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Abstract

OBJECTIVE: The pathophysiologic mechanisms of idiopathic tinnitus remain unclear. Low frequency rTMS applied over the auditory cortex has been proposed as a new and causally oriented treatment approach for pathological conditions with abnormal, increased cortical activity including tinnitus with increased activity in the auditory cortex. However available studies are characterized by a positive reports on the therapeutic effects of repetitive transcranial magnetic stimulation (rTMS) for treatment of tinnitus, there are few details about the duration of specific treatment effects.

DESIGN: The design of the study was randomized, prospective, placebo-controlled. Right-handed patients were treated with either real or sham 1 Hz frequency rTMS over a period of two weeks. Fifty-two patients with chronic, treatment resistant tinnitus and stable medication were enrolled in the study after giving written informed consent and forty-two patients completed the study and were included in data analysis.

RESULTS: The ability to reduce the symptoms of tinnitus appeared in both randomized groups immediately after the 1 Hz rTMS and sham stimulation phase. There was a significant reduction in both groups of the tinnitus total score on the Tinnitus Handicap Inventory (THI) (real rTMS p=0.005; sham rTMS p=0.049) and Tinnitus Questionnaire (TQ) total score (real rTMS p=0.003; sham rTMS p=0.049). On the THI evaluation scale, in the real rTMS a mild worsening was noted during week 6 in comparison with the state attained in week 2. During the subsequent course of the study a significant reduction of the total score persisted in the case of THI (real rTMS week 14 p=0.033 and borderline week 26 p=0.058). The reduction of symptoms as evaluated using the TQ was significant compared to baseline in the real rTMS group at week 2, 6 and 14 (p=0.003; p=0.024; p=0.022). The group treated with sham stimulation reached significant reduction of symptoms only at week 2 (p=0.049). A comparison of the difference in the recorded values of the total score during follow-up in relation to baseline expressed as a percentage demonstrates the difference in the effect of rTMS and sham stimulation as evaluated by both the basic scales. Graphical analysis of mean patterns of treatment response according to stimulation type shows a similarity between treatment response patterns evaluated by reduction of the total scores using THI and TQ.

CONCLUSIONS: The principal finding of this study is that real 1 Hz rTMS treatment was capable of significantly reducing the total baseline score of basic scales that measure tinnitus severity. This result is important as it proves that significant reduction of symptoms can be achieved even in a group of patients with long-term symptoms resistant to pharmacological treatment.

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Transcranial magnetic stimulation for the treatment of tinnitus: 4-year follow-up in treatment responders--a retrospective analysis.

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Author information

Abstract

BACKGROUND: Repetitive transcranial magnetic stimulation (rTMS) over the temporal cortex has been proposed as a new approach for the treatment of tinnitus. Even if most studies have shown beneficial effects, there is only limited knowledge about clinical predictors for treatment response and about the duration of treatment effects.

OBJECTIVE: In this study, we compared clinical characteristics of rTMS responders and nonresponders and assessed long-term outcome in the responder group.

METHOD: Results from 235 patients, who were treated with rTMS because of chronic tinnitus were analysed. Patients received either a standard protocol of low-frequency rTMS (n = 188; 110% motor threshold, 1 Hz, 2000 stimuli/day) over the left temporal cortex or combined frontal and temporal rTMS (n = 47; 110% motor threshold, 1000 stimuli at 20 Hz, left dorsolateral prefrontal cortex plus 1000 stimuli at 1 Hz left temporal cortex). Response criterion was defined as an improvement of at least 10 points in the tinnitus questionnaire (TQ) score between baseline and the follow-up assessment 90 days after treatment.

RESULTS: For the entire study group there was a highly significant effect of treatment on the TQ score. Fifty patients (21.3%) were responders according to the above mentioned definition. The response criterion was fulfilled by 19.7% of the patients receiving left temporal rTMS and by 26% of the patients receiving combined rTMS. The only significant difference between responders and nonresponders was a higher baseline score of the TQ in the responder group. There were no significant differences in all other assessed patient parameters (gender, age, tinnitus duration, tinnitus laterality, motor threshold, handedness). Ninety days after treatment the average TQ reduction in the responder group was 18.2 points as compared with baseline. At the two long-term follow-up assessments (2.12 ± 1.17 years and 3.9 ± 1.17 years after treatment) the improvement in the responder group was still 14.2, respective 14.4 points.

CONCLUSIONS: These data underscore the clinical relevance of rTMS in the treatment of tinnitus. A potential explanation for the observed long-lasting clinical effects is that rTMS interferes with tinnitus related neuronal activity and thus facilitates the intrinsic ability of the brain to restore normal function.