Electromyographic Analysis of Shoulder Rotation Strength Testing Positions

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Shoulder strength is important to stability and function of the glenohumeral joint. Muscular weakness surrounding the glenohumeral joint can lead to shoulder instability and increase susceptibility to shoulder injury. Therefore, clinicians perform shoulder rotation strength tests at various positions to assess measures of function, including peak torque and muscle activation. However, shoulder function may vary across positions. The purpose of this study was to compare measures of shoulder function (peak torque and muscle activation) between two commonly used shoulder rotational strength testing positions.

Eighteen physically active individuals (12 females, 6 males, age: 21.2±2.9 y, height: 170.7±8.3 cm, weight: 73.8±9.3 kg) participated in this study. Participants performed isometric shoulder internal and external rotational strength tests using an isokinetic dynamometer in two different positions: (1) supine with arm abducted at 90° in the frontal plane, and (2) seated with arm abducted at 90° in the frontal plane and internally rotated 45°. The elbow was flexed 90° in both positions. Electromyographic data were collected for the posterior (PD) and anterior deltoid (AD) muscles, since they produce a force couple. Maximum voluntary isometric contractions (MVICs) were then performed to establish baseline muscle activation to which the trials were normalized.

A 2 (position) x 2 (direction) repeated measures analysis of variance (RM·ANOVA) compared torque values between testing positions for external and internal rotation tests. A second 2 (muscle) x 2 (position) RM·ANOVA compared muscle activation (%MVIC) between testing positions for AD and PD muscles. The first RM·ANOVA did not reveal a significant position-by-direction interaction. The second RM·ANOVA did reveal a significant muscle-by-position interaction [$F(1, 17) = 5.414$, $p = 0.033$]. Post hoc analysis showed a difference between supine (mean: 25.2, SD: ± 3.3 %MVIC) and seated (mean: 32.2, SD: ± 3.8 %MVIC) positions for AD activation, where greater activation was measured in the seated compared to the supine position ($p = 0.025$). Figure 1 shows a comparison of muscle activation at each testing position.

Since there were no differences in peak torque between positions, greater AD activation in the seated position may suggest the AD has greater contribution to overall shoulder strength in the seated compared to supine position. The findings from the current study are significant since they show how two commonly utilized shoulder rotational strength tests can differ in muscle activation. Clinicians should consider how different testing positions may vary in muscle activation function. Future research should assess other testing positions and muscles surrounding the glenohumeral joint.

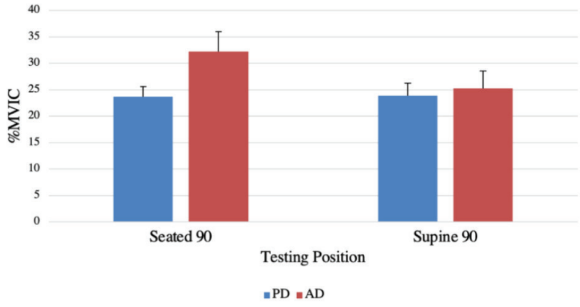

Figure 1: Percent maximum voluntary isometric contractions (MVIC) at both testing positions. AD denotes anterior deltoid and PD denotes posterior deltoid muscles.

Statement of Research Advisor

Molly's work highlights two common testing positions that are utilized in the clinical setting. These findings are important for clinicians when assessing individual muscle strength and activation throughout the rehabilitation process. This work should be furthered based on Molly's findings.

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