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The assessment of the combined effect of transcranial direct current stimulation and transcranial magnetic stimulation using neuro-imaging in tinnitus patients

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From prior study, standard stimulation techniques for neuromodulation were settled by the theory that brain activity can be controlled by frequency; low frequencies cause neuron activity decrease and high frequencies function in contrary way. But it has not yet known which pathway involved and how it works of inhibitory top-down neuromodulation for stimulation in the human brain. We have treated Transcranial Direct Current Stimulation (tDCS) or Transcranial Magnetic Stimulation (TMS) on tinnitus patients, onset from 3 months to 40 years chronic tinnitus, having various hearing and subjective tinnitus sound. Total 4 treatment group, TMS group which treated with 0.8 multiplied threshold of RMT, 200 pulses, on single side temporal area, bifrontal tDCS group, sham TMS group after tDCS and tDCS combined TMS group. Each group has 13 subjects equally assigned treatment double blind test, with a mean age of 54.15 years (SD=13.50). In the tDCS-TMS combined group, Visual Analogue Scale (VAS) of tinnitus intensity showed a decrease in 76.9% (10/13) of subjects. (Pearson's chi-squared test, p=0.123). It is contrary to prior study, it means tDCS reduce not only distress also tinnitus intensity. Analyzing pre-post tinnitus VAS score, there was no correlation among VAS intensity, distress, perception and THI improvement. In responders, we confirmed that tinnitus intensity, distress or perception of each treatment groups have decreased in statistically significance (Wilcoxon test, p<0.045) on single stimulation. Also, the statics and qEEG showed that only ipsilateral responders are observed in the TMS group and the tDCS group or combined group has contralateral tinnitus responders. Our results are an implication that the type of tinnitus with effect can be different depending on the stimulation methods. Still, the patient numbers are not enough to validate each type of tinnitus in statics, to standardize the treatment; it should be apply to larger population.

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