



# Brain Stimulation Therapy in Patients with Parkinson's Disease

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**KEYWORDS:** Parkinson's disease; External brain stimulation; Complex therapy

## BACKGROUND

Parkinson's disease (PD) is wide-spread nosology around the globe. Clinical features of PD consist of motor and non-motor disorders. Motor disorders include such symptoms as tremor, hypokinesia, rigidity, postural instability. Non-motor disorders include cognitive and emotional impairments, sleep disorders and vegetative disturbance. There are medication and non-medicated methods of treatment in Parkinson's disease. Brain stimulations may be perspective methods in complex therapy of PD patients.

## METHODS

Assessment tools: Montreal Cognitive Assessment (MoCa), Hospital Anxiety and Depression Scale (HADS), Vegetative disturbance scale, United Parkinson Disease Rate Scale (UPDRS), Hoehn-Yahr scale. Neurological examination also. 112 patients took part in this research, 79 of them were women and 33 of them were men. All patients were divided into 2 groups: 1) patients who get complex therapy without external brain stimulation (56 patients of control group); 2) patients who get complex therapy with external brain stimulation (56 patients of basic group). The average age of basic group patients was  $66,4 \pm 1,24$  years old, patients of control group -  $68,3 \pm 1,21$  years old. The average duration of disease was  $5,3 \pm 0,44$  years in basic group and  $5,7 \pm 0,52$  years in control group.

Complex therapy included medication methods of treatment (Levodopa, dopamine receptor agonists, inhibitors MAO-B, anticholinergic drugs, inhibitors COMT, amantadine drugs, antidepressants, anxiety medications, nootropic drugs) and non-medicated methods (exercise therapy, physiotherapy, behavioral therapy). Patients in 2 group used smartphones for external brain stimulation. Specific computer program was installed on it. During

the playback of audio signals through the smartphone audio headset, patients were asked to walk in accordance with the set temp and rhythm parameters. Such walking was prescribed every day for 15-20 minutes 2 times a day during the hospital staying for 14 days. The initial 2-3 times patients were engaged with the doctor, then-independently. The patient started sound stimulation during the best state of health. Parametric methods of statistics used for reduction. Obtained data were presented by mean values and errors in standard deviation ( $M \pm m$ ).

## RESULTS

According to obtained data 63,4% of patients had akinetic-rigid-trembling type of disease. 15,2% had akinetic-rigid type of disease, 0,9% had trembling type of disease, 16,9% had rigid-trembling type of disease, 3,6% had rigid-trembling type of disease. According to Hoehn-Yahr scale, 8,01% of patients had the first stage of disease, 24,1% had the second stage, 60,7% had the third stage, 7,1% had the fourth stage.

According to MoCa testing results, average score in control group before treatment was  $22,77 \pm 0,47$ , after therapy -  $24,54 \pm 0,43$  ( $p < 0,0001$ ), in basic group  $22,71 \pm 0,54$  and  $25,55 \pm 0,40$  ( $p < 0,0001$ ). 77,6% of all patients had cognitive impairments. 35,7% of them had slight cognitive impairments, 27,6% of them had mild cognitive impairments, 14,3% of them had strong cognitive impairments. According to HADS testing results average score of anxiety level in control group before treatment was  $8,98 \pm 0,58$  after therapy -  $8,11 \pm 0,48$  ( $p < 0,0001$ ), in basic group  $9,75 \pm 0,6$  and  $5,70 \pm 0,47$  ( $p < 0,0001$ ). Average score of depression level in control group before treatment was  $9,13 \pm 0,50$ , after therapy  $8,11 \pm 0,48$  ( $p < 0,0001$ ), in basic group  $8,68 \pm 0,55$  and  $7,30 \pm 0,52$  ( $p < 0,0001$ ). 64,2% of

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patients had anxiety syndrome, 58,9% of patients had depression syndrome.

According to vegetative disturbance scale average score in control group before treatment was  $2,27 \pm 0,19$ , after therapy –  $2,24 \pm 0,19$  ( $p > 0,05$ ), in basic group  $1,87 \pm 0,19$  and  $1,87 \pm 0,19$  ( $p > 0,05$ ). 87,5 percent of patients had vegetative disturbance, such as: obstipation (76,7%), frequent urination (19,6%), urine incontinence (21,4%), skin dryness (2,7%), postural hypotension (3,6%). According to UPDRS average score in control group before treatment was  $42,25 \pm 3,44$  and after therapy –  $40,30 \pm 3,36$  балла ( $p < 0,0001$ ), in basic group  $48,88 \pm 1,30$  and  $46,04 \pm 1,31$  ( $p < 0,0001$ ). The result of intergroup comparison of parameters: after the treatment statistic significant differences were obtained on the dynamics of anxiety level ( $p < 0,01$ ), indexes of the third part of the

UPDRS scale in regard to the facial expression, rigidity, movements in the foot ( $p < 0,01$ ), a test of getting up from a chair ( $p < 0,01$ ), axial bradykinesia and test with the finger tapping ( $p < 0,0001$ ). There were no statistic differences in changes of depression level and vegetative status.

## CONCLUSION

According to results of our research the most frequent type of Parkinson's disease was akinetic-rigid-trembling. Most of patients were on the third stage of disease and had cognitive, emotional impairments and vegetative disturbance. Obtained data shown efficiency of complex therapy in PD patients with external brain stimulation for decreasing the level of bradykinesia and decreasing the level of anxiety.