Changes in Vertebral Artery Hemodynamics Associated With McKenzie Therapeutic Cervical Movements: An Exploration Using Duplex Ultrasound Imaging

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ABSTRACT

Objective: The purpose of this study was to explore vertebral artery hemodynamic changes associated with McKenzie therapeutic cervical movements in healthy individuals.

Methods: A single-group repeated-measure design was used to examine 20 healthy participants aged 22.05 (1.69) years, mean (standard deviation). Vertebral artery volume flow, diameter, resistive index, time-averaged maximum velocity, and pulsatility index were measured using Duplex ultrasound. Vertebral artery hemodynamics were measured at cervical neutral positions then compared against vertebral artery hemodynamics measured during end-range loading and after repeated McKenzie therapeutic movements. Wilcoxon signed rank tests were used for comparisons, and standardized mean differences (SMDs) were calculated to quantify the changes in size.

Results: Repeated retraction with extension in a sitting position and end-range retraction with extension in supine position were significantly associated with an increase in vertebral artery volume flow, $P \leq .01$, and the SMD suggests small-medium changes in size. Statistical significant vertebral artery dilation was observed in the sitting position with protraction, combined retraction with extension, and flexion, $P \leq .01$, yet the SMD suggested small changes in size. End-range flexion was significantly associated with a reduction in vertebral artery pulsatility index, and the SMD suggested large changes in size. Repeated retraction with extension in supine position was significantly associated with an increase in vertebral artery time-averaged maximum velocity, yet the SMD revealed no clinically important difference.

Conclusion: For the healthy participants in this study, McKenzie cervical movements were mostly associated with an increase in vertebral artery hemodynamics. (J Manipulative Physiol Ther 2019;42:66-74)

Key Indexing Terms: *Spine; Cervical Vertebrae; Rehabilitation; Vertebral Artery*

INTRODUCTION

Neck pain and related dysfunctions and pathologies are common health issues that may have biobehavioral and socioeconomic consequences.[1-3] The multidimensional impact of neck pain and its biomechanical complexity poses challenges to health care management. Various neuromuscular impairments are associated with neck pain, which may restrict total neck mobility in the activities of daily living and further increases neck pain.[4,5] The etiology of neck pain is mostly nonpathologic in nature, but may be related to mechanical overloading resulting from faulty postures and repeated stressful neck movements.[6,7] The activities of daily living require the cervical spine to play a complex role in providing multidirectional and combined movements while maintaining head stability.[8] Cervical spine complexity extends to vertebral biomechanics in that both vertebral extension and flexion occur at different vertebral levels of the cervical spine during a single cervical movement.[9,10] However, designing management programs for cervical related disorders might be difficult owing to the anatomical and biomechanical complexity of the cervical spine.

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