ACC CONFERENCE PROCEEDINGS

Differential Effects of Cervical and Lumbar Spine Manipulation on Regional Motoneuron Pool Excitability*

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INTRODUCTION

Previous research from our laboratory indicates that there is an attenuation of motoneuron activity immediately following high-velocity, low-amplitude (HVLA) spinal manipulation, applied to the lumbosacral spine in asymptomatic subjects (1,2). To date, effects of cervical spinal manipulation on the transient attenuation of motoneuron activity are unknown. The cervical spine may possess a greater responsiveness to spinal manipulation than does the lumbar spine due, in part, to the cervical spine being more richly populated by zygapophysial joint mechanoreceptors and muscles spindles than the lumbar spine (3,4). There are also inherent differences in the circuitry of the cervical and lumbar spinal cords such as differences in neurotransmitter turnover rate, motor unit size, and low-frequency depression susceptibilty (5). The purpose of the current investigation was to compare and contrast the effects of cervical and lumbar spinal manipulation procedures on median and tibial nerve H/M ratios, respectively.

METHODS

Nine volunteers were recruited from a college student population. All subjects were neurologically screened by one clinician prior to the initiation of the experiments to exclude subjects with radiculopathy or peripheral neuropathy. The local ethics committee reviewed and approved all experimental procedures.

The subjects received both spinal manipulation procedures on multiple test days, in a random order, with a minimum of 48 hours elapsed time between experimental sessions. The tibial nerve H-reflex technique as described by Hugon (6) was used to quantify motoneuron activity in pre-post lumbar SM procedures. M-wave and H-reflex responses were recorded from the right gastrocnemius muscle (GM) using standard electromyographic (EMG) techniques. The median nerve H-reflex technique of Jabre (7) was used to evaluate maximal H-reflex responses and M-waves from the right flexor carpi radialis muscle (FCR). Immediately after the spinal manipulation procedure, maximal H-reflex responses were measured at 10-second intervals within the first 90 seconds to determine the acute time course of postmanipulation effects on motoneuron activity. Ten maximal H-reflexes were also evoked at 5 and 10 minutes postmanipulation. Details regarding H-reflex methodology and the spinal manipulative procedures employed have been previously reported by the authors (1,2).

A two-factor repeated measures ANOVA model was used to compare the H/M ratio recovery profiles following C5–6 SM and L5–S1 spinal manipulation

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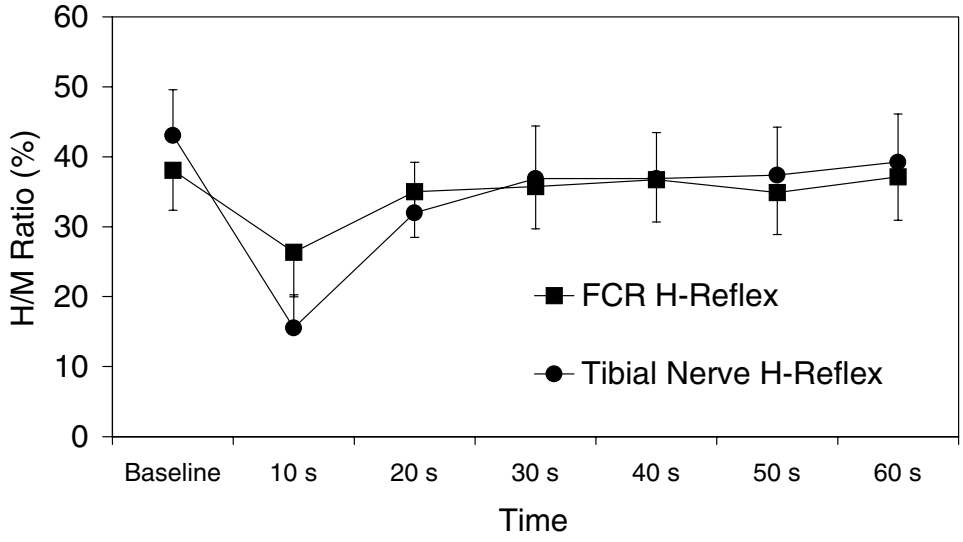

Figure 1. Segmental effects of spinal manipulation procedures on motoneuronal activity.

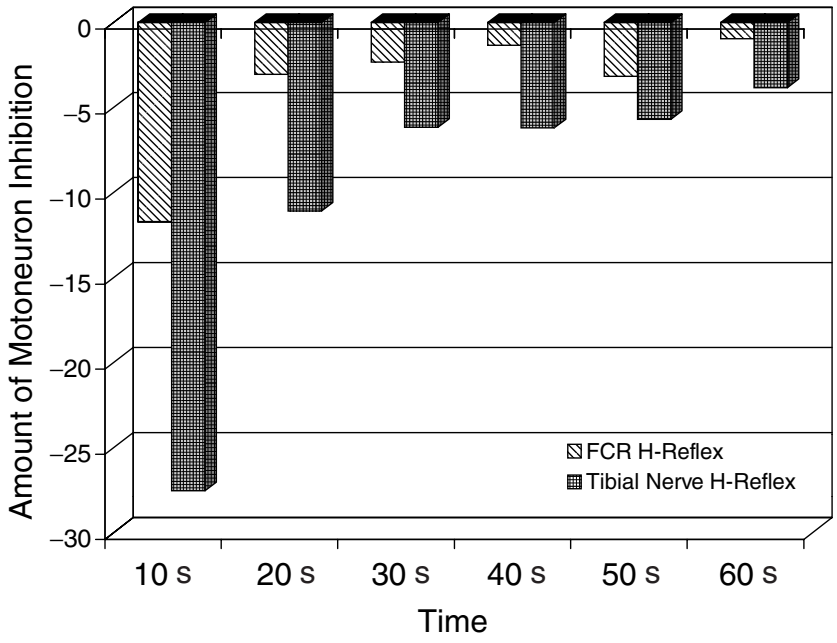

Figure 2. H/M ratio recovery profiles.

procedures. The Dunnett's procedure for a priori contrasts was used to detect any differences between baseline values and postmanipulation time points for each spinal manipulation procedure.

RESULTS

The attenuation of the tibial nerve H-reflex was greater following a L5–S1 spinal manipulation procedure as compared to the depression of the median nerve H-reflex following a C5–6 spinal manipulation procedure ($p < .05$). The amount of corresponding H-reflex depression was greater following a L5-S1 SM procedure than the C5–6 spinal manipulation procedure (Fig. 1; $p < .05$). The median nerve H-reflex recovered to its baseline value within 20 seconds after the C5–6 spinal manipulation procedure (Fig. 2). There was a rapid recovery of the tibial nerve H-reflex between 10 and 20 seconds with a more gradual recovery from 20 seconds to 40 seconds (Fig. 2).

CONCLUSION

The results of this investigation indicate that lumbar spinal manipulation procedure exerts a transient, but significant attenuation of the lumbar alpha motoneuronal pool as measured by tibial nerve H-reflex amplitude changes. The effects of cervical spinal manipulation procedure on the excitability of cervical motoneuronal pools were also determined to be significant, but to a lesser extent than the lumbar region. The results of this study do not support the supposition that cervical spine may possess a greater responsiveness to spinal manipulation than does the lumbar spine. However, the relationships among receptor density, segmental circuitry, and spinal manipulation effects on motoneuron activity between the lumbar and cervical spine remain to be elucidated.

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