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Original Research

Electromyography of 3 Scapular Muscles: A Comparative Analysis of The Cuff Link Device and a Standard Push-Up

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Abstract

Context: The Cuff Link is a closed kinetic chain rehabilitation apparatus for the upper extremity. Limited research has established its effectiveness to elicit muscle activation of the scapular muscles.

Objective: To determine if scapular muscle activation differs in response to 2 upper extremity closed kinetic chain exercises: Cuff Link and standard push-up.

Design: A single-group, repeated-measures design.

Setting: Controlled laboratory.

Patients or Other Participants: Twenty-eight healthy individuals (13 women: age = 19.69 ± 1.55 years, height = 167.44 ± 9.52 cm, mass = 61.00 ± 8.79 kg; 15 men: age = 22.00 ± 3.91 years, height = 181.44 ± 6.60 cm, mass = 82.36 ± 13.23 kg) with no history of shoulder or low back injury volunteered to participate in this study.

Intervention(s): Participants performed 10 trials of complete revolutions on the Cuff Link and 10 full-weight-bearing push-ups. We controlled trial velocity and randomized order. Trunk and shoulder positions were normalized to the participant's height. Using surface electromyography, we recorded muscle activity of the serratus anterior, middle trapezius, and lower trapezius. Rectified and smoothed electromyography data for the serratus anterior, middle trapezius, and lower trapezius were normalized as a percentage of the maximal voluntary isometric contractions (%MVIC).

Main Outcome Measure(s): Mean muscle activity of the serratus anterior, middle trapezius, and lower trapezius. We used paired-samples *t* tests to analyze the mean data for each condition. The α level was adjusted to .016 to avoid a type I

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Results: Middle trapezius %MVIC was greater during push-ups ($27.01 \pm 20.40\%$) than during use of the Cuff Link ($11.49 \pm 9.46\%$) ($P = .001$). Lower trapezius %MVIC was greater during push-ups ($36.07 \pm 18.99\%$) than during use of the Cuff Link ($16.29 \pm 8.64\%$) ($P = .001$). There was no difference in %MVIC for the serratus anterior between conditions.

Conclusions: The push-up demonstrated greater middle trapezius and lower trapezius activation levels compared with the Cuff Link. However, the push-up had a high participant failure rate. Because serratus anterior activation levels were similar, the Cuff Link may be an appropriate alternative for individuals lacking the upper body strength to perform a push-up.

Keywords: [scapula](#), [rehabilitation](#), [closed kinetic chain exercises](#)

W. Steven Tucker, MS, ATC, and Brian M. Campbell, PhD, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article; Erik E. Swartz, PhD, ATC, contributed to analysis and interpretation of the data and drafting, critical revision, and final approval of the article. Charles W. Armstrong, PhD, contributed to conception and design; analysis and interpretation of the data; and critical revision and final approval of the article.

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