TRANSCRANIAL DIRECT CURRENT STIMULATION (t-DCS) AND SPINAL DIRECT CURRENT STIMULATION (s-DCS) FOR TREATMENT OF GAIT DISORDERS IN PARKINSON'S DISEASE: A PILOT TRIPLE CROSS-OVER STUDY

Micol Avenali[1,2], Roberto De Icco[1,2], Mauro Fresia[2], Claudio Pacchetti[3], Cristina Tassorelli[1,2], Giorgio Sandrini[1,2]

[1]Department of Brain and Behavioural Sciences, University of Pavia, Pavia, Italy
[2]Department of Neurology and Neurorehabilitation, Mondino National Neurological Institute Foundation, IRCCS, Pavia, Italy
[3]Parkinson's Disease and Movement Disorders Unit, Mondino National Neurological Institute Foundation, IRCCS, Pavia, Italy

INTRODUCTION

Patients in the late stages of Parkinson's Disease (PD) develop several motor deficits that dramatically impair their quality of life. Interest in neuromodulation technique is increasingly emerging in the rehabilitation treatment of PD. Direct current stimulation (DCS) is a non-invasive brain stimulation technique able to modulate the activity of brain areas through the application of small electrodes on the scalp or at the spinal level. Previous studies suggested that transcranial DCS (t-DCS) is effective in improving motor symptoms in PD patients. Unlike, literature on the effect of spinal DCS (s-DCS) is scant, although treatment with s-DCS in animal models of PD induces an improvement of locomotion pattern.

AIM

The aim of our study is to evaluate the efficacy of a Direct Current Stimulation applied at the cortical or at the spinal level in the treatment of gait disorders and, in particular, of freezing of gait in patients with PD.

METHODS

The study was performed on 14 subjects with PD, according to a randomized, double-blind, cross-over design. All participants underwent to anodal t-DCS over primary motor cortex, anodal cathodal s-DCS applied to the 10th dorsal segment and cathodal s-DCS applied to the 10th dorsal segment in a randomized order. Each treatment foresaw 5 daily sessions lasting 20 minutes each. Each stimulation cycle was followed by a 30 days observation period. Assessment included clinical specific scales evaluating gait and balance impairment in PD: Unified Parkinson's Disease Rating Scale (UPDRS- part III), Tinetti Assessment Scale, Freezing of Gait Questionnaire (FOG) and Timed Up and Go (TUG) test.

RESULTS

At the end of stimulation cycle (T1), tDCS resulted in a significant improvement in all outcome measures (UPDRS- part III, Tinetti Assessment Scale, FOG and TUG test). After spinal stimulation, cathodal s-DCS showed a significant improvement in UPDRS-III and FOG scores, while anodal s-DCS was more effective in Tinetti and FOG scores. At 1-month follow-up (T2), t-DCS showed a stable effect in UPDRS-III score while cathodal s-DCS in FOG score. Anodal s-DCS had no significant effect in T2 on all these parameters. Comparing groups, t-DCS was more effective than both sDCS techniques in UPDRS-III and TUG scores either at T1 or T2. However, anodal s-DCS was more effective than the other methods on balance impairment (Tinetti score).

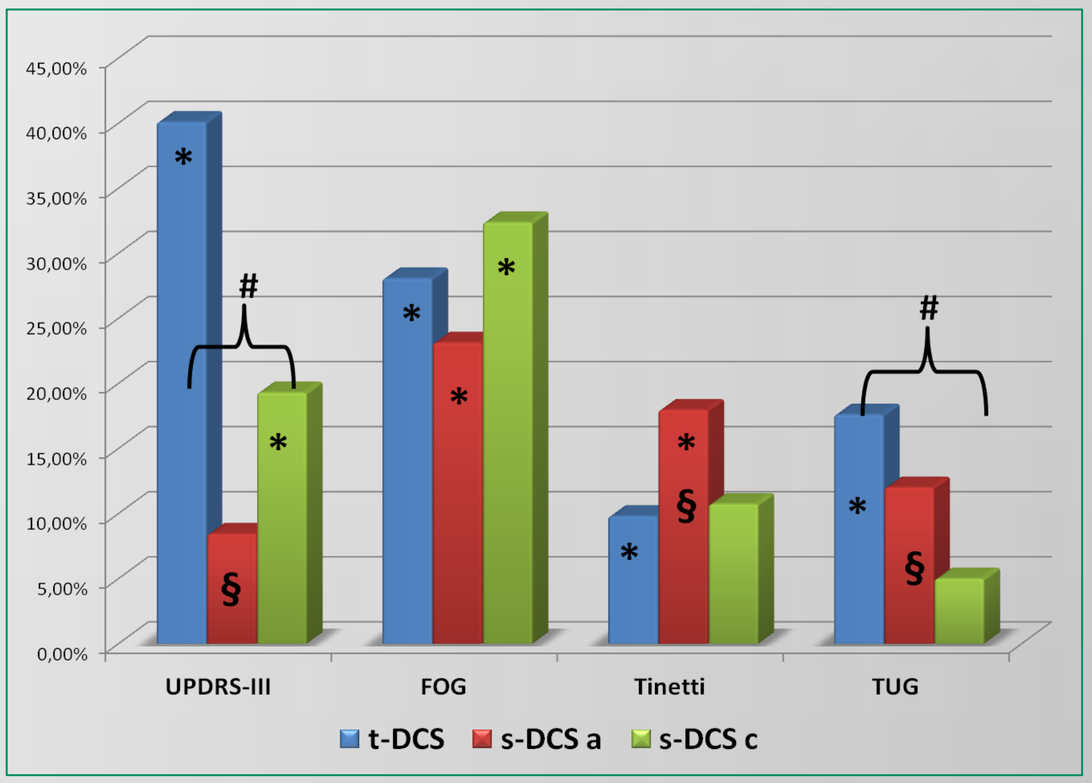

Fig.1: Percentage difference in mean score at T1 from baseline by 4 clinical scales for each technique (*= p <0,05 vs T0) and comparison between groups at T1 (§=p< 0,05 t-DCS vs s-DCS a; # = p<0,05 t-DCS vs s-DCS c).

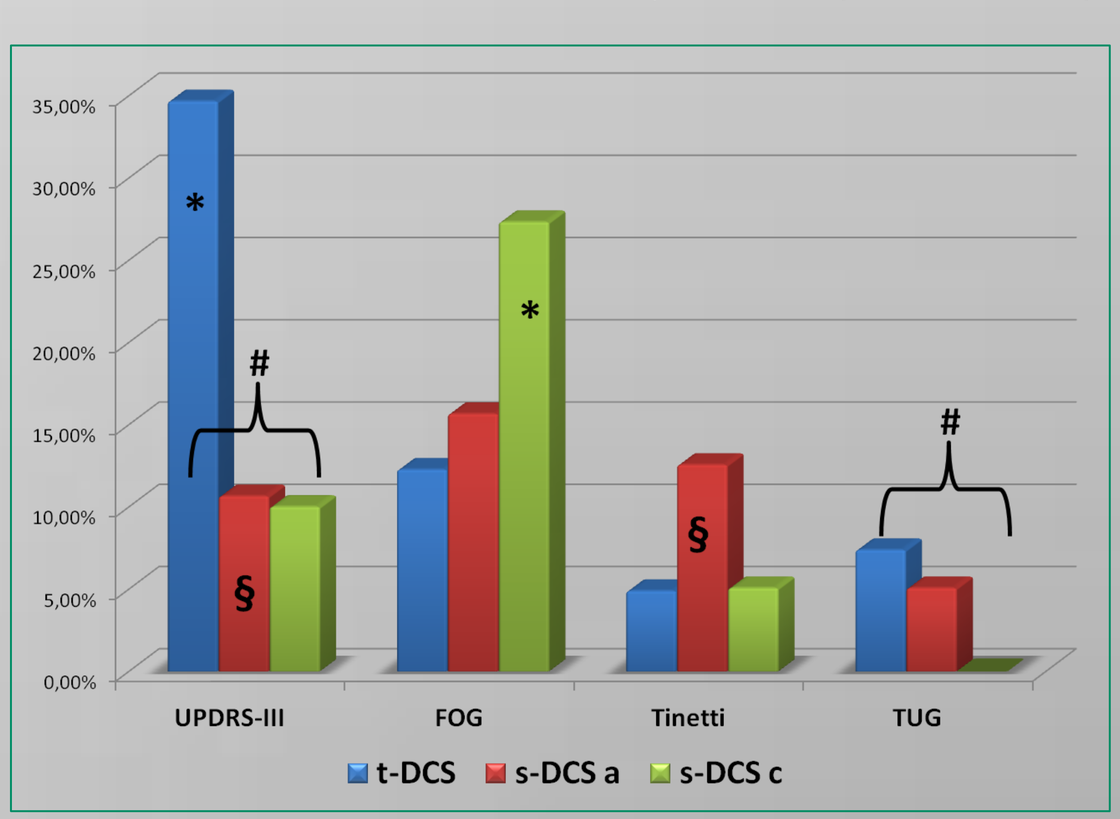

Fig.2: Percentage difference in mean score at T2 from baseline by 4 clinical scales for each technique (*= p <0,05 vs T0) and comparison between groups at T2 (§=p< 0,05 t-DCS vs s-DCS a; # = p<0,05 t-DCS vs s-DCS c).

CONCLUSIONS

All three neuromodulation techniques resulted in a improvement in motor performances operating on partially different parameters. However t-DCS was more effective than the other two on gait performances.

One limitation of this study includes the short-term duration of the therapeutic effect demonstrated by the loss of improvement on most parameters at 1 month follow-up. However anodal t-DCS, and associated increase in neuronal excitability, improves neuroplasticity of the cerebral cortex for induction of motor processes, therefore it is possible that repeated cycles may lead to more persistent benefits. Anodal t-DCS may represent an add-on option in the pharmacological and rehabilitative treatment of PD, especially in advanced stages.

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