

ACTIVATION OF RECTUS CAPITIS POSTERIOR MAJOR MUSCLES DURING VOLUNTARY RETRACTION OF THE HEAD IN ASYMPTOMATIC SUBJECTS



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ABSTRACT

Objective: The purpose of this study was to assess levels of electromyographic activity measured from rectus capitis posterior major (RCPM) muscles of asymptomatic subjects as their heads moved from a self-defined neutral position to a retracted position.

Methods: A 2×2 within-subjects factorial research design was used. Disposable, intramuscular electrodes were used to collect electromyographic data from asymptomatic subjects between the ages of 20 and 40 years old. Data analysis was performed using mixed effects β regression models.

Results: Activation of RCPM muscles was found to significantly increase ($P < .0001$) as the head moved from a self-defined neutral position to a retracted position. Rectus capitis posterior major muscle activation levels, measured as a function of head position, have not been previously reported.

Conclusions: The findings from this study showed that RCPM muscle activation significantly increases during voluntary retraction of the head. (J Manipulative Physiol Ther 2014;37:433-440)

Key Indexing Terms: Headache; Exercise Therapy; Neck Muscles; Electromyography

Retraction of the head is one of several clinical tools that are commonly used to assess and treat patients with headache.^{1,2} Unfortunately, head retraction

exercises have not been found to be significantly more effective in reducing head and neck pain than other active interventions, possibly due to the difficulty in defining inclusion criteria that would result in a homogeneous study group that would be responsive to this particular exercise.³ Retraction of the head results in selective stretching of rectus capitis posterior minor (RCPm) and rectus capitis posterior major (RCPM) muscles (Fig 1) as the occipitoatlantal (OA) and the atlantoaxial (AA) joints are flexed.^{4,5} Rectus capitis posterior major muscles arise from the spinous process of the axis and insert into the lateral part of the inferior nuchal line of the occipital bone.⁶

Bilateral contraction of rectus capitis posterior (RCP) muscles has been reported to contribute to extension of the head at the OA and AA joints, whereas unilateral contraction of the RCPM muscles contributes to ipsilateral rotation and side bending of the head.⁶ Considering their small size, relative to larger muscles acting in parallel with them, RCP muscles would not be expected to significantly contribute to gross movements of the head.^{7,8} The high spindle density in RCP muscles suggests that they provide significant feedback to the central nervous system that is related to motion and position of the head.⁹⁻¹² These suggest that the

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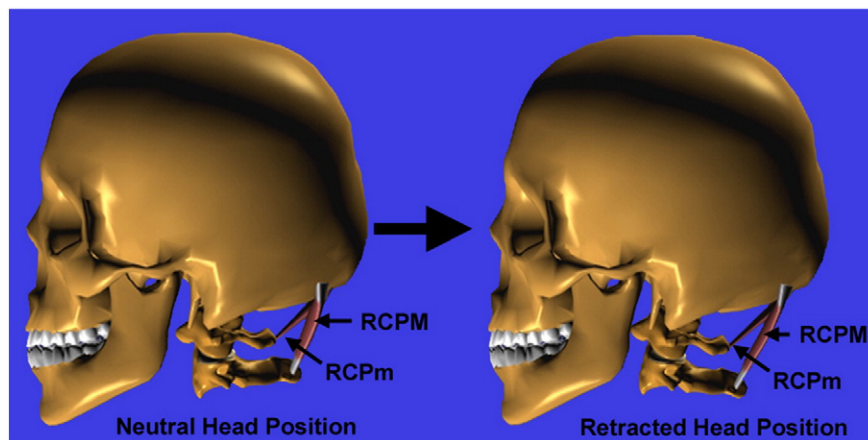


Fig 1. The image on the left shows a self-defined NHP. The image on the right shows a RHP. RCPM, rectus capitis posterior major; RCPm, rectus capitis posterior minor.

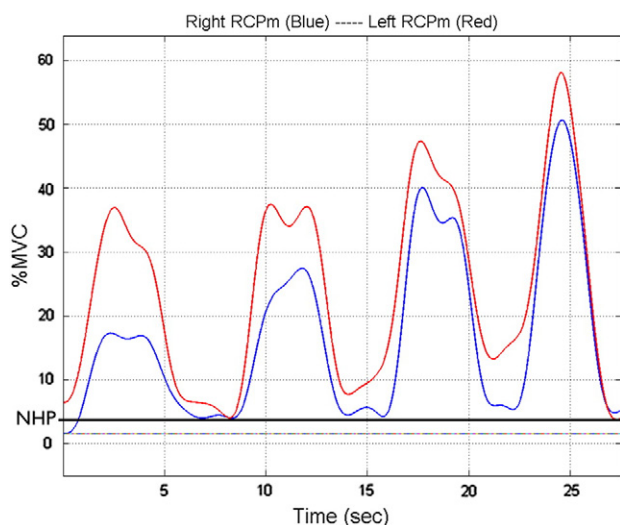


Fig 2. Processed EMG voltages from right and left RCPm muscles during voluntary retraction of the head from an NHP.¹⁵ The signals, recorded from subject 8, form an alternating sequence of 5 NHP trials (valleys) and 4 RHP trials (peaks). %MVC, percentage of maximum voluntary contraction; NHP, neutral head position; RCPm, rectus capitis posterior minor; RHP, retracted head position.

morphological and biomechanical properties of RCP muscles are optimized to contribute to segmental stability of the OA and AA joints through control of the angular position of the posterior arch of the atlas and the posterior process of the axis relative to the occiput.^{13,14}

Voluntary head retraction has been shown to result in increased electromyographic (EMG) activity in RCPm muscles.¹⁵ Levels of EMG activity in RCPm muscles, normalized to a maximum voluntary isometric contraction (MVIC), were found to significantly increase as subjects moved their head from a self-defined neutral head position (NHP) to a retracted head position (RHP) (Fig 2). A better understanding of the response of RCPM muscles in asymp-

tomatic subjects as they voluntarily retract their head could help clarify why head retraction exercises seem to reduce head and neck pain in some groups of chronic headache patients and could help define the patient cohort that would be most responsive to this form of exercise. Electromyographic voltages from RCPM muscles, with the head held in a self-defined neutral position or with the head held in a retracted position, have not previously been published.

Therefore, the purpose of this study was to assess levels of EMG activity measured from RCPM muscles of asymptomatic subjects as their heads moved from a self-defined neutral position to a retracted position.

METHODS

Research Design

This study used a 2 × 2 within-subjects factorial research design, supplemented by 2 additional covariates (sex and body mass index [BMI]) to study RCPM muscle activation. We recorded EMG data from the RCPM muscles during multiple trials in each head position (NHP vs RHP) and on each side of the body (left vs right) for each participant. This design was similar to that used in our previous article.¹⁵

Participant Enrollment

We recruited participants by advertising the study to 200 second-year osteopathic medical students at Michigan State University (MSU) via e-mail. Forty-three students responded to the advertisement, but only 20 met the enrollment eligibility criteria for this study. To ensure that study results would pertain to the population of adults with normal functioning of the upper cervical spine, our inclusion criteria required subjects who (1) had no head and neck pain at the time of participation, (2) had full range of motion for the upper cervical spine (ie, no substantial motion restrictions), and (3) were 20 to 40 years of age. The age criterion excludes adults who may have begun to

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