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CASE STUDY

High-velocity low-amplitude thrust manipulation of the lumbar spine immediately modifies soleus T reflex in asymptomatic adults

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Abstract *Background:* High-velocity low-amplitude thrust manipulations (HVLAM) are routinely used in osteopathic treatment. Despite the large number of studies that have been realized till now, the effects of spinal HVLAM on the physiological properties of muscles and nerves are not fully characterized.
Objective: The present study was designed to investigate the effects of a spinal lumbar L4/L5 HVLAM on the functional properties of the soleus T reflex in asymptomatic young adults.
Design: Controlled pre/post measures experimental design.
Methods: Right and left soleus T reflexes were elicited by striking right and left Achilles tendons with an instrumented reflex hammer and the electromyographic (EMG) signals were monitored in right and left soleus muscles. The amplitude and latency of EMG responses were measured before and after the delivery of a HVLAM targeting the L4/L5 segment. The conduction velocity was calculated from the latency value.
Subjects: 50 asymptomatic adults met all inclusion criteria. They were randomly allocated to either group a) receiving a sham manipulation (SM), or b) a HVLAM. Because of subject loss, the final size of SM and HVLAM groups was 24 and 18, respectively.

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Results: Our data show that the conduction velocity, but not the amplitude of the T reflex, is significantly increased by HVLAM in both soleus muscles with small to medium effect size. SM neither changes the amplitude nor modifies the conduction velocity.
Conclusion: Our data show that a lumbar L4/L5 HVLAM modifies the electrophysiological properties of the soleus T reflex.

Introduction

Spinal manipulations are usually provided by osteopathic and other manual and manipulative practitioners to their patients within a global comprehensive treatment approach.[1] Although many clinical reports claimed that spinal manipulations improve regional pain, range of motion, strength and functionality,[1] other evidence indicates correlation between spinal manipulation and risks of severe neurological or vascular alterations.[2,3] In particular, cases of vascular stroke and dissection, spinal cord injury and paraplegia after spinal manipulation have been reported.[4–7] Spinal thrust or "high-velocity, low-amplitude manipulation" (HVLAM) involves a high-velocity impulse applied to a diarthrodial joint with very low amplitude. HVLAM effectiveness has been associated with the patient perception of an audible cavitation noise; although such a criterion is now contested.[8,9] As highlighted elsewhere,[10] the extent of the practitioner's experience with HVLAM is important for HVLA efficiency and success. Improved understanding of the physiological processes modified by HVLAM and the consequences on human health are also of importance.

A recent review has documented the forces developed by practitioner, their spatial directions and their time course during spinal HVLAM.[11] HVLAM is recognized to promote the improvement of back pain[12] and of articular range of motion.[13–15] It was recently proposed that HVLAM-induced improvement in pain perception was related to the stimulation of catalase activity[16]; an enzyme involved in the neutralization of free radicals related to pain.[17] Other studies have suggested some immediate changes in neurophysiological electrical properties.[18–22] However, inconsistencies exist at the muscular level. On the one hand, muscular strength is increased upon spinal HVLAM.[23] On the other hand, spinal HVLAM was shown to lower[24,25] or to increase[26] muscular electrical activity. Other works have explored the physiological effect of HVLAM using a neuromuscular monosynaptic reflex as outcome. Spinal HVLAM decreases H reflex amplitude.[19,27,28] However, these studies lacked adequate control conditions and their results were considered as artifacts.[29] Nevertheless, in well-defined conditions a spinal lumbar HVLAM at the L5/S1 level was shown to promote H reflex amplitude attenuation.[30] Taken as a whole, these findings show that a clarification is needed concerning the experimental conditions used to study the effect of HVLAM and a more systematic approach of the different spinal levels on which HVLAM can be applied.

Therefore, the aim of the present study was to investigate the physiological consequences of a spinal HVLAM at the L4/L5 level on the soleus muscle T reflex elicited by the Achilles tendon striking.

Methods

Study design

We compared the soleus T reflex parameters (i.e. amplitude and velocity) collected in participants randomly allocated to a group receiving a) a HVLA manipulation (HVLAM group), or, b) a sham manipulation (SM).

Participants

The flow diagram corresponding to the recruitment, the allocation, the treatment of the participants and the analysis of the data is indicated in Fig. 1. 330 asymptomatic young adults from the direct environment of IdHEO Nantes Osteopathic School were invited to participate. After information concerning the aim and the procedure of the study, 87 participants gave their written informed consent. The present study was conducted according to the Declaration of Helsinki principles (see Section 2.6.1).

Inclusion criteria

Age over 18 years old was considered as inclusion criteria for the present study. The participants should not be opposed to osteopathic