

Research article

## Long-term reductions in tinnitus severity

Robert L Folmer

Address: OHSU Tinnitus Clinic, Oregon Hearing Research Center, Department of Otolaryngology, Oregon Health & Science University, Portland, USA

E-mail: folmerr@ohsu.edu

Published: 16 September 2002

Received: 31 May 2002

*BMC Ear, Nose and Throat Disorders* 2002, 2:3

Accepted: 16 September 2002

This article is available from: <http://www.biomedcentral.com/1472-6815/2/3>

© 2002 Folmer; licensee BioMed Central Ltd. This article is published in Open Access: verbatim copying and redistribution of this article are permitted in all media for any non-commercial purpose, provided this notice is preserved along with the article's original URL.

### Abstract

**Background:** This study was undertaken to assess long-term changes in tinnitus severity exhibited by patients who completed a comprehensive tinnitus management program; to identify factors that contributed to changes in tinnitus severity within this population; to contribute to the development and refinement of effective assessment and management procedures for tinnitus.

**Methods:** Detailed questionnaires were mailed to 300 consecutive patients prior to their initial appointment at the Oregon Health & Science University Tinnitus Clinic. All patients were then evaluated and treated within a comprehensive tinnitus management program. Follow-up questionnaires were mailed to the same 300 patients 6 to 36 months after their initial tinnitus clinic appointment.

**Results:** One hundred ninety patients (133 males, 57 females; mean age 57 years) returned follow-up questionnaires 6 to 36 months (mean = 22 months) after their initial tinnitus clinic appointment. This group of patients exhibited significant long-term reductions in self-rated tinnitus loudness, Tinnitus Severity Index scores, tinnitus-related anxiety and prevalence of current depression. Patients who improved their sleep patterns or Beck Depression Inventory scores exhibited greater reductions of tinnitus severity scores than patients who continued to experience insomnia and depression at follow-up.

**Conclusions:** Individualized tinnitus management programs that were designed for each patient contributed to overall reductions in tinnitus severity exhibited on follow-up questionnaires. Identification and treatment of patients experiencing anxiety, insomnia or depression are vital components of an effective tinnitus management program. Utilization of acoustic therapy also contributed to improvements exhibited by these patients.

### Background

Approximately 40 million people in the United States experience chronic tinnitus; 10 million of these people consider their tinnitus to be a significant problem [1]. Hazell [2] reported that 17% of the population in the United Kingdom has chronic tinnitus, but only 14% of those people experiencing tinnitus said that it bothers them a great

deal. Innumerable treatments for this condition have been utilized – with varying degrees of success – by clinicians and patients. The goal of effective tinnitus management is not necessarily to mask or remove the patient's physical perception of tinnitus sounds. In many cases this is not even possible. According to Duckro et al [3], "the treatment of chronic tinnitus is more accurately described

in terms of management rather than cure." Several studies have demonstrated that the matched loudness of tinnitus is not correlated with its severity [4–6].

Tinnitus severity can be defined and quantified several ways: by how much or how often a patient is bothered by tinnitus; by how much or how often tinnitus detracts from the patient's enjoyment of life; or by how disabling patients perceive their tinnitus to be. Various instruments have been developed to assess tinnitus severity. These include the Tinnitus Handicap Questionnaire [7], the Tinnitus Severity Index [8], and the Tinnitus Handicap Inventory [9]. Regardless of which assessment instrument is used, the goal of tinnitus management programs should be to reduce the severity of each patient's tinnitus. That is, clinicians should help patients to learn how to pay less attention to their tinnitus so that it bothers them less of the time. A realistic goal of an effective tinnitus management program is to help patients understand and gain control over their tinnitus, rather than tinnitus having control over them. Ultimately clinicians should strive to help patients progress to the point where tinnitus is no longer a negative factor in their lives.

Many studies have been undertaken to assess the effectiveness of tinnitus management programs or methods. Some of these studies assessed tinnitus severity before treatment was initiated and assessed it again immediately after the treatment program was concluded [10–12]. Other studies included a follow-up assessment of tinnitus severity (usually in the form of a questionnaire) two weeks [13], four weeks [14], six weeks [15], three months [16] or six months [17] after the conclusion of a treatment program.

Few studies of the efficacy of tinnitus treatments have assessed their longer-term effects on tinnitus severity. This is an important point to consider because patients' perception of their tinnitus often changes with time. For example, in their study of more than 1300 patients, Scott et al [18] made the following observations: discomfort from tinnitus and reported loudness of tinnitus increased; however, tolerance to tinnitus improved as the time from tinnitus onset increased.

The importance of long-term follow-up assessment is illustrated by the results of a study by Lindberg et al [19]. This investigation assessed tinnitus severity in 20 patients nine months after they had completed a relaxation / distraction counseling program. Scott et al [14] had published the effects of this treatment program on these same patients based on assessments administered pre-treatment and again four weeks after the conclusion of counseling. Scott et al reported that the patients improved significantly in discomfort and irritation from tinnitus as well as in depression and reported loudness of tinnitus.

However, based on results from the nine-month follow-up questionnaire, Lindberg et al [19] reported that significant improvement remained for only "discomfort from tinnitus." Patients' follow-up responses to the other severity measures were no longer significantly different from pre-treatment values.

Vesterager [20] mailed questionnaires to 154 tinnitus patients 0.5 to 4.5 years (median = 2.2 years) after they attended an audiology clinic in Denmark. The treatment program included patient education and reassurance, psychological counseling, hearing aids and maskers as appropriate. Tinnitus severity was evaluated prior to the initiation of treatment by scoring patients' responses in several areas of complaint including sleep problems, quality of life, concentration problems, sensitivity to stress, irritability, and fear of serious illness. Patients also rated the loudness of their tinnitus. When pre-treatment responses were compared to those from follow-up questionnaires, Vesterager reported that the most severely afflicted patients showed significant improvements in getting to sleep, concentration, and self-rated loudness of tinnitus.

Sanchez & Stephens [21] surveyed 86 patients 18–60 months after they attended the Tinnitus Clinic of the Welch Hearing Institute. In general, patients reported more benefits (2.8 per respondent) than shortcomings (0.8 per respondent) regarding their attendance at this clinic. Specific benefits reported by patients included being fitted with a hearing aid or tinnitus masker; positive characteristics of the staff; and the opportunity to discuss tinnitus with informed clinicians. Specific shortcomings included patient perceptions that clinic treatments were ineffective and the persistence of problematic tinnitus after clinic attendance.

Andersson et al [22] used questionnaires to assess tinnitus distress and the effects of cognitive behavioral therapy (CBT) in a group of patients 3–10 years (average = 4.9 years) after they attended a series of appointments at Uppsala University, Sweden. A majority (59%) of patients who received CBT exhibited reductions in tinnitus-related distress over time. In general, patients' tolerance of tinnitus increased between the time of their initial appointment and the follow-up questionnaire. Maskability of tinnitus at admission was a predictor of tinnitus-related distress at follow-up.

The present study was undertaken for the following reasons: 1) to assess long-term changes in tinnitus severity exhibited by patients who completed a comprehensive tinnitus management program; 2) to identify factors that contributed to changes in tinnitus severity within this population; 3) to contribute to the development and re-

finement of effective assessment and management procedures for tinnitus.

## Methods

Detailed questionnaires were mailed to 300 consecutive patients prior to their initial appointment at the Oregon Health & Science University Tinnitus Clinic between 1998–2001. These questionnaires requested information about patients' medical, hearing, and tinnitus histories [23]. The Appendix contains twelve questions that constitute the Tinnitus Severity Index [8,24], an efficient indicator of the negative impacts of tinnitus upon patients (see Appendix, additional file 1). An abbreviated version of the Beck Depression Inventory (aBDI) was also included [25]. Patients rated the loudness of their usual tinnitus on a 1-to-10 scale (see Appendix, additional file 1). Information from these questionnaires was entered into a database known as the Oregon Tinnitus Data Registry [26].

The initial appointment at the clinic had the following format:

- 1) The Tinnitus Management Team (composed of an otolaryngologist, a neurophysiologist, and an audiologist) reviewed questionnaires and medical records prior to meeting each patient.
- 2) Patients met with all Management Team members for an in-depth interview and review of their medical, hearing, tinnitus, and psychosocial histories and conditions. Patients received education about possible causes of tinnitus as well as reassurance and counseling regarding factors that could exacerbate or improve their condition.
- 3) Otolaryngological and neurological examinations.
- 4) Audiological evaluations including pure tone air and bone conduction thresholds; speech perception in quiet and noise; MCL/UCL; tympanometry.
- 5) Tinnitus evaluations that included matching tinnitus to sounds played through headphones; determination of minimum masking levels; measurements of residual inhibition (see Johnson, 1998 for a description of these procedures).
- 6) Evaluations of acoustic therapies: based on the patient's audiological evaluations, various devices were described and demonstrated. These could include hearing aids, in-the-ear sound generators, tinnitus instruments (combinations of hearing aids + sound generators), table-top sound generation machines, Sound Pillows, tapes or CDs.

7) The Tinnitus Management Team reviewed the results of evaluations and explained them to the patient.

8) Recommendations were formulated and explained to the patient. Referral and contact information regarding medical or psychiatric evaluations, psychological counseling, and other recommended services or products was also provided.

9) Follow-up: patients were encouraged contact the clinic anytime if they had questions and also to inform us of their progress. If they did not call us first, we contacted patients by telephone one and three months after their initial appointment.

Follow-up questionnaires were mailed to the same 300 patients 6 to 36 months after their initial appointment.

These protocols were reviewed and approved by the Institutional Review Board at Oregon Health & Science University. Informed consent was obtained in writing from patients prior to their participation in this study.

Data relating to patient demographics, audiometric thresholds, self-rated (according to the 1-to-10 scale in the Appendix, additional file 1) tinnitus loudness, tinnitus severity, sleep interference, and aBDI scores were analyzed (mean values were calculated and compared using analyses of variance and paired, two-tailed t-tests).

## Results

One hundred ninety patients (133 males, 57 females; mean age 57 years, age range 17 to 87 years) returned follow-up questionnaires 6 to 36 months (mean = 22 months) after their initial tinnitus clinic appointment.

### Tinnitus duration

At the time of their initial appointment, patients reported that their tinnitus had been present for the durations listed in Table 1.

### Audiometric data

Table 2 contains the grand averaged pure tone air conduction thresholds for 190 patients who returned follow-up questionnaires. This pattern of high frequency sensorineural hearing loss is typical for our clinic population. Approximately 90% of the patients who are evaluated in our clinic have some degree of hearing loss. The fact that males traditionally had a greater amount of noise exposure (in military service, in the workplace, and during recreational activities) contributes to the higher percentage of males in the present study and in our general tinnitus clinic population ( $\geq 70\%$  in both cases).

**Table 1: Tinnitus duration**

Years since tinnitus onset	<1	1-2	3-5	6-10	11-20	>20
Number of patients	57	35	22	24	25	27

**Table 2: Grand averaged pure tone air conduction thresholds (dB HL) of 190 patients**

Hz	250	500	1000	2000	3000	4000	6000	8000
Right Ear	14.1 ± 11.0	12.6 ± 12.3	16.0 ± 14.5	21.2 ± 19.0	33.3 ± 24.4	43.6 ± 25.1	46.4 ± 25.6	48.1 ± 27.0
Left Ear	15.1 ± 14.2	14.5 ± 15.6	16.3 ± 16.2	24.2 ± 21.7	36.9 ± 23.6	45.0 ± 25.1	47.9 ± 25.0	49.6 ± 26.9

**Table 3: Mean responses to questionnaires by 190 patients**

	INITIAL	FOLLOW-UP	p≤
<b>SELF-RATED LOUDNESS OF TINNITUS DOES YOUR TINNITUS...</b>	7.06 ± 1.76	6.47 ± 1.93	0.0001*
<b>MAKE YOU FEEL IRRITABLE OR NERVOUS?</b>	3.37 ± 1.02	2.98 ± 1.01	0.0001*
<b>MAKE YOU FEEL TIRED OR STRESSED?</b>	3.39 ± 1.10	3.03 ± 0.99	0.0001*
<b>MAKE IT DIFFICULT FOR YOU TO RELAX?</b>	3.42 ± 1.04	3.05 ± 0.99	0.0001*
<b>MAKE IT UNCOMFORTABLE TO BE IN A QUIET ROOM?</b>	3.40 ± 1.20	3.49 ± 1.04	ns
<b>MAKE IT DIFFICULT TO CONCENTRATE?</b>	3.46 ± 0.99	3.06 ± 0.99	0.0001*
<b>MAKE IT HARDER TO INTERACT PLEASANTLY WITH OTHERS?</b>	3.15 ± 1.10	2.77 ± 1.11	0.0001*
<b>INTERFERE WITH REQUIRED ACTIVITIES?</b>	2.95 ± 1.15	2.49 ± 1.13	0.0001*
<b>INTERFERE WITH SOCIAL ACTIVITIES?</b>	3.17 ± 1.13	2.74 ± 1.15	0.0001*
<b>INTERFERE WITH YOUR OVERALL ENJOYMENT OF LIFE?</b>	3.32 ± 1.06	2.79 ± 1.14	0.0001*
<b>INTERFERE WITH SLEEP?</b>	2.11 ± 0.72	1.94 ± 0.74	0.002*
<b>HOW MUCH EFFORT IS IT TO IGNORE TINNITUS?</b>	2.86 ± .87	2.43 ± 0.93	0.0001*
<b>HOW MUCH DISCOMFORT DO YOU USUALLY EXPERIENCE WHEN TINNITUS IS PRESENT?</b>	2.98 ± 1.03	2.52 ± 0.94	0.0001*
<b>TOTAL TINNITUS SEVERITY INDEX SCORE</b>	37.58 ± 9.00	33.29 ± 9.60	0.0001*

\*statistically significant improvement

### Self-rated loudness of tinnitus

Table 3 contains means, standard deviations, and a statistical comparison (paired, two-tailed t-test) of patients' ratings of the loudness of their tinnitus on the initial and follow-up questionnaires. There was a statistically significant reduction in self-rated tinnitus loudness at the time of the follow-up questionnaire compared to the initial questionnaire.

### Tinnitus Severity Index scores

Table 3 also contains means, standard deviations, and statistical comparisons of patients' responses to twelve questions that comprise the Tinnitus Severity Index. A repeated measures multivariate analysis of variance was performed on these data to control for the number of comparisons as well as for the fact that the same subjects responded to both the initial and follow-up questions. The overall Wilks' Lambda F value was 5.29 with  $p < 0.0001$ . This indicated that there was a significant change in responses on

the follow-up questionnaire and allowed us to proceed with univariate tests. P values resulting from univariate comparisons of initial and follow-up responses to each of the twelve tinnitus severity questions are listed in Table 3. Using an alpha of 0.05, the Bonferroni correction produced a significance level of 0.004 for each of these items.

According to the statistical criteria outlined in the previous paragraph, patients in the present study reported significant improvement in eleven of the twelve Tinnitus Severity Index questions. The only question that did not exhibit significant change was "Does your tinnitus make it uncomfortable to be in a quiet room?" Consequently, this group of patients exhibited a significant reduction in total Tinnitus Severity Index score between the time of their initial clinic appointment and the follow-up questionnaire.

**Sleep interference**

Table 4 contains patients' responses to the question "Does your tinnitus interfere with sleep?" on both the initial and follow-up questionnaires. Compared to the initial questionnaire, there was a significant increase in the number of patients who did not experience sleep interference at the time of follow-up ( $X^2 = 6.92$ ;  $p < 0.05$ ). Sleep patterns of 51 patients (26.8%) improved at least one category between initial and follow-up questionnaires (that is, from "often" to "sometimes" or from "sometimes" to "no" sleep interference). Sleep patterns of 26 patients (13.7%) worsened at least one category, and sleep patterns of the remaining 113 patients (59.5%) stayed the same on initial and follow-up questionnaires. Table 5 contains mean Tinnitus Severity Index scores for these three groups of patients. Patients with frequent sleep disturbances scored significantly higher on the other eleven tinnitus severity items (on both initial and follow-up questionnaires) than patients with fewer sleep disturbances. Patients whose sleep patterns improved at least one category exhibited a significant reduction in Tinnitus Severity Index score. Patients whose sleep patterns did not change exhibited a smaller degree of improvement in tinnitus severity. However, the Tinnitus Severity scores of patients whose sleep patterns worsened did not change significantly. In fact, Tinnitus Severity Index scores for those 26 patients tended to be higher at the time of follow-up compared to their responses on the initial questionnaire.

**Table 4: Responses to "Does your tinnitus interfere with sleep?"**

	INITIAL	FOLLOW-UP
No	39	60
Yes, sometimes	88	83
Yes, often	63	47

**Depression**

Mean aBDI scores for 190 patients in the present study were as follows:  $5.16 \pm 5.32$  on the initial questionnaire,  $5.91 \pm 6.55$  at follow-up. According to Beck & Beck [25], a score of 5–7 on this version of their Inventory can indicate mild depression. In the present study, there was no significant change in aBDI scores for the group. However, 64 patients (33.7%) reported that they were experiencing depression at the time of their initial tinnitus clinic appointment; 44 patients (23.2%) reported that they were experiencing depression at the time of the follow-up questionnaire. This is a significant reduction in the number of patients reporting current depression ( $X^2 = 5.17$ ;  $p < 0.02$ ).

Patients were divided into three groups based on the following criteria: 28 patients whose initial Beck Depression Inventory score decreased by 3 or more points on the follow-up questionnaire; 50 patients whose Beck Depression score increased by 3 or more points on follow-up; 112 patients whose follow-up Beck Depression score stayed within 0–2 points of their initial score. Table 6 contains mean Beck Depression Inventory scores for these three groups of patients. A score of 0–4 on this questionnaire indicates no or minimal depression; a score of 5–7 can indicate mild depression; a score of 8–15 can indicate moderate depression [25]. The mean Beck Depression Inventory score for 28 patients was 10.57 on the initial questionnaire and 3.54 on the follow-up questionnaire. According to Beck & Beck [25], this indicates group improvement from moderate depression to minimal or no depression. The mean Beck Depression Inventory score for 50 patients increased from 5.24 on the initial questionnaire to 12.79 at follow-up. This is a significant increase for the group from mild to moderate depression. The final group of 112 patients exhibited no significant change in Beck Depression Inventory score – they continued to exhibit no or minimal depression. Table 7 contains means of Tinnitus Severity Index scores for these three groups of patients. Patients whose Beck Depression score decreased 3 or more points exhibited significant reductions in Tinnitus Severity Index scores. Patients whose follow-up Beck Depression score stayed within 0–2 points of their initial Beck score exhibited a smaller degree of improvement in tinnitus severity. However, patients whose initial Beck Depression score increased 3 or more points on the follow-up questionnaire did not exhibit significant changes in Tinnitus Severity Index scores.

**Discussion**

A majority of patients in the present study exhibited significant reductions in tinnitus severity 6 to 36 months after participating in a comprehensive tinnitus management program. What was responsible for these improvements? Because the tinnitus management programs in our clinic

**Table 5: Tinnitus Severity Index scores**

	INITIAL	FOLLOW-UP	p<
51 patients whose sleep patterns improved	40.47 ± 8.31	31.25 ± 8.35	0.0001*
26 patients whose sleep patterns worsened	38.27 ± 8.43	40.88 ± 9.82	ns
113 patients whose sleep patterns stayed the same on initial and follow-up questionnaires	35.93 ± 9.52	33.09 ± 9.85	0.005*

\*statistically significant improvement

are multidimensional and designed for each patient according to his or her personal and medical histories and conditions, it is impossible to identify one procedure or treatment that was primarily responsible for the overall improvement of the group. However, a combination of the following recommendations and treatments contributed to reductions in tinnitus severity exhibited by patients in the present study:

**Patient education, reassurance, and demystification of tinnitus**

During their initial clinic appointment, all patients received information about the most likely cause of their tinnitus and about factors that can either exacerbate or improve the condition. A better understanding of the mechanisms of tinnitus and a review of effective management strategies can reduce anxiety associated with the "fear of the unknown" experienced by many patients [27].

Tinnitus education provided a great deal of reassurance for patients. Medical examinations and tests provided additional reassurance that their tinnitus was not a symptom of a degenerative or potentially fatal condition. The process of patient education and reassurance helps to demystify tinnitus and can facilitate a reduction in the severity of this symptom. Patients in the study by Sanchez & Stephens [21] reported that the "opportunity to discuss tinnitus with informed staff" was one of the most beneficial aspects of their clinic appointment.

**Acoustic therapy**

Acoustic therapy is using external sounds to provide relief or distraction from tinnitus. This is a vital component of an effective tinnitus management program. All of our patients use acoustic therapy in one or more of its forms.

There are numerous techniques and devices that can help patients to increase their exposure to safe and pleasant external sounds in order to decrease their awareness of tinnitus. This strategy has multiple advantages and benefits:

- Acoustic therapy is non-invasive and has no adverse side effects.
- Patients often obtain immediate relief from – or reduced perception of – their tinnitus.
- Patients can use external sounds to exert some control over their tinnitus. This often results in reduced patient frustration and anxiety.
- Some patients experience residual inhibition: tinnitus suppression or temporary disappearance following exposure to external sounds.
- Acoustic therapy can facilitate patients' habituation to tinnitus. That is, increasing the level of external sounds within safe limits can help patients learn to pay less attention to their tinnitus. If tinnitus becomes less noticeable, patients will be bothered by it less of the time.
- Increased exposure to external sounds (within safe limits) increases blood flow throughout the auditory system. This helps to nourish and maintain auditory structures and might also contribute to healing processes when possible.
- Increased exposure to external sounds over time could contribute to reorganizations of neural pathways responsible for tinnitus generation and perception. Reductions of superfluous activity within the central auditory system might result in permanent reductions in tinnitus perception.

Depending on test results and individual preferences, patients can increase the level of pleasant sounds in any environment by using hearing aids, in-the-ear sound generators, tinnitus instruments (combinations of hearing aids + sound generators), tabletop sound generation machines, Sound Pillows, tapes or CDs.

**Table 6: Beck Depression Inventory scores**

	INITIAL	FOLLOW-UP	p<
28 patients whose Beck Depression score <u>decreased</u> by 3 or more points	10.57 ± 5.45	3.54 ± 3.86	0.0001*
50 patients whose Beck Depression score <u>increased</u> by 3 or more points	5.24 ± 4.81	12.79 ± 6.65	0.0001*
112 patients whose follow-up Beck Depression score stayed within 0–2 points of their initial score	3.77 ± 4.58	3.43 ± 4.52	ns

\*statistically significant change

**Table 7: Tinnitus Severity Index scores**

	INITIAL	FOLLOW-UP	p<
28 patients whose Beck Depression score <u>decreased</u> by 3 or more points	43.46 ± 6.96	32.89 ± 8.87	0.0001*
50 patients whose Beck Depression score <u>increased</u> by 3 or more points	41.08 ± 8.07	40.79 ± 9.28	ns
112 patients whose follow-up Beck Depression score stayed within 0–2 points of their initial score	34.42 ± 9.75	30.76 ± 9.89	0.0002*

\*statistically significant improvement

**Improvements in sleep patterns**

Patients whose sleep patterns improved at least one category exhibited a 32% reduction in Tinnitus Severity Index score on the follow-up questionnaire. Improvements in sleep patterns experienced by these patients were attributable to several factors: medications; additions of pleasant sounds to the bedroom; reduced anxiety; improved coping strategies, attention-switching, and relaxation techniques; and psychological counseling. When appropriate, patients with insomnia were advised to talk with their physicians about the occasional use of over-the-counter or prescription medications that might improve their sleep patterns. In cases of severe and persistent insomnia that did not improve by implementation of our recommendations, patients were referred to specialized sleep clinics for evaluation and treatment. The fact that improvements in sleep interference contributed to improvements in overall ratings of tinnitus severity underscores the importance of identifying and effectively treating insomnia.

**Psychological counseling**

Some directive counseling occurred during the initial clinic appointment including advice about relaxation and attention-switching techniques, and identification of problems (including insomnia, depression, anxiety, stress, anger, and obsessive-compulsive tendencies) that might require long-term psychotherapy. Patients who would benefit from ongoing psychotherapy were referred to psychiatrists or psychologists near their home. Anderson et al [22] demonstrated that cognitive behavioral therapy

can help to reduce tinnitus-related distress for a majority of patients.

**Treatment for anxiety and depression**

Patients who reported high levels of stress or anxiety were referred to psychiatrists or psychologists for evaluation and treatment. In the present study, patients exhibited significant reductions in tinnitus-related anxiety as reflected by their responses to the following questions on initial and follow-up questionnaires (see Table 3): Does your tinnitus make you feel irritable or nervous? Does your tinnitus make you feel tired or stressed? Does your tinnitus make it difficult for you to relax?

Psychiatric evaluations were recommended a) for all patients who reported current depression; b) for patients who scored 8 or higher on the aBDI at the time of their initial appointment. Ongoing psychotherapy was also recommended for these patients. Even though there was no significant change in mean aBDI scores for the group as a whole, there was a significant reduction in the number of patients who reported current depression at the time of follow-up (44) compared to the initial clinic appointment (64). Patients whose initial aBDI scores decreased 3 or more points on the follow-up questionnaire exhibited a 33% reduction in Tinnitus Severity Index scores. Patients whose initial aBDI scores increased 3 or more points on the follow-up questionnaire did not exhibit any significant changes in tinnitus severity. These results underscore

the importance of identifying and effectively treating depression.

Previous studies demonstrated that tinnitus severity is positively correlated with patients' degree of depression [28], insomnia [29] and anxiety [6]. Effective treatment of these co-symptoms with psychological counseling in conjunction with medications often reduces the severity of patients' tinnitus. A common question is: "Did improvements in insomnia, anxiety and depression lead to improvements in tinnitus severity, or did a reduction in tinnitus severity precipitate improvements in these co-symptoms?" Halford & Anderson [30] gave an excellent answer to this chicken-and-egg conundrum: "It is considered that the causal relationship between these psychological variables and tinnitus severity is likely to be bidirectional."

#### **Lifestyle changes**

Based on findings from questionnaires, patient interviews and testing, specific recommendations were made to some individuals regarding the following: recreational and occupational noise exposure; medications; diet; exercise; employment; socialization; acoustic therapy. Patients were referred to other professionals for evaluation and treatment when necessary.

#### **Follow-up**

Patients were encouraged to contact the tinnitus clinic any time during business hours if they had questions or concerns. Patients who ordered in-the-ear devices required follow-up appointments for fittings and adjustments. If we did not hear from them first, we called patients one week, one and three months after their initial appointment. Follow-up questionnaires were mailed to patients six months and one year after their initial appointment. Additional questionnaires are sometimes sent to patients years later.

Clinician-initiated contact at regular intervals after the initial appointment is important for several reasons:

- to let patients know that clinicians are committed to helping them
- to address patients' questions or concerns
- to check patients' compliance with recommendations
- to modify recommendations or to suggest different strategies when necessary
- to assess the effectiveness of the tinnitus management program

We reminded patients that recommendations made to them at the conclusion of their initial appointment in the clinic are starting points. If a patient follows all of the initial recommendations and yet the severity of his tinnitus does not improve over the course of six months, we either suggested different strategies for him to try or asked the patient to return to the clinic for re-evaluation and additional counseling. Different devices and tinnitus management strategies might be described or demonstrated during the follow-up appointment. Particular recommendations were then reinforced or modified.

#### **Conclusions**

Identification and treatment of patients experiencing anxiety, insomnia or depression are vital components of an effective tinnitus management program. Utilization of acoustic therapy also contributed to improvements exhibited by patients in the present study. Individualized treatment programs that were designed for each patient contributed to the overall improvement in tinnitus severity reported on follow-up questionnaires. Several clinicians agree that a combination of tinnitus management strategies is more effective than one form of remediation used in isolation [16,27,31,32]. Even though a customized combination of recommendations is effective for many patients with chronic and bothersome tinnitus, the process can be very time consuming. The time required for patient assessment, education, reassurance, and counseling, as well as for designing and initiating an individualized tinnitus management program can take more than four hours during the initial appointment. Follow-up appointments can last two hours or more. Most family physicians and otolaryngologists are not able to spend even a small fraction of this much time with one patient during an office visit. If a clinician has assessed and treated every reasonable medical cause for a patient's tinnitus, and the patient reports little improvement in tinnitus severity, the clinician should refer the patient to a comprehensive tinnitus management program with experienced personnel who are willing and able to spend a substantial amount of time with each patient. Because chronic tinnitus has several characteristics and co-symptoms in common with chronic pain, pain management strategies can be effective for some tinnitus patients [6,32].

#### **Competing interests**

None declared.

#### **Authors' contributions**

The author conceived and conducted the study. He read and approved the final manuscript.



## Additional material

### Additional File

*Tinnitus Severity Questions*

Click here for file

[<http://www.biomedcentral.com/content/supplementary/1472-6815-2-3-S1.doc>]

## References

- Seidman MD, Jacobson GP: **Update on tinnitus.** *Otolaryngologic Clinics of North America* 1996, **29(3)**:455-465
- Hazell J: **Tinnitus and disability with ageing: adaptation and management.** *Acta Otolaryngol (Suppl)* 1990, **476**:202-208
- Duckro PN, Pollard CA, Bray HD, Scheiter L: **Comprehensive behavioral management of complex tinnitus: a case illustration.** *Biofeedback and Self-Regulation* 1984, **9(4)**:459-469
- Meikle MB, Vernon J, Johnson RM: **The perceived severity of tinnitus.** *Otolaryngol Head and Neck Surg* 1984, **92(6)**:689-696
- Baskill JL, Coles RRA: **Relationships between tinnitus loudness and severity.** In: *Proceedings of the Sixth International Tinnitus Seminar (Edited by: Hazell J)* London, The Tinnitus and Hyperacusis Centre 1999, 424-428
- Folmer RL, Griest SE, Martin WH: **Chronic tinnitus as phantom auditory pain.** *Otolaryngol Head and Neck Surg* 2001, **124(4)**:394-400
- Kuk FK, Tyler RS, Russell D, Jordan H: **The psychometric properties of a tinnitus handicap questionnaire.** *Ear Hear* 1990, **11(6)**:434-445
- Meikle MB, Griest SE, Stewart BJ, Press LS: **Measuring the negative impact of tinnitus: A brief severity index.** *Abstr Assoc Res Otolaryngol* 1995, 167
- Newman CW, Jacobson GP, Spitzer JB: **Development of the Tinnitus Handicap Inventory.** *Arch Otolaryngol Head Neck Surg* 1996, **122(2)**:143-148
- Dobie RA, Sakai CS, Sullivan MD, Katon WJ, Russo J: **Antidepressant treatment of tinnitus patients: report of a randomized clinical trial and clinical prediction of benefit.** *Am J Otol* 1993, **14**:18-23
- Sadlier M, Stephens SDG: **An approach to the audit of tinnitus management.** *J Laryngol Otol* 1995, **109**:826-829
- Rosenberg SI, Silverstein H, Rowan PT, Olds MJ: **Effect of melatonin on tinnitus.** *Laryngoscope* 1998, **108**:305-310
- Lindberg P, Scott B, Melin L, Lyttkens L: **The psychological treatment of tinnitus: an experimental evaluation.** *Behav Res Ther* 1989, **27(6)**:593-603
- Scott B, Lindberg P, Lyttkens L, Melin L: **Psychological treatment of tinnitus.** *Scand Audiol* 1985, **14**:223-230
- Ireland CE, Wilson PH, Tonkin JP, Platt-Hepworth S: **An evaluation of relaxation training in the treatment of tinnitus.** *Behav Res Ther* 1985, **23(4)**:423-430
- Dineen R, Doyle J, Bench J: **Managing tinnitus: a comparison of different approaches to tinnitus management training.** *Br J Audiol* 1997, **31**:331-344
- Hazell JWP, Wood SM, Cooper HR, et al: **A clinical study of tinnitus maskers.** *Br J Audiol* 1985, **19**:65-146
- Scott B, Lindberg P, Melin L, Lyttkens L: **Predictors of tinnitus discomfort, adaptation and subjective loudness.** *Br J Audiol* 1990, **24**:51-62
- Lindberg P, Scott B, Melin L, Lyttkens L: **Long-term effects of psychological treatment of tinnitus.** *Scand Audiol*. 1987, **16**:167-172
- Vesterager V: **Combined psychological and prosthetic management of tinnitus: a cross-sectional study of patients with severe tinnitus.** *Br J Audiol* 1994, **28**:1-11
- Sanchez L, Stephens D: **Survey of the perceived benefits and shortcomings of a specialist tinnitus clinic.** *Audiology* 2000, **39**:333-339
- Andersson G, Vretblad P, Larsen HC, Lyttkens L: **Longitudinal follow-up of tinnitus complaints.** *Arch Otolaryngol Head Neck Surg* 2001, **127**:175-179
- Johnson RM: **The masking of tinnitus.** In: *Tinnitus Treatment and Relief (Edited by: Vernon JA)* Boston, Allyn and Bacon 1998, 164-186
- Meikle MB: **Methods for evaluation of tinnitus relief procedures.** In: *Tinnitus 91: Proceedings of the Fourth International Tinnitus Seminar (Edited by: Aran JM, Dauman R)* Amsterdam, Kugler Publications 1992, 555-562
- Beck AT, Beck RW: **Screening depressed patients in family practice: a rapid technic.** *Postgrad Medicine* 1972, **52(6)**:81-85
- Meikle MB: **Electronic access to tinnitus data: The Oregon Tinnitus Data Archive.** *Otolaryngol Head and Neck Surg* 1997, **117**:698-700
- Jastreboff PJ, Hazell JWP: **A neurophysiological approach to tinnitus: clinical applications.** *Br J Audiol* 1993, **27**:7-17
- Folmer RL, Griest SE, Meikle MB, Martin WH: **Tinnitus severity, loudness and depression.** *Otolaryngol Head and Neck Surg* 1999, **121**:48-51
- Folmer RL, Griest SE: **Tinnitus and insomnia.** *Am J Otolaryngol* 2000, **21(5)**:287-293
- Halford JB, Anderson SD: **Anxiety and depression in tinnitus sufferers.** *J Psychosom Res* 1991, **35(4)**:383-390
- Jakes SC, Hallam RS, Chambers C, Hinchcliffe R: **Group cognitive therapy for medical patients: an application to tinnitus.** *Cog Therapy Res* 1992, **16(1)**:67-82
- Hamill-Ruth RJ, Ruth RA, Chastain DC, Cook A: **Management of tinnitus and hyperacusis using a multidisciplinary pain model.** *American Pain Society Bulletin* 2000, **10(5)**: [<http://www.ampain-soc.org/pub/bulletin/sep00/article1.htm>]

## Pre-publication history

The pre-publication history for this paper can be accessed here:

<http://www.biomedcentral.com/1472-6815/2/3/prepub>

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMedCentral will be the most significant development for disseminating the results of biomedical research in our lifetime."

Paul Nurse, Director-General, Imperial Cancer Research Fund

Publish with **BMC** and your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours - you keep the copyright



**BioMedCentral.com**

Submit your manuscript here:

<http://www.biomedcentral.com/manuscript/>

[editorial@biomedcentral.com](mailto:editorial@biomedcentral.com)