Abstract:

The theoretical part of our work is divided into three chapters and provides a contemporary systematic literature review of tinnitus, neurostimulation, and selected neurostimulation methods in its therapy. The first chapter includes an overview of the history, epidemiology, etiopathogenesis, theoretical development models, diagnosis, treatment methods, and comorbidities of tinnitus. The second chapter summarizes the history, principles, practical application, use, and adverse effect profile of the transcranial direct current stimulation (tDCS). The third chapter describes the use of neurostimulation methods in tinnitus therapy, especially synthesizing previous works' knowledge, comparing the protocols used, and identifying the positive influence of the intervals between individual tDCS applications on the therapeutic effects.

The research part evaluates the short-term and long-term effects of tDCS on the subjective perception of tinnitus, symptoms of depression and anxiety, and quality of life measured by the use of questionnaires. It is a prospective, randomized, double-blind, placebo-controlled clinical trial of 39 participants diagnosed with chronic, non-pulsatile tinnitus. The research protocol included six applications of bifrontal tDCS in two consecutive weeks, 48 to 72 hours apart, with a current intensity of 1.5 mA for 20 minutes. The assessment was performed before the start of the stimulation (T1), after the completion of the stimulation series (T2), 6 weeks after T2 (T3), and half a year after the start of the therapy (T4). A statistically significant reduction in hearing problems associated with tinnitus was demonstrated in the stimulated group compared to placebo at T3 ($p=0.035$) and T4 ($p=0.049$). Significant positive trends were also noted in other tinnitus domains – intrusiveness, rest disturbance, tinnitus-related quality of life, and overall severity level. The effect on depressive and anxious experiences did not reach statistical significance. Our work confirms the hypothesis that using the bifrontal stimulation protocol with longer intervals between applications can influence tinnitus, filling a critical knowledge gap.

Keywords: tinnitus, transcranial direct current stimulation, tDCS, bifrontal stimulation, dorsolateral prefrontal cortex