A novel paired associative stimulation protocol with a high-frequency peripheral component: review of results in spinal cord injury rehabilitation

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INTRODUCTION

In recent decades, a multitude of therapeutic approaches has been developed for spinal cord injury (SCI), but few have progressed to regular clinical practice. Novel non-invasive, cost-effective, and feasible approaches to treat this challenging condition are needed. Non-invasive stimulation techniques provide an attractive possibility to activate and strengthen residual neural connections after incomplete SCI.

METHODS

Paired associative stimulation (PAS) is a combination of transcranial magnetic stimulation (TMS) and peripheral nerve stimulation (PNS). We developed a novel variant of this technique called high-PAS, which consists of high-intensity TMS and high-frequency PNS. This presentation will review our recent clinical results.

RESULTS

25 patients with incomplete SCI with wide range of injury severity, age, and time since injury received high-PAS to upper or lower limbs in 4 case series (5 patients each) and 4 case studies. High-PAS sessions to multiple peripheral nerve - motor cortex pairs were applied 3-5 times per week for 4-12 weeks. We documented significant increases in manual motor scores (MMT) of upper and lower limbs, functional hand tests, walking tests, and measures of functional independence in incomplete SCI patients (tetraplegic and paraplegic, traumatic and neurological).

CONCLUSION

High-PAS is a promising new approach for enhancing motor rehabilitation outcomes after incomplete SCI. To confirm clinical results, we are currently conducting a double-blind sham-controlled randomized clinical trial in subacute SCI patients (20 patients). We also continue studies in healthy subjects to further optimize the stimulation protocol.