Chiropractic alters TMS induced motor neuronal excitability: Preliminary findings

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Abstract: The objective of this study was to use the electromyography (EMG) via surface and intramuscular single motor unit recordings to further characterize the immediate sensorimotor effects of spinal manipulation and a control intervention using TMS. The results provide evidence that spinal manipulation of dysfunctional spinal segments increases low threshold motoneurone excitability.

I. INTRODUCTION

Spinal manipulation has been reported to help individuals suffering from neck pain (1,2), back pain (1,3), and headaches (4). However, the mechanisms for this improvement in function and reduction in pain are not well understood and remain largely theoretical (5,6,7).

The changes brought about by spinal manipulation may involve central and / or peripheral nervous systems. Although some studies examined the effects of it on peripheral reflex pathways (8,9), only a few papers exist on the central effects of the spinal manipulation. These studies have shown no changes in motor evoke potential (MEP) amplitude (10,11) with spinal manipulation.

However, recently a new method has been used to study central and peripheral effects of a stimulus using peristimulus frequencygram (PSF; 12) and claimed that the classical methods of determining neuronal pathways contain significant errors and needs to be re-studied (13). This novel method has recently been used to re-characterize the excitatory muscular responses evoked by the transcranial magnetic brain stimulation (TMS) (14). Their study highlighted the importance of using both classical probability-based and novel frequency-based analysis to accurately determine the muscular activity in response to TMS.

II. METHODS

Due to this evidence, the aim of the current study was to re-investigate the TMS induced muscle responses following spinal manipulation using single motor unit data and a combination of surface electromyography (EMG), peristimulus time histogram (PSTH) and peristimulus frequencygram (PSF) analyses on tibialis anterior (TA). We also aimed to utilize both the classical and novel methods of analyses of the data.

Subjects received single pulse TMS via a double cone coil over the TA motor area during weak isometric dorsiflexion of the foot. On two separate days several hundred stimuli were delivered at a frequency of about 0.3Hz and the intensity set at active motor threshold before and immediately after either a spinal manipulation of dysfunctional spinal segments or a control intervention. The order of the interventions was randomized.

TA EMG was recorded with surface and intramuscular fine wire electrodes. Three subjects also received sham double cone coil TMS pre and post a spinal manipulation intervention. The single motor unit data were analyzed from the constructed PSF and PSTH.

From the averaged surface EMG data MEPs were constructed and analyzed. Seven single motor units were identified for the spinal manipulation intervention and five single motor units were identified for the control intervention.

III. RESULTS AND DISCUSSION

Following spinal manipulations there was an increase in the single unit MEP amplitude. No changes were observed following the control intervention. The results provide evidence that spinal manipulation of dysfunctional spinal segments increases low threshold motoneurone excitability.

A significant increase in the level of excitation may indicate subject's confidence to move his/her leg after the manipulation. Therefore, spinal manipulation can be used on to strengthen weakened muscles in human subjects.

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