

Original Article

Music therapy as an early intervention to prevent chronification of tinnitus

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Abstract: In the present study a music therapeutic intervention according to the 'Heidelberg Model' was evaluated as a complementary treatment option for patients with acute tinnitus whom medical treatment only brought minimal or no improvement. The central question was if music therapy in an early phase of tinnitus was able to reduce tinnitus symptoms and to prevent them from becoming chronic. 23 patients with acute tinnitus (6-12 weeks) were included in this study and took part in our manualized short term music therapeutic treatment which lasted ten consecutive 50-minutes sessions of individualized therapy. Tinnitus severity and individual tinnitus related distress were assessed by the Tinnitus Beeinträchtigungs-Fragebogen (i.e. Tinnitus Impairment Questionnaire, TBF-12) at baseline, start of treatment, and end of treatment. Score changes in TBF-12 from start to end of the treatment showed significant improvements in tinnitus impairment. This indicates that this music therapy approach applied in an initial stage of tinnitus can make an important contribution towards preventing tinnitus from becoming a chronic condition.

Keywords: Music therapy, early intervention, acute tinnitus, recent-onset tinnitus, chronification

Introduction

Acute tinnitus is the phenomenon of ringing or buzzing in the ears without an external sound source that has been persisting for no longer than three months. The sudden appearance of tinnitus can be triggered by different factors. The most common causes are sudden sensorineural hearing loss as well as noise-induced hearing loss, resulting from exposure to high-intensity sounds (acute acoustic trauma). Furthermore, acute tinnitus frequently occurs as a result of stressful and emotionally charged life situations or as a side effect of medication.

Several pharmacological treatment options for acute tinnitus have been established. Usually it is treated equivalently to sudden sensorineural hearing loss [1] or any cochlear damage [2]. Nonetheless, after initial medical intervention, tinnitus symptoms are often persisting and leading to substantial distress. Many tinnitus patients display psychiatric co-morbidities or psychological stress symptoms [3]. Particularly

in patients with tinnitus of recent-onset, depression and strong emotional reactions during initial manifestation of tinnitus might be of prognostic value concerning the level of emotional distress and decompensation in chronic stage of tinnitus [4].

Although the exact causes for tinnitus generation are not completely understood yet, structural and functional alterations of neuronal networks seem to play a crucial role [5-7]. So far, the research on neural changes associated with tinnitus perception has focused almost exclusively on patients with chronic tinnitus. Electrophysiological and neuro-imaging studies in patients with chronic tinnitus give increasing evidence of alterations both within the central auditory system and in non-auditory brain areas [8-13]. These non-auditory brain areas include structures involved in attention and concentration (dorsolateral prefrontal cortex, ventrolateral prefrontal cortex, and anterior cingulate cortex), in memory recollection and consolidation (hippocampus and parahippocampal gyrus), in emotional evaluation and regulation (amygdala)

and in interoceptive awareness (insular cortex).

The main objective of a recently published paper on acute tinnitus by Vanneste et al. [14] was to investigate the differences of the neural networks between tinnitus of recent-onset and chronic tinnitus. Their results indicate that the neural structures detected in both acute and chronic tinnitus were identical (comprising auditory cortices, insula, dorsal anterior cingulate cortex and premotor cortex) but they also revealed differential activity and connectivity patterns within this network.

The latter mentioned trial is dealing with an important issue concerning the transition from acute to chronic manifestation of tinnitus. Nearly everybody is familiar with brief spontaneous tinnitus sensations lasting from a few seconds up to several hours. However, little is known about how and why a transient tinnitus sensation develops into a chronic condition, and if there are any preventive factors which could influence the chronification of tinnitus symptoms.

The aim of the current study was to evaluate a neuro-music therapy approach as a complementary treatment option for patients with acute tinnitus who achieved minimal or no improvement of tinnitus symptoms by means of medical treatment.

The central question was if music therapy applied in an early phase of tinnitus was able to reduce tinnitus symptoms and to prevent them from becoming a chronic condition.

The study was conducted in accordance with the Declaration of Helsinki and approved by the local ethics committee.

Materials and methods

Study participants

The pilot study was conducted in accordance with the Declaration of Helsinki and approved by the local ethics committee. Patients were eligible for the study if they had a clinical diagnosis of acute tinnitus persisting for a maximum of 3 months without significant impact of an initial medical intervention according to AWMF guidelines (glucocorticoids or rheological drugs). If the tinnitus was Tinnitus related to ana-

tomous lesions of the ear, to retrocochlear lesions or to cochlear implantation, patients were excluded. Further exclusion criteria were clinical diagnosis of a severe mental disorder, clinical diagnosis of Menière's Disease, severe hyperacusis or severe hearing impairment.

23 patients (11 woman and 12 men), 19-60 years old (mean : 41,3; SD : 12,1) fulfilled the criteria and were included in the trial after they have given written informed consent. Mean time since tinnitus onset was 6-12 weeks, all patients had age appropriate hearing levels and no record of any otological or psychological co-morbidity.

Procedure

Immediately after completion of pharmacological treatment tinnitus patients underwent a preparticipation evaluation. In addition to standard audiological testing and otolaryngological examination, important demographic and tinnitus related data were collected.

Before implementation of music therapy a waiting period up to four weeks must be observed in order to exclude both delayed drug response and the influence of possible spontaneous remission.

The Heidelberg Model of Music Therapy

The "Heidelberg Model of Music Therapy" is a manualized short term music therapeutic intervention lasting for nine consecutive 50-minute sessions of individualized therapy. It strives for an integration of strategies to manage the psychological state and possibly restore the underlying neurophysiological reorganisation. At the basis of this music therapy concept is the notion that tinnitus is experienced as an auditory percept - just as musical stimuli are experienced as auditory percepts. An outstanding feature of this treatment approach is the way in which patients actively influence their symptoms. This leads to an improved self-efficacy and a more differentiated picture of their symptomatology. For a detailed description of this music therapy concept see Argstatter et al. [15].

TBF

Tinnitus severity and individual tinnitus related distress were assessed by the Tinnitus Beein-

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Table 1. Changes in TBF-12 Questionnaire

| 1. From baseline (T_0) to start of treatment (T_1) | | | | |
|--|--------------|--------------|--------|------|
| | T_0 | T_1 | | |
| | M (SD) | M (SD) | Z | p |
| TBF | 13.12 (6.17) | 13.05 (5.54) | -1.316 | .188 |
| TBF _e | 8.82 (3.84) | 8.81 (3.43) | -1.205 | .228 |
| TBF _f | 4.29 (2.54) | 4.52 (2.18) | -.054 | .957 |
| 2. From start (T_1) to end of treatment (T_2) | | | | |
| | T_1 | T_2 | | |
| | M (SD) | M (SD) | Z | p |
| TBF | 13.05 (5.54) | 9.71 (5.01) | -3.146 | .002 |
| TBF _e | 8.81 (3.43) | 5.95 (3.39) | -3.367 | .001 |
| TBF _f | 4.52 (2.18) | 3.67 (1.88) | -2.325 | .020 |

trächtungs-Fragebogen (i.e. Tinnitus Impairment Questionnaire, TBF-12). The TBF-12 was developed by Greimel et al. [16] and represents the German version of the 25-item English 'Tinnitus Handicap Inventory' (THI) patient questionnaire [17].

The TBF-12 refers to both tinnitus-related functional disabilities (such as concentration difficulties or hearing impairment) and emotional impairments (such as fear, anger or frustration due to the tinnitus).

This 12-item questionnaire therefore records subjective tinnitus severity on a global TB score as well as on two factors or subscales: (1) emotional-cognitive impairment (TBF_{emocog}) and (2) functional-communicative impairment (TBF_{fucom}).

The TBF presents a high internal consistency as reflected by Cronbach's alpha coefficients of $\alpha = .90$ for the TBF global score, $\alpha = .87$ for the factor TBF_{emocog}, and $\alpha = .85$ for the factor TBF_{fucom}.

Statistical analyses

In order to measure and to quantify therapy outcome, TBF scores obtained at three different measurement times (inclusion examinations (= baseline: T_0), start of treatment (T_1), end of treatment (T_2)) were compared. Statistical analysis was performed by using the program IBM SPSS Statistics 20. Due to the small sample size the comparison of means at different assessment times was conducted by the non-parametric Wilcoxon Signed Ranks Test for two

related samples using a level of significance of p -value $< .05$.

Quality of tinnitus sound as well as cause of tinnitus as possible prognostic or influencing factors for therapy outcome were each analyzed statistically using the nonparametric Kruskal Wallis test.

Results

Tinnitus-related characteristics of study participants

Quality of tinnitus sound: 12 patients (52.2%) had a clear tonal tinnitus, 8 patients (34.8%) categorized their tinnitus as noise-like, and 3 patients (13.0%) described their tinnitus as a combination of tonal and noise-like sound.

The causes attributed to tinnitus development were: sudden sensorineural hearing loss (10 patients, 43.5%), job-related or private stress (6 patients, 26.1%), and acute acoustic trauma (2 patients, 8.7%). 5 patients (21.7%) could not determine any specific cause of their symptoms.

Therapy outcome

Score changes in TBF-12 from baseline to start of treatment as well as from start to end of treatment are presented in **Table 1**. The TBF-12 scores (the global score and the two subscales) indicate no improvement in subjective experienced tinnitus impairment from T_0 to T_1 . When comparing TBF-12 scores at T_1 (start of treatment) with TBF-12 scores at T_2 (end of treatment) it is remarkable that there are significant improvements in global TBF-score and in both subscales.

Prognostic factors for therapy outcome

In order to investigate whether the quality of tinnitus sound or the cause of tinnitus were influencing therapy outcome, the individual TBF-12 difference between T_1 and T_2 where compared between different subgroups of tinnitus patients. The Kruskal Wallis test revealed no significant differences in therapy outcome neither in relation to tinnitus sound (tonal, noise-like, combination of both): $H(2) = 1.21$, $p = .549$, nor in relation to cause of tinnitus (sudden sensorineural hearing loss, stress, acute

acoustic trauma, no specific cause): $H(3) = 2.93, p = .402$.

Discussion

The music therapy for recent onset tinnitus according to the 'Heidelberg Model' seems to provide an effective treatment option for patients with acute tinnitus after initial medical treatment has failed.

In recent onset tinnitus, from both a neural and a psychotherapeutic perspective, an early therapeutic intervention seems to be crucial in order to prevent the acute symptoms to become a chronic disease.

The particular advantage of the "Heidelberg Model of Music Therapy" is that it strives for an integration of strategies to manage the psychological state and possibly restores the underlying neurophysiological reorganisation.

At the neural level, consequences of the neural plasticity contribute to the enduring perception of tinnitus. The term "neural plasticity" means the adaptation to altered peripheral input and the compensation for the effects induced by injury or diseases. The early consequences of neural plasticity in the acute phase of tinnitus include mainly the redirection of neural information within the CNS with the development of cross-modal interaction and the initiation of creation of new connections [18].

From the psychotherapeutic point of view it is remarkable that during the initial stage of tinnitus, highly distressed patients display specific reaction patterns which have proved to be dysfunctional and maladaptive in the chronic stage [4]. Especially tinnitus-related sleep disorders, anxiety, and life satisfaction are considered as important predictors of the later tinnitus distress as well as the extent of the decompensation in the chronic stage [19].

Until now there has not been validated any questionnaire especially designed for patients with acute tinnitus. Consequently, fear and uncertainty about the new situation as well as dysfunctional behaviour at initial tinnitus stage can not be recorded adequately. In 2003, Linke et al. [20] have developed a short tinnitus-score for the purpose of measuring patients' subjective evaluation of acute tinnitus. To our knowledge this 8-item tinnitus-score has not yet

been evaluated on a sufficient number of patients. Therefore the Tinnitus Impairment Questionnaire (TBF-12) was used as instrument for valuing therapy outcome because of its good applicability in the therapeutic context. Although it consists of only 12 items, but it has good psychometric properties and correlates highly with other tinnitus questionnaires. TBF-12 was originally not designed to measure to measure tinnitus change over time, but it shows sensitivity to change if the subjective tinnitus complaints decrease or increase [21].

Since there is no control group of patients receiving no treatment, we cannot rule out that other factors apart from the music therapeutic interventions have influenced the positive therapy outcome.

However, a comparison between TBF-score changes from baseline to start of therapy on the one hand and TBF-score changes from the beginning to the end of the treatment on the other hand points out the impact of the therapeutic interventions. While subjective tinnitus distress remains stable over the period from baseline to start of therapy, significant improvements have been shown within the five days of treatment. These improvements occurred regardless of the cause or sound characteristics of tinnitus. This indicates that music therapy applied in an initial stage of tinnitus can make an important contribution towards preventing tinnitus from becoming a chronic condition.

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Disclosure of conflict of interest

There are no editorial or financial conflicts of interests.

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