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Long-term changes in multimodal intensive tinnitus therapy

A 5-year follow-up

Background

Tinnitus

"Tinnitus" refers to a perceived acoustic phenomenon that is not associated with external sources [1, 16]. Instead, it is thought to be caused by peripheral and central neurophysiological and psychophysiological mechanisms involving the auditory pathway [8, 24, 35]. Tinnitus can:

(1) comprise simple or complex sounds;
(2) be intermittent or constant;
(3) occur uni- or bilaterally;
(4) be compensated or decompensated, i. e., highly distressing; and
(5) be acute or chronic (>3 months) [29].

Patients with decompensated tinnitus are often characterized by: (1) an increased attentional focus on tinnitus, (2) associated concentration difficulties, (3) high levels of stress or anxiety, and (4) depression [12]. Tinnitus is further associated with a variety of psychiatric, neurological, cardiovascular, or autoimmune conditions [25, 34]. Additionally, processing of tinnitus-related stimuli and experience has to be considered on all levels of auditory processing as well as in its interactions with non auditory cortical areas [13]. Neuropsychologically, individual tinnitus-related distress has been associated with activation of a nonspecific central distress network [7, 30]. Given the complexity of tinnitus, a multimodal conceptualization and treatment model is indicated.

Therapeutic approaches

The current literature reports many different treatment modalities for tinnitus [18, 36]. Among these, tinnitus retraining therapy [2, 20–22] has been most widely used. Cognitive behavioral therapy (CBT) has been shown to result in significant improvements in tinnitus-related distress [6].

Tinnitus retraining therapy

Tinnitus retraining therapy (TRT; [20]) aims to help patients habituate to the perception of tinnitus. TRT includes a combination of counseling and distracting auditory stimulation using noise maskers or hearing aids. In German-speaking countries, TRT further incorporates psychological components [32]. While some studies confirm the efficacy of TRT (e. g., [10]), it is often used in a nonstandardized manner thus posing challenges to the systematic evaluation of its effectiveness [29].

Cognitive behavioral therapy

Whilst the clinical effectiveness of TRT is not clearly established, CBT has demonstrated its efficacy in improving quality of life and comorbid symptoms such as depression in chronic tinnitus [26] while not directly affecting perceived tinnitus loudness.

Multimodal therapy programs

Multimodal therapy programs (including counseling, CBT, and auditory stimulation) have been shown to result in an improvement of quality of life, tinnitus severity, and perceived disability [6, 15, 16, 27, 28]. Inpatient multimodal psychosomatic therapies also show good effects [16]. For example, Seydel et al. [33] examined the efficacy of a modified, multimodal TRT (MTRT)—which used to be offered at the Charité before 2012—at 1- and 3-year follow-up periods. Treatment comprised a 7-day intensive program and follow-up examinations for a period of up to 1 year. It included informational counseling, detailed psychosocial as well as ENT diagnostics, CBT, attentional retraining exercises, relaxation exercises, and physiotherapy. Therapeutic improvements were recorded using the Tinnitus Questionnaire (TQ; [11]). Tinnitus burden, quality of life, stress, and depressive symptoms improved significantly at the end of therapy. Gains were maintained at 1- and 3-year follow-up. The MTRT programme has further been shown to result in increased habituation to tinnitus and in improvement in associated distress as measured by the TQ [31–33].

The current study presents the 5-year follow-up outcome data of the MTRT program. It is hypothesized that (1) post-treatment levels of tinnitus burden as well as associated stress and depressive symptoms will be maintained at 5-year follow-up, and (2) patients with decompensated compared to compensated tinnitus will show improvements that are more

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Table 1 Descriptive statistics for the Tinnitus Questionnaire

	Day 1 (M, SD)	Day 7 (M, SD)	5-Year follow-up (M, SD)
Emotional burden[a]	9.02 (5.17)$_a$	6.94 (4.78)$_{b**}$	6.53 (5.08)$_b$
Cognitive burden[a]	5.90 (4.11)$_a$	4.45 (3.67)$_{b**}$	4.42 (3.90)$_b$
Persistence[a]	9.49 (3.58)$_a$	8.07 (3.90)$_{b**}$	7.76 (4.43)$_b$
Hearing difficulties	5.47 (3.83)	4.89 (3.71)	4.99 (3.96)
Sleep difficulties[a]	3.24 (2.86)$_a$	2.91 (2.74)$_{ab}$	2.13 (2.36)$_{b**}$
Somatic complaints	1.62 (1.73)	1.57 (1.64)	1.70 (1.70)
Total score[a]	34.74 (16.86)$_a$	28.83 (16.14)$_{b**}$	27.53 (17.98)$_b$

For the TQ, a significant main effect of time was found ($F = 15.85$, $p < 0.0001$; Cohen's $d = 0.483$). Post hoc test indicated significant improvements in tinnitus burden between days 1 and 7. This difference was maintained at follow-up. A similar pattern resulted for tinnitus-related emotional and cognitive burden, persistence of sound, and sleep difficulties

*$p < 0.05$, **$p < 0.01$

[a]Significant main effect of time. Subscripts indicate significant differences across time points

$_a$significant main effect of time concerning begin of therapy (day 1)

$_b$significant main effect of time concerning end of therapy (day 7)

Table 2 Descriptive statistics for the Perceived Stress Questionnaire

Subscales	Day 1 (M, SD)	Day 7 (M, SD)	5-Year follow-up (M, SD)
Worries[a]	0.33 (0.21)$_a$	0.28 (0.21)$_{b*}$	0.25 (0.24)$_b$
Tension	0.50 (0.22)	0.41 (0.23)	0.42 (0.24)
Joy	0.58 (0.21)	0.63 (0.23)	0.59 (0.24)
Demands[a]	0.45 (0.24)$_a$	0.39 (0.23)$_{b*}$	0.39 (0.24)$_b$
Total score[a]	0.41 (0.18)$_a$	0.35 (0.18)$_{b*}$	0.34 (0.20)$_{b*}$

[a]Significant main effect of time. Subscripts indicate significant differences across time points

*$p < 0.05$, **$p < 0.01$

For the PSQ, a significant main effect of time was found ($F = 4.16$, $p < 0.002$, Cohen's $d = 0.305$). Post hoc test indicated significant improvements in perceived stress between days 1 and 7. This difference was maintained at follow-up. A similar pattern resulted for the "worries" and "demands" subscales

Table 3 Descriptive statistics for the General Depression Questionnaire

	Day 1 (M, SD)	Day 7 (M, SD)	5-Year follow-up (M, SD)
Total score[a]	15.77 (11.79)$_a$	9.82 (7.23)$_{b**}$	12.83 (9.91)$_a$

[a]Significant main effect of time. Subscripts indicate significant differences across time points

*$p < 0.05$, **$p < 0.01$

For the GDQ, a significant main effect of time was found ($F = 11.37$, $p < 0.001$, Cohen's $d = 0.425$). Post hoc test indicated significant improvements in depressive symptoms between days 1 and 7. This difference was not maintained at follow-up

pronounced since the multimodal therapeutic program includes interventions specifically aimed at targeting depressive symptoms and anxiety.

Method

Participants

At the time of admission in 2009, 192 patients participated in the 7-day MTRT program at Charité University Hospital. Participants were between 18 and 77 years old (mean [M] = 49.2 years, standard deviation [SD] = 12.2). Of the participants, 23.4% presented with decompensated tinnitus (according to Göbel and Hiller [11]). Tinnitus severity was independent of age and gender. Participants completed questionnaires as part of the assessment on the first day of the program. Participants gave written consent for their data to be used for research purposes. The study was approved by the local ethics committee. Exclusion criteria (psychiatric comorbidities, sufficient language proficiency and physical constitution enabling patient participation in the multimodal treatment program) were examined and found not to apply to participants in the current sample.

In 2014, participants were contacted for the 5-year follow-up survey. Ninety-four questionnaire sets (48.9%) were returned and included in the data analysis for the present study. Of these participants, 46% were female. The subsample did not differ from the main sample in terms of tinnitus burden, stress, and depressive symptoms. Systematic differences in terms of therapeutic change were not assessed owing to the length of the follow-up period and potential breadth of uncontrolled variables.

Measures

For details on the selection of the psychometric self-assessment tools used in the present study, see [32].

Tinnitus burden

The TQ [11] comprises five subscales:

(1) tinnitus-related emotional and cognitive burden,
(2) persistence of sound,
(3) hearing difficulties,
(4) sleep difficulties, and
(5) somatic complaints.

There are 52 items to be answered on a three-point scale ("true," "partially true," "not true"). Higher scores denote higher distress. A score of more than 47 points is defined as decompensated tinnitus.

Stress

The Perceived Stress Questionnaire—Short Version (PSQ-S; [9]) assesses the extent to which worries, tension, joy, and demands are experienced. Patients rate 20 items on a four-point scale from 0 to 3 ("almost never," "sometimes," "frequently," "most often"). The subscale "joy" is recoded for the calculation of the total score. Higher values describe a higher stress.

Depressive symptoms

The General Depression Scale (GDS; [14]) measures depressed mood on a four-point scale ("rare," "sometimes," "often," "mostly") for 20 items. Higher values denote more severe symptom levels. A total score of more than 23 points suggests major depression [14].

Statistical analysis

We used a repeated-measures analysis of variance (rmANOVA) to detect changes in the aforementioned outcome variables at T1 (day 1), T2 (day 7), and T3 (5-year-follow-up). Next, we investigated differences between participants with decompensated versus compensated tinnitus levels using a multivariate analysis of variance (MANOVA) and Bonferroni-corrected post hoc tests.

Results

Tables 1, 2 and 3 illustrate tinnitus burden, perceived stress, and depressive symptoms levels over time (Hypothesis 1).

In order to investigate differences in outcome for participants with decompensated versus compensated tinnitus, MANOVAs were calculated for the TQ (**Fig. 1**) along with PSQ and GDS total scores.

Comparison of the tinnitus burden of participants with decompensated versus compensated tinnitus over time (Hypothesis 2) revealed a significant time × tinnitus severity interaction effect: $F(2.174) = 5.94$, $p < 0.001$. Bonferroni corrected post hoc tests indicated significantly higher improvements of tinnitus burden in participants with decompensated than in those with compensated tinnitus.

There were no time × tinnitus severity interactions for the perceived stress scale. For the depression scale, the time × tinnitus severity interaction effect was significant. Post hoc tests indicated a worsening of depressive symptoms at the 5-year follow-up compared with posttreatment. During the latter period, however, the improvements gained were maintained relative to pretreatment scores in participants with decompensated versus compensated tinnitus.

Discussion

The present data expand the evidence base for MTRT as an effective, multimodal treatment for tinnitus and associated difficulties. Following previous findings that demonstrated the effectiveness of MTRT at 3-month, 1-year and 3-year follow-up [32, 33], findings from the present study demonstrate the maintenance of therapeutic gain at 5-year follow-up. In keeping with previous findings, participants report ongoing improvements in tinnitus burden and stress [3, 6, 19, 29]. It is remarkable that tinnitus- as well as stress-related treatment gains are maintained at 5-year follow-up, suggesting that short, multimodal intensive treatments may predict longstanding improvements in tinnitus distress and associated emotional difficulties. Similarly, posttreatment improvements that are maintained at 5-year follow-up also comprise several tinnitus-related constructs such as depressive symptoms, also in keeping with previous findings in the area [28]. While depression-related scores significantly improve at posttreatment relative to pretreatment, such benefits appear to somewhat decline by 5-year follow-up. Notwithstanding, depressive symptoms remain significantly improved relative to pretreatment.

We assume that treatment exerts its effects by facilitating habituation to tinnitus and providing helpful strategies for coping with tinnitus burden and stress. While Cima and others suggested offering patients with decompensated tinnitus more intensive treatment [6, 35], our data do not appear to support this suggestion: Patients with both compensated and decompensated tinnitus benefited from our program, with the latter showing stronger improvements. Patients appear to benefit from both the multimodal as well as the intensive (7-day) components of the MTRT. It appears that it is crucial to treat both tinnitus burden and interrelated, associated emotional difficulties—also for patients whose tinnitus has not (yet) decompensated. Insight into interactions between emotions (stress, depressive symptoms), muscular tensions, sleep difficulties, and cognitive burden may motivate changes in lifestyle and relevant contributing factors. Current evidence suggests that a combination of individual and group interventions may be superior to group interventions alone [6, 16, 23, 35]. As such, idiosyncratic components (e.g., developing an individual formulation—including ENT data—and offering individual sessions) are crucial for the success of multimodal treatment programmes, while structured group interventions may further help patients gain insight into factors that contribute to tinnitus burden and distress. Patients may also benefit from booster sessions—as are provided in quarterly counseling sessions at our clinic.

Abstract

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Long-term changes in multimodal intensive tinnitus therapy. A 5-year follow-up

Abstract

Background. We present 5-year follow-up data for tinnitus-specific and comorbid depressive symptoms as well as stress-related outcome variables of an intensive multimodal 7-day tinnitus therapy.
Method. Tinnitus burden (Tinnitus Questionnaire), stress (Perceived Stress Questionnaire), and depressive symptomatology (General Depression Scale) were measured at the 5-year follow-up after a multimodal intensive 7-day intervention. In all, 94 patients participated in the study.
Results. All outcome variables showed significant improvement at the end of the 7-day intensive treatment. These effects remained significant after 5 years.
Conclusion. The results of the present study support the effectiveness of the 7-day multimodal intensive therapy for tinnitus. Posttreatment improvements were related to both tinnitus burden as well as stress and depressive symptoms and were maintained at the 5-year follow-up.

Keywords
Tinnitus · Stress · Depressive symptoms · Multimodal treatment · Outcome

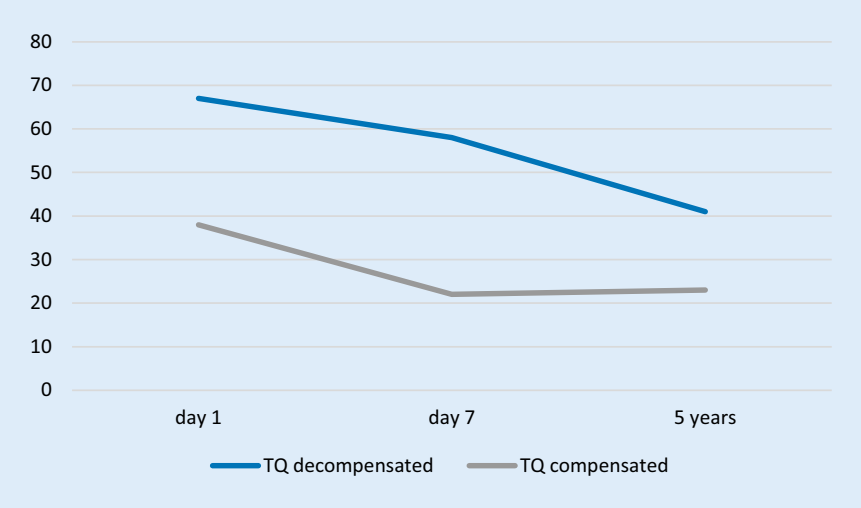

Fig. 1 ▲ Change in tinnitus burden for participants with decompensated vs. compensated tinnitus. *TQ* Tinnitus Questionnaire

Patients in the present study presented with an average TQ score of 35 at baseline (second degree according to Biesinger et al. [4]), which suggests a perception of control over tinnitus severity. Patients with decompensated compared to compensated tinnitus benefited more from MTRT. We assume that associated difficulties such as stress and depressive symptoms denote decompensation [5, 13]. Hence, it is important to focus on and incorporate these aspects into multimodal treatment approaches because mere psychoeducational approaches may not adequately address the needs of patients with both compensated and decompensated tinnitus. Moreover, it is important to raise awareness of and motivate psychological or physical therapy where indicated. Following findings from the present study, our group is currently focusing on psychological interventions that target comorbidities and associated difficulties. Although attrition and selection effects cannot be ruled out for the present sample (50% drop-out rate), the magnitude and stability of effects pertaining to tinnitus distress, perceived stress and depressive symptoms suggest a strong and encouraging therapeutic impact of our multimodal treatment program. To further boost therapeutic outcome, a "compact multimodal tinnitus-specific cognitive behavioural therapy" program (CTCBT) has recently been developed and implemented in our group. Initial findings are promising [5].

Limitations

The current study has several limitations. First, the present study did not use a wait-list control group. In the associated study, initial pre- to posttreatment effects were established comparing treatment with a wait-list control group [32]. However, even the prospect of a therapeutic intervention can result in measurable effects [17], which should be considered when establishing a wait-list control design. Nonetheless, effect sizes as found in the present study are unlikely to have been obtained by the passage of time or chance alone. Second, differences between responders and nonresponders could not be investigated in the present study. Third, we did not assess whether patients received other psychosocial interventions following discharge from our service. Thus, the maintenance of gains at 5-year follow-up might be attributable to unmeasured third variables benefitting tinnitus distress and associated difficulties. While effect sizes were comparable to our 3-year follow-up study [33], the current data did not allow us to measure potential systematic biases in patient attrition.

Conclusion

Intensive multimodal tinnitus therapy has been shown to be an effective treatment for patients suffering from tinnitus. Treatment effects comprise significant improvements in tinnitus distress and stress that are maintained at 5-year follow-up. A combination of standardized psychological and psycho-educational group treatment as well as idiosyncratic components appear to benefit patients. Patients with decompensated tinnitus appear to continue to benefit from interventions after discharge. A possible mechanism of change is the development and maintenance of coping strategies aimed at reducing tinnitus distress and depressive symptoms.

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Compliance with ethical guidelines

Conflict of interest. P. Brüggemann, J. Otto, N. Lorenz, S. Schorsch, A. J. Szczepek, B. Böcking, and B. Mazurek declare that they have no competing interests.

Participants gave written consent for their data to be used for research purposes. The study was approved by the local ethics committee.

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