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Clinical methods to quantify trunk mobility in an elite male surfing population

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ABSTRACT

Background: Thoracic mobility in the sagittal and horizontal planes are key requirements in the sport of surfing; however to date the normal values of these movements have not yet been quantified in a surfing population.
Objectives: To develop a reliable method to quantify thoracic mobility in the sagittal plane; to assess the reliability of an existing thoracic rotation method, and quantify thoracic mobility in an elite male surfing population.
Design: Clinical Measurement, reliability and comparative study.
Methods: A total of 30 subjects were used to determine the reliability component. 15 elite surfers were used as part of a comparative analysis with age and gender matched controls.
Results: Intraclass correlation coefficient values ranged between 0.95–0.99 (95% CI; 0.89–0.99) for both thoracic methods. The elite surfing group had significantly ($p \leq 0.05$) greater rotation than the comparative group (mean rotation 63.57° versus 40.80°, respectively).
Conclusion: This study has illustrated reliable methods to assess the thoracic spine in the sagittal plane and thoracic rotation. It has also quantified ROM in a surfing cohort; identifying thoracic rotation as a key movement. This information may provide clinicians, coaches and athletic trainers with imperative information regarding the importance of maintaining adequate thoracic rotation.

1. Introduction

It appears that the thoracic spine is a region which has been neglected when it comes to the consensus on gold standard clinical methods to measure range of motion (ROM) (Edmondston, Ferguson, Ippersiel, Ronningen, Sodeland, & Barclay, 2012; Johnson & Grindstaff, 2010). One of the difficulties of determining ROM in the thoracic region is that multiple joints above and below contribute to thoracic spine ROM (Kuo, Tully, & Galea, 2009). The thoracic movements of interest have generally been in the sagittal and horizontal planes; especially when considering the coronal orientation of the thoracic facets joints which favour rotation.

Physiotherapists usually attempt to utilize musculoskeletal screening measures that are specific to the sport the athlete participates in; however methods used must be standardised and shown to be reliable and valid (Spurrier, 2015). Generally, the premise behind musculoskeletal screening is three fold. This involves identifying limitation or asymmetry, enhancing performance and identifying injury prone regions (Spurrier, 2015). It would be deemed appropriate that athletes whose sports have a significant amount of stress on the thoracic spine would require a clinical method to assess this region.

In the case of surfing the thoracic spine is a key region which is stressed; especially considering that reduced range of motion may result in stress on surrounding joints and potentially affect performance (Furness, Hing, Abbott, Walsh, Sheppard, & Climstein, 2014). The sport of surfing can be broken down into three key

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phases; paddling (45% of the time), sitting (50% of the time) and actual wave riding (5% of the time) (Farley, Harris, & kilding, 2012; Meir, Lowdon, & Davie, 1991). During paddling the thoracic spine must be held in a prolonged extended position to allow for adequate arm clearance (Everline, 2007). A reduction in thoracic extension during paddling could potentially result in greater pressure via extension occurring at the lumbar spine or cervical spine (Furness et al., 2014). It could also result in greater shoulder abduction and extension to clear the water, thus causing shoulder impingement. During actual wave riding, thoracic rotation is a critical movement to assist in producing torque during turning manoeuvres (Fig. 1) (Everline, 2007). The surfer rotates towards the wave during the bottom turn and away from the wave during the top turn. During these movements the thoracic spine also flexes during the bottom turn and extends during the top turn; a combination of ROM and strength is needed with this movement. It could be suggested that for high-performing surfers, limitations in thoracic extension and rotation would result in the athlete 'turning out of their lower back', something that is generally identified as poor-scoring technique, and injurious.

When designing a surf specific musculoskeletal screen it is imperative to look at injury prone regions and specific joints which are under stress during the activity. Furness et al. (2014) revealed the two key areas with the highest frequency of chronic injury were the shoulder and lumbar spine. With regards to acute injuries the shoulder has been shown to have the highest frequency of injuries (Furness, Hing, Walsh, Abbott, Sheppard, & Climstein, 2015). The thoracic spine serves as a link between these two locations and could be a contributing factor to injuries sustained in both the lumbar spine and shoulder. Poor thoracic mobility has been associated with increased cervical pain and lumbar pain (O'Gorman & Jull, 1987) and shoulder pathology (Lewis & Valentine, 2010). Treatment directed at the thoracic spine has been associated with improvements in a range of musculoskeletal conditions including cervical and shoulder pathologies (Iveson, McLaughlin, Todd, & Gerber, 2010). An inability to attribute these findings to improvements in thoracic ROM may be due to the lack of feasible and reliable clinical methods to quantify thoracic ROM (Iveson et al., 2010).

It could be proposed that poor thoracic mobility or excessive kyphosis during paddling could cause the scapulae to be protracted and downwardly rotated leading to potential compression of the subacromial tissues (subacromial bursa and rotator cuff tendons). This could also result in compensatory cervical extension or lumbar extension while paddling. It could be speculated that reduced thoracic rotation could result in greater stresses placed on the lumbar spine and hips. Simple screening measures to assess the thoracic spine could potentially rule in or out this region as a possible contributor.

Fig. 1. An example of thoracic rotation during a top turn manoeuvre adapted from ASP (2014).

A thorough systematic literature review (accessing Pubmed, EMBASE, CINAHL, and SPORT-Discuss) was conducted to identify clinical tests which could be used in assessing thoracic extension and rotation. When reviewing literature around thoracic extension large variations existed in the ROM expressed, the actual test position, clinical devices used and the starting position. Due to the large discrepancies it was deemed appropriate to design a new sports specific method to determine thoracic mobility in the sagittal plane. The literature around thoracic rotation revealed less variation with ROM expressed, starting positions and devices used (Furness, 2015). The lumbar locked position was determined an appropriate method to quantify thoracic rotation as it is easily applied clinically and requires minimal equipment. Therefore the purpose of this study was to establish a reliable method to quantify thoracic movement in the sagittal plane; to assess the reliability of the lumbar locked method (thoracic rotation) and quantify thoracic mobility in an elite surfing population.

2. Methods

2.1. Subjects

Reliability testing was completed on 27 individuals for the thoracic methods in the sagittal plane and 30 subjects for the rotation method; a sample size of 15–20 is often used in reliability studies with continuous data (Lexell & Downham, 2005). Participants were asked to complete a subjective questionnaire reporting age and injury history. This was done to gather background and demographical information about participants. The study was approved by the Bond University Ethics committee (RO1610) and informed consent was gained from all participants. Subjects were eligible for the study if they were between the ages of 18–75 and able to adopt the starting position (four point kneeling with hips and knees in maximal flexion).

Exclusion criteria included any acute or chronic spinal pathology (in the past 3 months) that may be aggravated or worsened through repeated testing of thoracic extension, flexion and rotation. Based on these aforementioned criteria, no participants were excluded. Participants were between the ages of 20 and 57 years with the mean age being 30.83 ± 10.96 years. A total of 27 subjects (12 males and 15 females) were utilised to determine the reliability of the thoracic methods in the sagittal plane with the average age being 31.69 ± 11.52 years (range 20–57). A total of 30 subjects (16 females and 14 males) with a mean age of 30.84 ± 10.96 years (range 20–57) were used for determining reliability of the thoracic rotation method.

Comparative analysis was completed on 15 elite surfers, all of which were males with a mean age of 26.47 ± 4.59 years (range 18–34 years). Five of the male surfers were competing on the World Championship tour (WCT) which involves the top 32 ranked surfers in the world. The remaining surfers were competing in the World Qualifying Series (WQS) ranked in the top 100 surfers in the world.

2.2. Raters

The evaluators were two Physiotherapists, one with seven years of clinical experience in the assessment and treatment of orthopaedic conditions and the other a new graduate Physiotherapist. The new graduate performed all measurements and the other physiotherapist recorded; this was done to ensure blinding