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Evaluating Virtual Reality and tDCS in Upper Limb Stroke Rehabilitation: A Comparative Meta-Analysis

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Introduction

Stroke is a cerebral vascular disease associated with high rates of morbidity, disability and mortality. A nearly 40-year study has revealed that stroke is now the second leading cause of death worldwide and in several countries, it ranks as the leading cause. Regardless of survival, 80% of stroke patients experience fluctuating neurological impairments throughout their lives, significantly impacting their quality of life. The loss of years lived with high disability leaves many patients suffering greatly. In recent decades, the incidence of stroke has risen by 68%. As a result, the prevention and timely treatment of stroke are crucial, but equally important is the focus on post-stroke recovery [1].

Description

Cortical excitability can be modulated using non-invasive brain stimulation techniques. One such method, transcranial direct current stimulation (tDCS), is gaining popularity in clinical treatment due to its affordability, ease of use and safety. A meta-analysis has shown that tDCS improves motor performance in patients recovering from chronic stroke or mild to moderate stroke. Additionally, Kim et al. observed enhanced short-term corticospinal facilitation when tDCS was combined with virtual reality (VR). Similarly, Llorens and colleagues found that the combination of VR and tDCS was significantly more effective than traditional physical therapy alone. These studies suggest that patients may achieve better long-term outcomes by receiving both non-invasive brain stimulation with tDCS and guided training through VR. Some research indicates that stroke patients may benefit more from the combination of tDCS and VR than from VR alone. However, to date, no study has systematically and specifically compared the efficacy of tDCS and VR together with VR alone for upper extremity rehabilitation. Therefore, we conduct this meta-analysis and systematic review to assess whether the combination of tDCS and VR offers superior outcomes compared to VR alone [2].

The purpose of this article is to present the first comprehensive meta-analysis and systematic review comparing VR and tDCS for stroke patients' upper extremity rehabilitation. As a common disease, stroke significantly affects quality of life. Estimating the taking care of oneself and portability of patients with stroke decides the effect of the treatment on the personal satisfaction. Even though the BI is unable to assess patients' cognition, speech function, visual function, or pain, it is still a reliable and valid index. Intriguingly, there was a significant improvement in BI between tDCS combined with VR and VR alone. This implied that blend treatment worked on the personal satisfaction in patients with stroke better compared to VR alone. The quality of movement was used to score the FM-UE scale, which was commonly used to measure upper extremity impairment. This meta-examination uncovered that the blend of tDCS and VR didn't bring about better improvement in the FM-UE scale contrasted with VR alone [1].

This cycle was significant and worked with by different medications or restoration measures. We were also bothered by the delay in initiating rehabilitation measures. Kwakkel, others proposed that FM-UE scores in no less than about a month post-stroke were unequivocally connected with long haul forecast. The majority of the patients who participated in Yao et al.'s study were in the subacute phase and significantly improved in FM-UE following VR and tDCS treatmen. The other study did not reach the same conclusion because it only included patients with chronic stroke. Furthermore, the cathodal terminal was set over the hand region of the unaffected engine cortex in 3 RCTs, while the anodal terminal was set over the essential engine cortex of the impacted half of the globe in another RCT. Accordingly, the time window and excitement type for consolidated treatment should have been additionally characterized. This meta-analysis had several limitations. Right off the bat, the four included RCTs was completely single-focus and little examples, which prompted a decrease in the believability of the proof. Second, Lee et al.'s trials and Yao and others were single-blind studies, which may introduce the possibility of bias and the accuracy of the results may be affected by the bias of the patient or researcher. Thirdly, the inclusion criteria and treatment procedures of the various trials varied as well [2].

Conclusion

For stroke patients who require upper-extremity training, the treatment strategy of combining tDCS and VR is slightly superior to VR alone. It is linked to significantly improved quality of life in stroke patients. Regarding motor function and motor impairment in the upper extremity, VR alone is not superior to the combined treatment. Notwithstanding, the scores of the FM-UE scale and the BBT will generally increment. For combined therapy, the type of stimulation needs to be further defined. Multi-center studies involving more patients are required in the future. It is necessary to further define the precise window of time for tDCS and VR therapy.

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