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Tapping the Neural Circuitry: Surface Spinal Stimulation in Spinal Cord Injury: A Case Report

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Abstract

Context/Objective: To examine the effect of Surface Spinal Stimulation with varied beat frequency on muscle fibre recruitment in lower limb in Incomplete Spinal Cord Injury. *Design:* Interventional Study. *Setting:* Department of Physiotherapy, Punjabi University Patiala, Punjab, India. *Interventions:* Surface Spinal Stimulation (SSS) was delivered at the T 10 –L1 vertebral level with the adhesive electrodes placed para-vertebrally on each side of spine, 5 cm apart. Rectangular self-adhesive electrodes of size 4.5 cm * 9 cm were used. The electrical stimulations had an amplitude modulated Alternating Current (AC), with a carrier frequency of 2500 Hz, modulated to "beat" frequency of 30 Hz,50 Hz,70 Hz and 90Hz .Stimulation amplitude was raised to elicit sensory stimulation. *Outcome Measure:* Surface Electromyography (EMG) was used to assess the alterations in muscle fibre recruitment of various muscle groups. Pre/Post Test design was adopted. *Results:* Pre to Post test SSS values changed significantly with all the varied beat frequencies. *Conclusion:* This case study showed that the SSS, similar to epidural stimulation can be used in enhancing muscle recruitment, without negatively impacting residual motor control in incomplete SCI. Further studies are required to explore more about this non invasive method of tapping the neural circuitry.

Introduction

Background: Detailed characterization of the impact of SCI on CNS motor control processing is a complex and difficult task. Currently, the most widely used method of tracking the recovery of voluntary capability after SCI is the ASIA Impairment Scale *(Waring et al, 2009).* This gold standard has a limitation of not being able to provide the information about the recruitment rate of the target muscle and the activation of synergistic muscles with concurrent inhibition of antagonistic muscles that is necessary to perform functional volitional movement efficiently *(McKay et al, 2011).*

The diminished level of movement that follows a spinal cord injury has been attributed generally to an inability to activate motor pools. There are three salient issues linked to the impaired ability to recruit appropriate bands of motor units in a manner that yields effective movement. First, a significant proportion