TMS-Induced Modification of the Neural Network Coding Tinnitus Sensation

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Repetitive Transcranial Magnetic (rTMS) stimulation has been shown to be effective in modulating tinnitus. Most frequently the use of low-frequency rTMS has been thought to reduce excess activity of the auditory cortex. However, recent animal studies show diverging results regarding firing rates of neurons in the auditory cortex following tinnitus induction. At the same time, evidence increasingly suggests that the tinnitus percept and affective (distress) could be related to synchronous activity of neurons in the auditory cortex, as well as between auditory and non-auditory brain regions. This finding implies that the effects of rTMS may be at least partially mediated by mechanisms acting on synchronicity. Furthermore, low frequency rTMS may not be the optimal parameter for achieving changes.
In the proposed project, we will apply 4 parameters of TMS (1 and 10 Hz rTMS; intermittent and continuous Transcranial magnetic theta burst stimulation) which have been shown to modify cortical excitability. Applications will be to the auditory cortex in a single-blind sham, controlled parameter study. Ongoing spontaneous activity will be recorded before and after treatment using magnetencephalography. The parameter which proves to be most successful in transiently normalizing spontaneous activity will be chosen and applied in a clinical study to test for robust effects on behavioral and neurophysiological measures. Additionally, we will conduct a pilot study with opposing activation parameters (e.g.,1 and 10 Hz rTMS) applied to the frontal and parietal sites, which are implicated to be involved in tinnitus distress. If a combination of parameters is successful in "desynchronizing" activity between these brain regions, then this could serve as a significant clinical tool for reducing tinnitus-related distress.

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