

Preliminary longitudinal results of neuropsychological education as first and sole intervention for new tinnitus patients

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Abstract

Introduction: Tinnitus is a potentially aggravating symptom without curative treatment. Cognitive Behavioral Therapy has been proved effective. It aims to learn to cope with tinnitus by reducing fearful appraisal of tinnitus. Education is an important part of that therapy. Neuropsychological education alone in an early stage of the symptom might reduce the need for extensive therapy. **Objective:** To evaluate change of tinnitus related handicaps after neuropsychological education. **Materials and Methods:** One hundred and six new tinnitus patients without otological illnesses were educated in a neurophysiological model of tinnitus after otological inspection and audiometry. This was organized as a monthly standard session. Primary outcome was the Tinnitus Handicap Inventory (THI) score and subscores before intervention and 6 weeks after with follow up after 12 months. Seventy four participants were included for analysis. **Results:** Six weeks post intervention a trend was seen in reduction of catastrophic reactions. After 12 months a significant decrease in THI scores was observed (all p values ≤ 0.01). The majority received no other treatment after the education. There were no significant differences between participants evaluating the workshop positively or negatively with respect to THI scores or tinnitus severity. **Conclusion:** Neuropsychological education may be a sufficient intervention for new tinnitus sufferers.

Keywords: tinnitus, neuropsychology, education, counseling, disease prevention.

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INTRODUCTION

Chronic subjective tinnitus is a phantom sound perception that affects millions of people worldwide¹. The burden of disease can vary greatly, from tinnitus without noticeable suffering to very severe symptoms associated with the risk of suicide²⁻⁴. Having bothersome tinnitus is also associated with psychosomatic suffering^{5,6}, depression, anxiety, irritability, sleep disturbance^{7,8}, cognitive dysfunctioning^{9,10}, general loss of fitness, loss of quality of life, higher health care consumption and loss of economic productivity¹¹.

While neurostimulation and sound therapies are promising, but still experimental¹², there is no evidence from studies to show that pharmacological or other medical interventions have (direct) positive effect in the treatment of tinnitus^{13,14}. In the absence of a cure for tinnitus, clinical management typically focuses on coping by reducing the burden like distress, anxiety or depression and on the audiological treatment of hearing loss^{12,15}.

Although cognitive behavioral therapy (CBT) has been proved to be an effective treatment¹⁶, Tinnitus Retraining Therapy (TRT)¹⁷ provides the most widely used treatment for symptom management. In both CBT and TRT education has an important role. In TRT, directive counselling is combined with sound therapy using hearing aids (or if necessary cochlear implants), broad band ear-level sound generators or environmental sound enrichment (types of masking). A randomised controlled trial by Henry et al.¹⁸ suggests that the combination of masking and counselling in TRT is more effective in establishing habituation than tinnitus masking alone¹⁹. The TRT protocol is fairly extensive in that it recommends follow up sessions at decreasing intervals during two years in which the counselling is repeated.

OBJECTIVES

How effective education is without any form of sound therapy or even without behavioral therapy, remains unclear. For sufferers as well as caretakers, tinnitus is a complex phenomenon to cope with, which requires specialized knowledge. In the first period after the onset of symptoms, patients tend to seek information and guidance. General information is usually given in general practice. A lack of specialized knowledge and therapeutical directives based on that, leaves the patient vulnerable in early stages for developing psychiatric symptoms²⁰.

We developed an educational workshop (2 x 90 minutes) entitled 'Control Over Tinnitus' (COT) based on our earlier published neuropsychological theory of tinnitus mechanisms²¹, which can be applied effectively in the early stages of tinnitus. The workshop can be given to a group as well as to the individual

patient, preferably within three months after the onset of symptoms (period of adjustment).

The primary aim of this evaluation is to investigate whether COT leads to reduction of tinnitus related disabilities in new tinnitus patients. We hypothesize that COT does not effect tinnitus severity, but that it will reduce tinnitus related problems as measured by the Tinnitus Handicap Inventory (THI)²².

MATERIALS AND METHODS

Procedure

Participants in the current evaluation were new consecutive patients who, because of tinnitus, consulted the Ear, Nose and Throat (ENT) outpatient clinic of the Erasmus University Hospital Rotterdam, the Netherlands. They were each clinically examined by an ENT doctor and audiometrically assessed as part of the diagnostic protocol. To all patients who were diagnosed with subjective tinnitus, COT was offered by verbal introduction and an information booklet about the workshop. Having tinnitus was the only inclusion criterium. Exclusion criteria were: clinical suspicion of dementia, drug abuse or psychosis. For those patients and patients who were not willing to participate in a group, COT was offered individually. Participants of individual COT are excluded from this evaluation.

COT was organized as a monthly standard education for a heterogenous group. In a written introductory letter before the start of COT, it was explained to the participants that filling out questionnaires was not a part of the education and that helping to evaluate the workshop was on a voluntary basis. Questionnaires were asked to be filled out before the actual beginning of the education. New COT group meetings were held every two weeks and consisted of 10-15 new patients. In the information booklet which was given at invitation, their spouse or relative was invited to join. In general, this led to an average group size of 20-30 people, with half of them being a tinnitus patient. The maximum waiting time for participation in COT was one month.

Measures

Educational level was assessed by the level of highest attended school, categorized into 3 groups (low, middle, high). The impact of tinnitus in daily living was assessed with the THI at T1. The primary outcome was the reduction in score of the THI at T2. The original THI has a highest-retest reliability²³. The maximum total score is 100. A higher total score indicates a worse outcome, reflecting the overall self-report of unwellbeing and social impairment because of tinnitus. In addition to the use of the total score, subscale scores were evaluated. The subscales of the THI reflect three domains: functional limitations, emotional responses and catastrophic

responses²⁴. Answering possibilities were 'yes' (scored with 4 points), 'sometimes' (2 points) or 'no' (0 points).

We additionally asked: (1) how frequently tinnitus was heard, using a five point scale, ranging from continuous to less than 4 times a month ('incidental'), (2) whether they had been receiving other treatments for tinnitus after their participation in COT (answering possibilities were 'no', 'medication', 'psychological counseling', 'fysiotherapy, acupuncture or other alternative therapy' and 'fitting hearing aids') and (3) whether they personally felt that the education had been of significant help to them, to which they could answer 'yes' or 'no'.

The THI and answers to the additional questions were assessed before the actual start of COT (T0), six weeks after COT (T1) and again twelve months (T2) after COT (T1 and T2 by postal survey).

Intervention

The intervention consisted of 2 consecutive educational, interactive sessions of 90 minutes, separated by a 60 minutes break. The cognitive mechanism of tinnitus was explained using a visual representation of the neuropsychological model (Figure 1) proposed by us in 2010²¹. In the first part, called 'Control over Causes', the preservation of auditory streams were educated by explaining cognitive mechanisms using memory and attention and their role in auditory perception. Mental processes were emphasized. Then a parallel was made with effects on mental processes accompanying psychological and psychosocial dysfunctioning without significant hearing loss.

The suggestion was made that tinnitus is an auditory symptom of neurocognitive overload, rather than a mere symptom of hearing loss. The visual model was used to strengthen the insight in different possible causes of neurocognitive hyperactivity. It was then pointed out that tinnitus is a consequence of overload as a result of a foregoing stressor, rather than an idiopathic phenomenon or disease²¹.

In the second part, called 'Control Over Consequences', reactive stress mechanisms were explained, pointing out a transition by time from active fight or flight reaction to a passive, 'burned out syndrome', consisting of emotional, physical and functional consequences of chronic stress from tinnitus. Vicious circles were identified. Again the education was build upon and accompanied by a visually presented schema (Figure 2). In this part of the workshop it was stated that the absence of soothing answers to the patients core-questions in an early stage leading tot maladaptive coping, may have lead to a negative appraisal of the perception and consequently to chronic stress reactions²⁵.

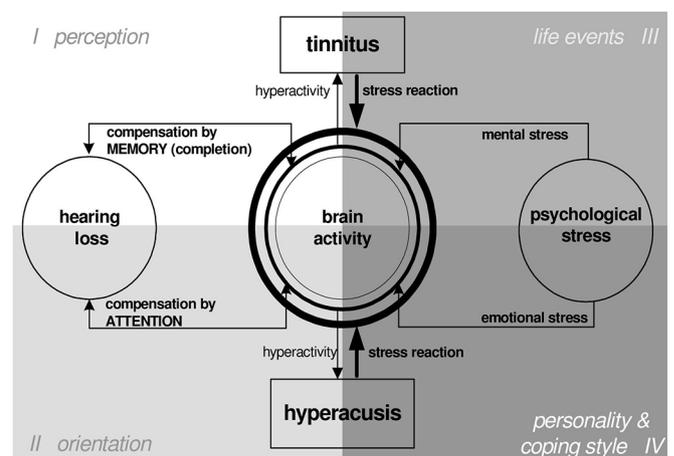


Figure 1. This is the core of the educational workshop 'Control over Tinnitus'. The model visually accompanies the educated cognitive mechanism of tinnitus (and hyperacusis) and emphasizes the role of three possible underlying causal problem fields (causing overload) in a neuropsychological context and explicitly differentiates these from a secondary stress reaction. In an interactive way it is explained that either a significant hearing loss (through normal cognitive (mnestic) compensation called 'completion') or initial psychological imbalance (or a combination) cause an mental overload leading to neuronal hyperactivity. A third possible cause of this overload lies within the brain itself, being a physical organ (e.g. sickness, fatigue, braindamage, usage of drugs etc.). It is educated that the mental overload elevates the adaptive compensatory completion phenomenon to the extent of a symptom which then triggers an emotional stressresponses and a vicious circle as a consequence. Participants are encouraged to think about solutions or therapies for their initial cause of overload in stead of searching for therapy for the primary symptom of it, tinnitus.

Throughout the education the psychological and somatic changes, symptoms and behaviors were 'normalized' by placing them in connection with an understandable feeling of threat. The education concluded with a step by step identification of optional self-help interventions for preventing or reducing symptoms of chronic stress, thus offering the patients active directions to overcome feelings of powerlessness and to preserve (or regain) psychological-somatic strength.

Statistics

Population characteristics were described by means and percentages. Outcome variables were tested for normal distribution. When the data was normally distributed, *t*-tests and means with standard deviations (SD) were used. When the data was not normally distributed non parametric tests and medians were used.

To compare the outcome parameters before and after the intervention we used paired statistics. The emotional subscale of the THI was not normally distributed and thus the nonparametric related sample Wilcoxon signed rank test was used to analyze these data. Patients who did not fill in all items of all three

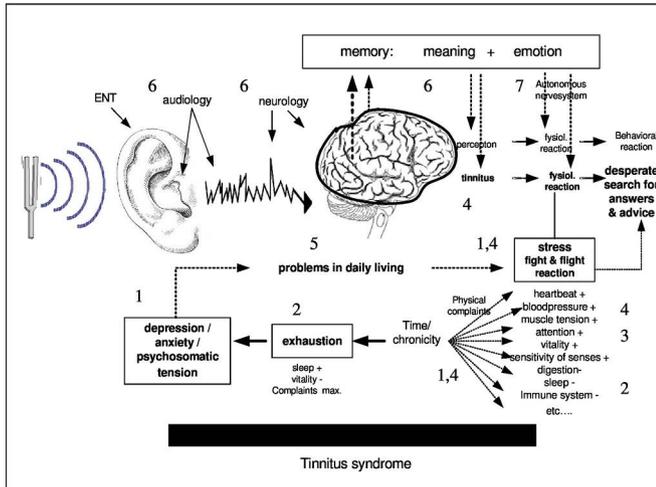


Figure 2. It is explained how the perception of tinnitus with its negative appraisal based on absence of treatment and general pessimistic information and congruent emotional responses, triggers normal autonomic stress responses. Then the development of chronic stress symptoms are educated and vicious circles identified. The numbers stand for the advocated stepped behavioral (guided) self-help possibilities: 1 pharmacological options; 2 training/therapeutical focus on sleep and corrections of daily use of energy; 3 attention distraction techniques making use of hobby or work; 4 relaxation exercise and activities; 5 enhance coping capabilities in general with special attention to negative psychosocial circumstances; 6 understanding of audiogram and objective diagnostical findings; 7 the therapeutical target of habituation by means of emotional stabilisation (explained as an automatic consequence of positive labelling).

consecutive THI questionnaires were excluded from analysis with THI scores. Data were analyzed using IBM SPSS version 21.

RESULTS

At baseline (T0), 106 participants finished the COT education and all were assessed with the THI. Six weeks (T1) and twelve months later (T2) they all received the THI again. After 12 months the THI was returned by 91 patients (86%). Figure 3 shows the flow chart of the participants. Characteristics of the 91 responders and 15 non-responders are presented in Table 1. These groups differed statistically with respect to gender, age and the emotional subscale of the THI. Ninety-six percent of the participants reported to have had audiometry. Seventy-four patients did answer all THI questions at all 3 assessments ('complete responders') and were included for analysis with THI scores (Figure 3).

The baseline characteristics of these 74 patients were compared with the 32 patients with missing data. There were no statistical significant differences in age, gender, education levels, tinnitus frequency (severity) and THI scores.

The scores on the THI and its subscales at baseline, after 6 weeks and 12 months are presented in

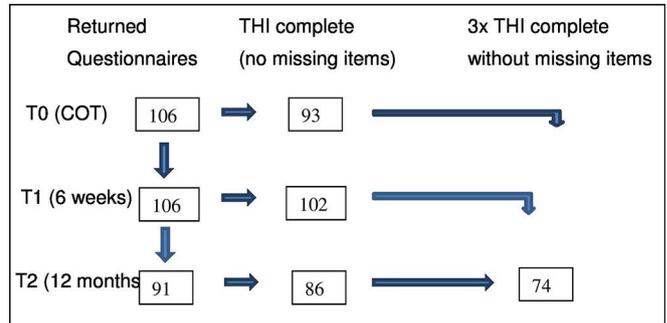


Figure 3. T0 is measurement before neuropsychological education 'Control Over Tinnitus'; T1 is measurement 6 weeks after education 'Control Over Tinnitus'; T2 is measurement 12 months after education 'Control Over Tinnitus'.

Table 2. At six weeks, there was a trend for a decrease in catastrophic reactions ($p = 0.06$). Twelve months post intervention a significant decrease in THI total score and all subscales (the primary outcome variable) was observed (all p values ≤ 0.01).

Before COT, 92% of the participants reported continuous tinnitus, compared with 91% six weeks and 88% 12 months after COT. None of the patients had received a tinnitus focused therapy before COT and all patients had only received basic information by the general practitioner or on the internet before referral. 65% of the 91 responders received no other treatment after COT, whereas 11% started psychological counseling, 9% received one or two hearing aids, 4% received physiotherapy, 4% used medication, 2% started Cognitive Behavioral Therapy (CBT) and 4% tried alternative treatments.

At 12 months, all 91 participants answered the question whether they personally felt COT had been helpful for them. Fifty-four of them (54%) answered positive on that question. Forty-three percent (23/54) of them received an additional intervention elsewhere after COT, whereas this was 24% ($\chi^2 = 3.21$; $p = 0.07$) in the participants who did not feel COT had been helpful. There were no statistical significant differences between participants rating the COT as helpful or not, with respect to THI scores or tinnitus severity.

CONCLUSION

The purpose of this evaluation was to investigate whether neuropsychological psychoeducation (workshop Control over Tinnitus), which was based on our earlier published model²¹, as a first step intervention, would decrease the tinnitus related emotional and functional impairments of tinnitus patients, despite ongoing tinnitus. Our findings support that hypothesis; the majority of participants considered additional therapy unnecessary despite a natural course of tinnitus patients towards varied but significant suffering⁵.

Table 1. Baseline characteristics of the participants.

	(n = 91)	non-responders (n = 15)	p-value	
Gender	54 (59%) 37 (41%)	13 (87%) 2 (13%)	0.042	
Mean age (sd)	54 (12)	47 (11)	0.032	
Education levels	low middle high	18 (20%) 38 (42%) 35 (39%)	2 (13%) 7 (47%) 6 (40%)	0.833
Tinnitus severity	continuous daily weekly incidental (< weekly) missing	75 (82%) 4 (4%) 2 (2%) 1 (1%) 9 (10%)	14 (93%) 1 (7%) - - -	0.809 (continuous vs rest)
THI at baseline (median)	Total sum score Emotional Functional Catastrophical	48 (n = 81) 12 (n = 89) 24 (n = 83) 10 (n = 89)	49 (n = 12) 20 (n = 15) 26 (n = 12) 12 (n = 15)	0.330 0.046 0.567 0.221
Hearing loss > 30 dB	yes no not available	60 (66%) 17 (19%) 14 (15%)	11 (73%) 4 (27%) -	0.243

THI: Tinnitus Handicap Inventory; sd: Standard Deviation; dB: Decibel Responders.

Table 2. Scores before and after COT for completely responders (n = 74).

	Before COT (baseline)	6 weeks after COT	p-value ¹	12 months after COT	p-value ²
THI total score					
Median	47	41	0.25	34	< 0,01
IQR	28-62	26-63		16-56	
THI emotional score					
Median	12	10	0.20	8	< 0,01
IQR	6-17	4-16		2-16	
THI functional score					
Median	24	23	0.84	20	< 0,01
IQR	16-32	16-32		8-31	
THI catastrophic score					
Median	10	10	0.06	8	< 0,01
IQR	8-12	4-12		4-12	
	12	12		12	

COT: Workshop Control over Tinnitus; THI: Tinnitus Handicap Inventory; IQR: Interquartile range; p-value¹: Comparison between baseline measurement and 6 weeks after COT; p-value²: Comparison between baseline measurement and 12 months after COT.

We found that at 12 months after COT the score on the Tinnitus Handicap Inventory was significantly reduced compared to baseline, despite ongoing tinnitus. A trend was already seen in the reduction of catastrophic thinking 6 weeks after COT, indicating reassurance. The significant decrease in reported impairments (from a mean of 45 to 38 points) in one year after only 180 minutes of standardized neuropsychological education can be considered as fairly good in comparison with extensive CBT¹⁶.

The decrease in the THI scores in the multi-stepped care treatment of Cima et al.¹⁶ covering several elements (including education) was from a mean of 39 to 26. Which of the different elements of that therapy contributed to the improvements was unknown. Phillips et al.⁹ reported a decrease of 18 points on THI score after Tinnitus Retraining Therapy.

Although there was no control group, making it impossible to draw conclusions from our evaluation,

the reduction in the tinnitus related impairments seems to suggest that a progressive decline of well being due to tinnitus could be prevented by neuropsychological psychoeducation when given within the first three months of tinnitus.

Other factors may have accounted for the improvement of well being in our population. First of all, additive treatments may explain the improvement. However, most of the patients chose not to use other therapies. This may indicate reassurance, which makes this a less likely explanation of our results. In fact, one of the behavioral self-help directives of COT is to seek and select further therapy if necessary on the basis of insight instead of panic.

Second, it could have been the case that the majority of participants were simply not prone to develop psychological imbalance, for the determinants of a deviant course in wellbeing are insufficiently clear.

Thirdly, natural habituation of tinnitus regardless the education may explain the improvements observed in the current evaluation. In our opinion, this is unlikely because the course of an individual's state of well being in bothersome tinnitus without further specialized therapy, typically progresses towards significant psychological suffering⁵. Furthermore, the THI score represents a subjective judgment of well being and is therefore dependent on psychological health and satisfaction about the offered care and feelings of being understood by health care professionals.

Tyler et al.²⁶ as well as Henry et al.²⁷ have suggested that every clinical tinnitus management program should consist of education. To this end, they advised educational counselling and suggested that additional therapy by psychologists or other mental health care professionals would be required only in cases of psychiatric comorbidity. We tend to agree with them as long as an educational protocol like COT takes place as early as possible in order to emotionally stabilize the tinnitus patient and reduce the risk of psychopathological development.

In our opinion, education should not be used only as an introduction for a tinnitus therapy but as a first step, stand alone intervention with a therapeutic purpose of its own. In this sense, we suggest that the educational emphasis should be directed towards emotional stability, self-help, or therapeutic compliance, while addressing self-awareness and one's own capacity to effect change in circumstances. For that reason the education should be standardized, like the neuropsychological education of COT. In that way it can take on the role of a first step in a stepped care approach in which every single step should be potentially the last step.

Randomized and blind studies using different educational paradigms and a control group would be

necessary in order to be able to draw conclusions. Additionally, longitudinal research of determinants for the development of psychiatric comorbidity because of tinnitus is needed to maximize the efficiency of specialized education in general health care. As the patients in this evaluation were recruited from a tertiary ENT department, results cannot plainly be applied to other populations.

We conclude that the neuropsychological educational protocol COT may be a sufficient first step intervention for new tinnitus sufferers, helping them to cope with tinnitus. This is relevant as regards to treatment efficiency and prevention of psychiatric disorders.

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