

EFFECTS OF HIGH-VELOCITY, LOW-AMPLITUDE MANIPULATION ON CATALASE ACTIVITY IN MEN WITH NECK PAIN

Carolina Kolberg, DC, MS,^a Andrea Horst, BS,^b Angela Kolberg, DC, PhD,^c Adriane Belló-Klein, PhD,^d and Wania A. Partata, PhD^e

ABSTRACT

Objective: The aim of this study was to identify the influence of high-velocity, low-amplitude (HVLA) manipulation on lipid peroxidation and catalase activity in subjects with neck pain who answered the Neck Disability Index and quadruple visual scale questionnaires.

Methods: Twenty-two men (mean age, 38 years) with neck pain were recruited through radio and newspaper advertisements in the local media. Every patient received 6 sessions of HVLA manipulation, 3 times a week for 2 weeks. Blood samples were drawn from the cubital vein before treatment in the first session and after the third and sixth sessions. The quadruple visual scale was used with the same scheme. The Neck Disability Index questionnaire was applied before the beginning of treatment and after the last session. Catalase activity and lipoperoxidation were measured in erythrocyte samples.

Results: Results showed no change in lipid peroxidation. Nevertheless, the catalase activity was increased by HVLA manipulation. The same treatment reduced pain perception and disability in these subjects.

Conclusion: The present study has shown that catalase activity of the erythrocytes, but not lipoperoxidation, increased after 6 sessions of HVLA manipulation treatment in men with neck pain. The results support the beneficial role of HVLA in the treatment of patients with neck pain. (*J Manipulative Physiol Ther* 2010;33:300-307)

Key Indexing Terms: Neck Pain; Catalase; Male; Lipid Peroxidation; Manual Therapy

Pain is a common symptom of injuries and diseases. Pain perception depends on integrated receptors and molecule pathways. Changes in the receptors environment and sensory nerve fibers function usually

occur in these conditions.^{1,2} The understanding of the mechanisms involved in pain continues to be a burgeoning field of research. Strategies to control the pain mechanisms have revealed the crucial role of reactive oxygen species (ROS) in these processes.³⁻⁵ Reactive oxygen species play a role in normal cellular processes, and their concentration is controlled by antioxidant systems involving numerous nonenzymatic molecules and enzymes such as catalase.^{5,6} Located in peroxisomes, catalase converts hydrogen peroxide into water.⁷ Oxidative stress and cellular damage may occur when the ROS production is greater than antioxidant system activity.⁶ Some works have described changes to the antioxidant system in the presence of several pathologies, including central nervous system disorders.⁸ Clinical evidences sustain the role of the nervous system in hyperalgesia and allodynia in chronic inflammatory joint diseases and also symptoms perpetuation.^{4,6,9}

Neck pain is a very common problem in the general population, second only to low back pain in frequency.¹⁰⁻¹² Approximately 10% of the male population suffers chronic neck pain at least once during lifetime.^{13,14} A wide variety of therapies are used to treat neck pain,¹⁵ including spine manipulation.¹⁶⁻¹⁸ *Spinal manipulation* is defined as the

^a Postgraduate Student, Department of Physiology, Instituto de Ciências Básicas da Saúde, UFRGS, Porto Alegre, RS, Brasil.

^b Postgraduate Student, Department of Physiology, Instituto de Ciências Básicas da Saúde, UFRGS, Porto Alegre, RS, Brasil.

^c Research Collaborator, Department of Physiology, Instituto de Ciências Básicas da Saúde, UFRGS, Porto Alegre, RS, Brasil.

^d Associate Professor and Research Advisor, Department of Physiology, Instituto de Ciências Básicas da Saúde, UFRGS, Porto Alegre, RS, Brasil.

^e Associate Professor and Research Advisor, Department of Physiology, Instituto de Ciências Básicas da Saúde, UFRGS, Porto Alegre, RS, Brasil.

Submit requests for reprints to: Carolina Kolberg, DC, Ms, Departamento de Fisiologia, Instituto de Ciências Básicas da Saúde, UFRGS, Rua Sarmento Leite, 500, CEP. 90050-170, Porto Alegre, RS, Brasil (e-mail: carolina.dc@clinicakolberg.com.br).

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use of a short- or long-lever high-velocity thrust directed to one or more of the joints of the spine.¹⁹ Several studies demonstrate the effectiveness of cervical high-velocity, low-amplitude (HVLA) manipulation in reducing neck pain.^{15,16,20-24} Previous studies suggest that HVLA manipulation may change pain thresholds and physiological parameters such as substance P, inflammatory cytokines, and prostaglandins, all related to painful conditions.²⁵⁻³² In addition, it has been demonstrated that dysfunctional joints release proinflammatory agents such as oxygen and nitrogen free radicals that affect neural function.⁴ However, the direct connection between ROS and HVLA manipulation has not been established. Peroxynitrite is a potential oxidant and cytotoxic agent formed as result of high nitric oxide and superoxide production; and it is reduced by oxyhemoglobin,⁵ thus raising the plausible hypothesis of the analgesic action of HVLA manipulation caused by increased blood flow due to dilution of prooxidant agents locally formed. Chiropractic care could also affect antioxidant enzymes activity, including catalase. Therefore, this study was designed to investigate the possible influence of HVLA manipulation on oxidative stress parameters, such as lipoperoxidation and catalase activity, in men with chronic neck pain. The quadruple visual scale and the Neck Disability Index (NDI) questionnaires were applied to identify the analgesic effect and possible improvement of neck disability conditions.³³⁻³⁵

METHODS

Subjects

This study was performed using only men as research subjects because women's sex hormones vary throughout the menstrual cycle and it has been demonstrated that sex hormones influence the nociceptive threshold.^{36,37} These individuals were between 20 and 50 years of age and had as their chief complaint pain in the area defined as neck pain by the Task Force on Neck Pain and Its Associated Disorders.³⁸ The symptoms were present for at least 90 days³⁹ and strong enough (have an average sufficient intensity greater than 2 of 10 on a visual numerical pain scale) to permit clinically worthwhile effect data to be demonstrated.⁴⁰

The exclusion criteria were neck pain symptoms related to serious pathologies such as malignancy, infection, inflammatory disorder, or fracture. Patients were also excluded when there were signs of cervical spinal cord compromise or radiculopathy and/or history of neck surgery. In addition, subjects were only eligible for trial inclusion if the chiropractic doctor considered that manipulation could be an appropriate approach for their condition. The subjects were healthy and not under any kind of pain treatment. They did not practice regular physical activity. Those who practiced physical activity more than twice a week for at least a month were excluded.

Chemical dependents such as alcoholics and smokers were also excluded.

Experimental Procedures

Men with neck pain were recruited through radio and newspaper advertisements in the local media. The interview used an inclusion/exclusion questionnaire, anamneses, and physical examination to select the volunteers. Written informed consent was obtained from each subject after fully explaining the procedures. Afterward, they were submitted to 6 sessions of spinal HVLA manipulation (diversified techniques), 3 times a week for 2 weeks. The HVLA procedures were performed in all segments of the spine with restriction of movement determined by motion palpation.

Blood samples were drawn before the first treatment session and immediately after the third and sixth sessions from each patient. Patients were advised to remain fasting for 8 hours and reduce the intake of sausages, red meat, chocolate, caffeine, citric fruits, and grains during the treatment period. The blood samples were drawn from the cubital vein using disposable needles and monovettes (Vacutainer, 7 mL) with anticoagulant heparin. The first volume of blood obtained (2 mL) was discarded to avoid hemolysate material in the sample. Finally, 5 mL of venous blood was quickly obtained and kept on ice until the preparation of red blood cells (RBCs) for later analysis.

Pain levels of symptomatic subjects were assessed using the quadruple visual scale³³ applied before treatments in the first session and at the end of the third and sixth sessions. The quadruple visual scale is a 10-point scale to identify the pain intensity in 4 different stages. Patients were asked about the intensity of their average neck pain, neck pain at the moment of the visit, and worst and best neck pain phase. The NDI questionnaire was applied just before the first treatment session and after the last session. The NDI consists of 10 questions to determine the disabilities a patient experiences in daily life due to neck pain.^{34,35} Each of the 10 items is scored from 0 to 5. The original report, by Vernon and Mior,³⁴ provided scoring intervals for interpretation, as follows: 0 to 4 = no disability, 5 to 14 = mild; 15 to 24 = moderate; 25 to 34 = severe; greater than 34 = complete disability.

The interview, treatment, and drawing of blood samples were performed in a private chiropractic clinic. The blood samples were analyzed in the Physiology Department Laboratories of the Federal University of Rio Grande do Sul. The treatment procedures were performed by the chiropractor responsible (C Kolberg), whereas the questionnaires were applied by a second chiropractor and the blood samples were drawn by a biomedical doctor.

This study was approved by the Ethics Committee of the Federal University of Rio Grande do Sul (protocol no. 2007699).

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