ULTRASONOGRAPHIC-MEASURED ACROMIOHUMERAL DISTANCE ASSOCIATED WITH WHEELCHAIR PUSHRIM KINETICS IN INDIVIDUALS WITH SPINAL CORD INJURY

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INTRODUCTION

The shoulder is the most commonly reported site of pain and injury in manual wheelchair users (MWUs) with spinal cord injury (SCI). Approximately 31-73% of MWUs with SCI have encountered shoulder pain and pathology (Boninger, Towers, Cooper, Dicianno, & Munin, 2001). The primary pathology implicated in most cases of shoulder pain in individuals with SCI is subacromial impingement syndrome (Bayley, Cochran, & Sledge, 1987; Dyson-Hudson & Kirshblum, 2004; Lee & McMahon, 2002). Subacromial impingement syndrome implies extrinsic compression of the supraspinatus outlet, narrowing of the subacromial space and consequent compression of the rotator cuff tendons. A substantial number of previous studies confirm manual wheelchair propulsion as a contributing factor in the development of shoulder pathology (Boninger & Cooper, 1999; Mercer et al., 2006). The component of propulsion force directed toward the wheel hub and required to generate friction is thought to act equal and opposite toward the shoulder translating the humeral head into the subacromial space (Requejo et al., 2008). This force may potentially lead to compression and damage of soft tissue causing impingement. In people with SCI, uneven loading on surrounding muscles during propulsion and a weak rotator cuff may lead to impingement of the soft tissue structures within the subacromial space (Lippitt & Matsen, 1993). Previous researchers found acute changes of biceps and supraspinatus tendons related to wheelchair propulsion using ultrasound (S. W. Brose et al., 2008; Collinger, Gagnon, Jacobson, Impink, & Boninger, 2009; van Drongelen, Boninger, Impink, & Khalaf, 2007). Known biomechanical factors (increased cadence, increased propulsion forces) for shoulder pathology were found related to post-propulsion quantitative ultrasound measures (Collinger, Impink, Ozawa, & Boninger, 2010). Lin et al. used ultrasound to detect acute changes in the acromiohumeral distance (AHD), a linear measure of the subacromial space, after a rotator cuff exercise and weight relief raises. Changes in the AHD were also correlated with shoulder pain and subject characteristics (Lin, Koontz, Worobey, & Boninger, 2012). While this study provided insight into how muscle fatigue impacts the AHD the effects of a propulsion task on the AHD are unknown. The purposes of this study were to determine if AHD changes relate to wheelchair propulsion technique. A second goal was to investigate the relationship between AHD changes with subject demographics, shoulder pain and pathology. We hypothesized that individuals who propelled with higher cadence, higher forces, and a greater number of laps on an overground course would have greater AHD narrowing compared to those who propelled with decreased force, cadence and fewer number of laps. A narrower AHD was assumed to correlate with higher physical examination injury scores at the shoulder (PESS) when controlling for subject characteristics.

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