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RESEARCH REPORT

H-reflex responses to High-Velocity Low-Amplitude manipulation in asymptomatic adults

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Abstract *Background:* High-Velocity Low-Amplitude (HVLA) manipulation of the spine is a broadly used technique in Osteopathic Manipulative Treatment (OMT), and studies have shown that spinal manipulation might lead to transient decrease in motoneuronal activity assessed through Hoffmann Reflex (H-reflex) test. However, its physiologic response is not fully understood, and there is no consensus on H-reflex responses to spinal manipulation.
Objective: The purpose is to assess motoneuron excitability by the H-reflex test before and after HVLA manipulation of the lumbar spine of asymptomatic adults.
Design: Prospective controlled experimental study with pre and post-intervention measures.
Methods: The participants were first submitted to a sacrolumbar (L5-S1) control intervention and after an HVLA manipulation of the same vertebral segment. H-reflex amplitudes were measured before and after the procedures; the participants were positioned lying on their left side and they did not change the position during the experimental procedure.
Participants: Nineteen asymptomatic adults were recruited through public advertisements and referrals from healthcare professionals.
Results: There was a variation of the H-reflex amplitude; but with no systematic change across participants. Six out of 19 participants had a decrease on H-reflex greater than 20% after the manipulation, and no significant change in 13 participants.
Conclusion: The results hypothesize that the electrophysiological effects of HVLA manipulation have different results among participants, and that this variability may

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be due to dysfunction at the level manipulated, changes in autonomic tone and/or technical issues delivering the technique.

Implications for clinical practice

- High velocity low amplitude manipulation is commonly used in daily practice to treat back pain.
- It is paramount to understand its physiological effects and how it affects the body.
- Our study shows evidence that the results of this type of manipulation are variable and this brings a need for new studies using appropriate samples to assess the effects of high velocity low amplitude manipulation on somatic and/or neurovegetative dysfunctions.
- Understanding the mechanisms of how osteopathic manipulative therapy works, when properly applied, should contribute to technique selection and thus the potential to offer better treatment to our patients.

Introduction

High-Velocity Low-Amplitude (HVLA) manipulation of the spine is a widely used technique in Osteopathic Manipulative Treatment (OMT) for acute and chronic low-back pain.[1–3] There is moderate evidence that spinal manipulation may reduce pain and improve function in chronic and acute low back pain in the short term when compared with sham spinal manipulation.[4,5] However, the therapeutic mechanisms are not thoroughly understood.[6]

The monosynaptic stretch reflex can play a major role in motion restriction, and it had been suggested that OMT could restore range of motion by resetting the stretch receptor gain.[7–10]

The H-reflex is an estimate of alpha motoneuron (αMN) excitability and can be used to investigate whether an intervention such as spinal manipulation changes the H-reflex intensity by altering the monosynaptic reflex transmission within the spinal cord.[11,12] Studies show that patients with spinal cord injuries, and with acute or chronic low back dysfunction have altered H-reflex responses when compared with healthy participants.[13,14] Furthermore, Humphreys et al.[15] demonstrated that spinal manipulation might normalize H-reflex responses.

Floman et al.[16] investigated the H-reflex responses in participants with L5-S1 unilateral disc herniation before and after lumbar spine manipulation in side-lying position. At pre-manipulation phase the H-reflex mean amplitude was significantly lower on the side of disc herniation, and after lumbar manipulation the H-reflex increased significantly on the affected side while the values on the healthy side remained unchanged.[17]

These findings diverge from the study of Dishman et al.[18,19] who assessed the effects of spinal manipulation on tibial nerve H-reflex recorded from the gastrocnemius muscle in 17 healthy participants. They observed the suppression of motoneuron activity after lumbar (L5-S1) manipulation; but the experimental protocol involved changing the position of spinal manipulation and H-reflex testing.[18,19]

Suter et al.[17] investigated healthy participants and patients with low back pain and observed no significant changes in H-reflex amplitude in healthy participants receiving manipulation to the sacroiliac joint (SIJ) — with participants in the same position, i.e., the participants were not moved during the procedure. They concluded that H-reflex responses after SIJ manipulation are sensitive to movement/repositioning, and that the H-reflex depression after manipulation documented in previous studies were movement artifacts rather than treatment effects. However, participants with low back pain presented changes in motor neuron excitability after SIJ manipulation, because the H-reflex amplitude response decreased 20% after treatment compared with the measures before treatment. It is noteworthy that the protocol used by Dishman et al.[18] was L5-S1 manipulation and the protocol used by Suter et al.[17] was SIJ manipulation.

Dishman et al.[18] reported the H-reflex attenuation after L5-S1 spinal manipulation, where a constant prone position was utilized during the whole experiment. Nevertheless they changed the direction of the applied force vectors when performing the procedures. In a recent study Orakifar et al.[21] also demonstrated H-reflex attenuation after SIJ manipulation, and they attributed it to inhibited Ia afferents discharge.