst searching for appropriate articles for this review, two studies were identified from the ClinicalTrials.gov registry as being works in progress (NIDCD 2009; TRC 2009). When the results of these trials are reported, the finding of this review may be superseded by better quality evidence.

Quality of the evidence

The fact that only a single trial was identified, and that this trial had methodological flaws particularly with respect to allocation bias, means that it is not possible to reach a firm conclusion regarding the use of TRT.

Agreements and disagreements with other studies or reviews

To our knowledge there are currently no other systematic reviews of TRT for tinnitus.

TRT is based upon the neurophysiological model of tinnitus. This review has illustrated that there may be evidence for other treatments based on the neurophysiological model of tinnitus. However, despite these studies describing their interventions as being true TRT, they fell short of meeting the criteria for true TRT when a strict definition was adhered to (Jastreboff 2004). This has therefore led us to produce a protocol for another Cochrane Review entitled 'Neurophysiological model-based treatments for tinnitus' (Phillips 2010).

AUTHORS' CONCLUSIONS

Implications for practice

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

Implications for research

Further research should consider:

1. treatment protocols that strictly adhere to the format of TRT administration as proposed by its creator (Jastreboff 1999);
2. the use of more robust methodology that would avoid criticism of the method of randomisation; this would avoid any suggestions of bias and result in higher quality studies for systematic review.

ACKNOWLEDGEMENTS

We would like to acknowledge the work done on antidepressants for patients with tinnitus (Baldo 2006). This review shares a similar format to conserve clarity with respect to the review of tinnitus.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Henry 2006

Methods	Randomised controlled trial
Participants	n = 123

Tinnitus Retraining Therapy (TRT) for tinnitus (Review)

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Henry 2006 (Continued)

	Military veterans
	Screened initially with the Tinnitus-Impact Screening Interview
Interventions	Group 1: Tinnitus Retraining Therapy (TRT) Group 2: tinnitus masking (TM) TRT versus TM
Outcomes	Tinnitus Handicap Inventory (THI) Tinnitus Handicap Questionnaire (THQ) Tinnitus Severity Index (TSI) Verbally administered TRT interview forms
Notes	Significant improvement for both groups Group 1: greater improvement in outcome measures in the TRT group as compared with the TM group

Risk of bias

Bias	Authors' judgement	Support for judgement
Adequate sequence generation?	High risk	The sequence was a non-specified form of random allocation for the first patient, followed by alternation
Allocation concealment?	High risk	The first qualifying patient was placed into a treatment group by random selection; each subsequent patient was placed by alternating between groups
Blinding? All outcomes	High risk	This study was not blinded
Incomplete outcome data addressed? All outcomes	Low risk	Incomplete outcome data were addressed appropriately
Free of selective reporting?	Low risk	All data were presented in full in an appropriate manner
Free of other bias?	Low risk	No other sources of potential bias were identified

Characteristics of excluded studies [ordered by study ID]

Study	Reason for exclusion
Caffier 2006	ALLOCATION: Randomised controlled trial PARTICIPANTS: 40 patients with compensated tinnitus or decompensated tinnitus INTERVENTIONS:

Study	Reason for exclusion
	A modified form of TRT was used, this was not truly TRT as defined by Jastreboff
Goebel 1999	ALLOCATION: Randomised controlled trial PARTICIPANTS: 52 patients with chronic decompensated tinnitus and unimpaired hearing INTERVENTIONS: TRT was not truly as defined by Jastreboff
Schmitt 2002	ALLOCATION: Randomised controlled trial PARTICIPANTS: 83 patients with tinnitus INTERVENTIONS: TRT was not truly as defined by Jastreboff

TRT = Tinnitus Retraining Therapy

Characteristics of ongoing studies *[ordered by study ID]*

NIDCD 2009

Trial name or title	'Randomized trial of Tinnitus Retraining Therapy'
Methods	Randomised, single-blind (subject), parallel assignment
Participants	Both sexes aged 18 years and older
Interventions	Group 1: Counselling plus everyday noise type 1 Group 2: Counselling plus static noise type 2 Group 3: Counselling plus static noise type 3 Group 4: Hearing aid and counselling plus everyday noise type 1 Group 5: Hearing aid and counselling plus static noise type 2 Group 6: Hearing aid and counselling plus static noise type 3
Outcomes	Primary outcome measures: Iowa Tinnitus Handicap Questionnaire Secondary outcome measures: tinnitus measures
Starting date	January 2004
Contact information	Principal investigator: Richard S Tyler, Ph.D, University of Iowa
Notes	—

TRC 2009

Trial name or title	'The effect of Tinnitus Retraining Therapy on subjective and objective measures of chronic tinnitus'
Methods	Randomised, double-blind (subject, investigator), active control, parallel assignment, efficacy study
Participants	Both sexes aged 18 years to 75 years
Interventions	Group 1: TRT Group 2: sound therapy
Outcomes	Primary outcome measures: 1. Change in objective measure of tinnitus loudness using psychoacoustic matching task 2. Change in subjective handicap rating of tinnitus using a standardised questionnaire Secondary outcome measures: 1. Change in subjective ratings of tinnitus loudness, annoyance and awareness
Starting date	November 2005
Contact information	Principal Investigator: Carol A Bauer, M.D. Southern Illinois University School of Medicine
Notes	—

ADDITIONAL TABLES

Table 1. Tinnitus questionnaires

Title	No. of items/factors	Psychometrics
Tinnitus Questionnaire (Hallam 1996)	52 items, 5 factors	$\alpha = 0.91$ for total scale; for sub-scales $\alpha = 0.76$ to $\alpha = 0.94$
Tinnitus Handicap Questionnaire (Kuk 1990)	27 items, 3 factors	$\alpha = 0.93$ for total scale
Tinnitus Severity Scale (Sweetow 1990)	15 items	α not reported
Tinnitus Reaction Questionnaire (Wilson 1991)	26 items, 4 factors	$\alpha = 0.96$ and a test-retest correlation of $r = 0.88$
Subjective Tinnitus Severity Scale (Halford 1991)	16 items	$\alpha = 0.84$
Tinnitus Handicap/Support Scale (Erlandsson 1992)	28 items, 3 factors	α not reported
Tinnitus Handicap Inventory (Newman 1996)	25 items, 3 scales	$\alpha = 0.93$ for total scale
Tinnitus Coping Strategy Questionnaire (Henry 1995)	33	$\alpha = 0.88$
Tinnitus Coping Style Questionnaire (Budd 1995)	40	—

Table 1. Tinnitus questionnaires (Continued)

Tinnitus Cognitions Questionnaire (Wilson 1998)

APPENDICES

Appendix 1. Search strategies for other databases

CENTRAL	EMBASE (Ovid)	PubMed
1. TINNITUS single term (MeSH) 2. TINNIT* 3. #1 OR #2 4. COGNITIVE THERAPY single term (MeSH) 5. PERCEPTUAL MASKING single term (MeSH) 6. HABITUATION, PSYCHOPHYSIOLOGIC single term (MeSH) 7. CONDITIONING, CLASSICAL single term (MeSH) 8. counselling single term (MeSH) 9. ADAPTATION, PSYCHOLOGICAL single term (MeSH) 10. PSYCHOTHERAPY GROUP single term (MeSH) 11. JASTREBOFF OR HAZELL OR NEUROPHYSIOLOGICAL* OR TRAINING NEXT WORKSHOP* OR TRAINING NEXT CLINIC* OR SOUND NEXT ENRICHMENT OR SOUND NEXT THERAP* 12. COUNSELLING NEAR EDUCATION* OR COUNSELLING NEAR STRUCTURED 13. counselling NEAR EDUCATION* OR counselling NEAR STRUCTURED 14. RETRAIN* OR RELEARN* OR RECONDITION* OR HABITUAT* 15. #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 16. #3 AND #15	1 exp tinnitus/ or tinnit*.tw. 2 exp Cognitive Therapy/ or exp Counseling/ or exp Psychotherapy, Group/ 3 (JASTREBOFF or HAZELL or NEUROPHYSIOLOGICAL* or (TRAINING adj WORKSHOP*) or (TRAINING adj CLINIC*) or (SOUND adj ENRICHMENT) or (SOUND adj THERAP*)).tw. 4 (counselling and (structured or education)).tw. 5 (RETRAIN* or RELEARN* or RECONDITION* or HABITUAT*).tw. 6 (cognitive and therapy).tw. 7 exp Perceptual Masking/ 8 6 or 4 or 3 or 7 or 2 or 5 9 8 and 1	#1 "Tinnitus"[Mesh] #2 tinnit* #3 #1 OR #2 #4 "Cognitive Therapy"[Mesh] #5 "Perceptual Masking"[Mesh] #6 "Habituation, Psychophysiology"[Mesh] #7 "Conditioning, Classical"[Mesh] #8 "counselling"[Mesh] #9 "Adaptation, Psychological"[Mesh] #10 "Psychotherapy, Group"[Mesh] #11 JASTREBOFF [tiab] OR HAZELL [tiab] OR NEUROPHYSIOLOGICAL* [tiab] OR TRAINING WORKSHOP* [tiab] OR TRAINING CLINIC* [tiab] OR SOUND ENRICHMENT [tiab] OR SOUND THERAP* [tiab] #12 RETRAIN* [tiab] OR RELEARN* [tiab] OR RECONDITION* [tiab] OR HABITUAT* [tiab] #13 ((counselling [tiab] or counselling [tiab]) AND (structured [tiab] or education [tiab])) #14 #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 #15 #3 AND #14
Web of Science	BIOSIS Previews/ CAB Abstracts (Ovid)	mRCT
#1 TS=tinnit* #2 TS=(JASTREBOFF OR HAZELL OR NEUROPHYSIOLOGICAL* OR TRAINING WORKSHOP* OR TRAINING CLINIC* OR SOUND ENRICHMENT OR SOUND THERAP*) #3 TS=(COUNSELLING AND (EDUCATION* OR STRUCTURED)) #4 TS=(RETRAIN* OR RELEARN* OR RECONDITION* OR HABITUAT*) #5 #4 OR #3 OR #2 #6 #5 AND #1	1 exp tinnitus/ or tinnit*.tw. 2 exp Cognitive Therapy/ or exp Counseling/ or exp Psychotherapy, Group/ 3 (JASTREBOFF or HAZELL or NEUROPHYSIOLOGICAL* or (TRAINING adj WORKSHOP*) or (TRAINING adj CLINIC*) or (SOUND adj ENRICHMENT) or (SOUND adj THERAP*)).tw. 4 (counselling and (structured or education)).tw.	tinnit%

(Continued)

5 (RETRAIN* or RELEARN* or RE-
CONDITION* or HABITUAT*).tw.
6 (cognitive and therapy).tw.
7 2 OR 3 OR 4 OR 5 OR 6
8 1 AND 7

CONTRIBUTIONS OF AUTHORS

JP: Lead author, protocol development, design of search strategy, review preparation, quality assessment, data extraction and analysis.

DM: Protocol development, review preparation, quality assessment, data extraction and analysis.

DECLARATIONS OF INTEREST

Don McFerran does occasional work at the Tinnitus and Hyperacusis Centre which was one of the departments that developed TRT. However, he was not involved in that development process and has not published specifically on the topic of TRT. He has also conducted research into a possible drug treatment for tinnitus with Glaxo SmithKline. The review authors have provided advice to researchers about the design of a potential TRT trial, after consultation with and on the advice of the Cochrane ENT Group.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We have adopted the Cochrane 'Risk of bias' tool as guided by the *Cochrane Handbook for Systematic Reviews of Interventions* ([Handbook 2008](#)).

INDEX TERMS

Medical Subject Headings (MeSH)

Acoustic Stimulation [*methods]; Patient Education as Topic [*methods]; Randomized Controlled Trials as Topic; Tinnitus [etiology] [*therapy]

MeSH check words

Adult; Humans