Effect of tDCS combined with TENS on Pain, Proprioception and Functional Mobility in Older Adults with Knee Osteoarthritis

Dongmei Wang[1,2], Qipeng Song[2]
[1]Beijing Sport University, Beijing, Chain.
[2]Shandong Sport University, Jinan, China.
Email: Wangdongmei3392@163.com

Summary

This study evaluated the combined effects of transcranial direct current stimulation (tDCS) and transcutaneous electrical nerve stimulation (TENS) in older adults with knee osteoarthritis (KOA). The results showed that the tDCS+TENS group had significantly greater improvements in pain reduction, proprioception, and functional mobility compared to the TENS-only group. Specifically, tDCS+TENS resulted in better outcomes in pain relief, proprioception thresholds during knee flexion and extension, and Timed Up and Go (TUG) times.

Introduction

Knee Osteoarthritis (KOA) is a degenerative joint disease, and current therapeutic targets focus on pain relief. Pain and proprioceptive deficits are the main symptoms in older adults with KOA, severely affecting the patient's functional mobility [1]. The transcutaneous electrical nerve stimulation (TENS) is frequently used to alleviate pain and enhance proprioception, yet its efficacy is limited. The transcranial direct current stimulation (tDCS) combined with TENS may yield superior effects in pain relief and proprioception improvement. This study aimed to assess whether the combined intervention (tDCS+TENS) could achieve better effects than TENS alone.

Methods

Twenty-three older adults with KOA were recruited and randomly assigned to either the tDCS+TENS group (n=11, age 66.9±3.7 years, height 160.9±5.7 cm, weight 68.8±7.8 kg) or the TENS group (n=12, age 64.8±5.8 years, height 164.6±8.5 cm, weight 74.7±14.4 kg). Participants in the tDCS+TENS group received the combined intervention, while those in the TENS group received TENS with sham tDCS for six weeks, with three sessions per week, each lasting 20 minutes. Pain was assessed using the WOMAC questionnaire, and proprioception thresholds were measured during knee flexion and extension, as well as Timed Up and Go (TUG) times were recorded before (week 0) and after (week 7) the intervention. Two-way ANOVA with repeated measures was used to analyze the data.

Results and Discussion

Significant group-by-intervention interactions were detected in pain score ($p=0.001$, $\eta^2_p=0.400$), proprioception thresholds during knee flexion ($p=0.038$, $\eta^2_p=0.189$) and extension ($p=0.003$, $\eta^2p=0.354$), as well as the TUG time ($p=0.035$, $\eta^2_p=0.204$). Both the tDCS+TENS ($week_0=18.64\pm9.05$, $week_7= 10.09\pm7.09$, $p<0.001$, $d=1.052$) and TENS ($week_0= 20.33\pm8.08$, $week_7= 17.08\pm8.11$, $p=0.003$, $d=0.401$) groups were effective in reducing pain, with greater effectiveness observed in the tDCS+TENS group ($p=0.040$, $d=0.918$). The proprioception thresholds during knee flexion ($week_0= 5.32\pm3.35$, $week_7= 2.90\pm2.37$, $p<0.001$, $d=0.834$) and extension ($week_0= 5.73\pm2.71$, $week_7= 3.56\pm2.10$, $p<0.001$, $d=0.895$) decreased more in the tDCS+TENS group compared to the TENS group (flexion: $week_0= 6.46\pm4.15$, $week_7= 5.48\pm3.55$, $p=0.043$, $d=0.254$; extension: $week_0= 4.30\pm3.90$, $week_7= 3.63\pm3.21$, $p=0.038$, $d=0.188$) from week 0 to week 7. The TUG time (tDCS+TENS: $week_0=11.01\pm2.98$, $week_7=8.45\pm1.97$, $p<0.001$, $d=1.01$) decreased at week 7 in the tDCS+TENS group.

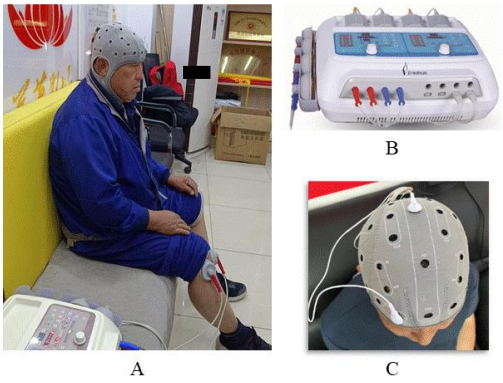

Figure 1: Illustration of superimposed-burst test in peroneal muscles

Conclusions

The combined tDCS and TENS intervention was more effective than TENS alone in reducing pain, improving proprioception, and enhancing functional mobility in older adults with knee osteoarthritis. These results suggest that tDCS+TENS could be a promising treatment for managing KOA symptoms, addressing both sensory and motor deficits.

References

[1] Song Q, Shen P, Mao M, Sun W, Zhang C, Li L (2020). *Scand J Med Sci Sports*,**30**(9):1655-1663.
[2] Comino-Suárez N, Serrano-Muñoz D, Beltran-Alacreu H, Belda-Pérez P, Avendaño-Coy J (2023). *J Electromyogr Kinesiol*,**103**(5):428-438