LaFreniere, Renee
University of British Columbia, Department of Physical Therapy
Jensen, Matt; Smoljanovic, Tomislav; Wakeling, James; Klimstra, Marc; Thomas, Rebecca; Pollock, Courtney L.

Contribution of trunk swing to performance of fixed seat rowing

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Introduction: Classification of athletes in para sport ensures that athletes with similar levels of sport-specific ability, in the context of permanent physical impairments, compete in a specific sport class. Para rowing classification is based on the biomechanics of the rowing stroke. Force is generated in rowing (with a sliding seat) using sequential movements that can be broken down into the *leg drive* (push of the legs into extension), *trunk swing* (extension of the trunk pivoting from the hip joint) and *arm pull* (flexion of the elbows, extension of the shoulders). This research aims to explore the contribution of trunk swing to performance variables of fixed-seat rowing in athletes in the Para Rowing (PR)1 and PR2 sport classes.

Methods: PR1 and PR2 athletes at an international regatta consented to participate. NE rowers without physical impairments were recruited from a university rowing club. Rowing ergometers used for rowing-specific dryland training, were used in 2 different seating conditions that resulted in either: 1) Restricted trunk swing or, 2) Unrestricted trunk swing during the rowing stroke. Participants performed a warm-up followed by maximal effort 500m pieces (race-pace) on the rowing ergometer in each seating configuration. Force production at the handle (peak force (N) and impulse (Ns) was measured at a frequency of 100 Hz using a compression-tension strain gauge, placed in line between the handle and ergometer chain. Fixed-seat rowing-specific trunk strength was measured as trunk extension force quantified in Newtons (N) using hand-held dynamometry in both seating conditions after completing each 500m ergometer piece. Trunk extension strength and rowing performance measures were compared using mixed model two-way General Linear Models with Bonferroni post-hoc analysis, including within subject factor of condition and one between group factor of sport class.

Results: NE and PR2 rowers showed significantly greater stroke impulse (Ns) and mean peak force (N) in the unrestricted trunk swing condition than in the restricted trunk swing condition ($p<0.01$). The PR1 rowers showed no significant difference in impulse or mean peak force between conditions. NE and PR2 rowers demonstrated significantly greater trunk extension force than PR1 rowers in both restricted trunk swing and unrestricted trunk swing conditions ($p<0.01$). Only the PR1 rowers generated significantly greater trunk extension force during the supported trunk condition compared to the unsupported trunk condition ($p<0.01$).

Discussion: These results differentiate between PR1 and PR2 rowers with respect to the contribution of trunk swing. For PR1 rowers, the unrestricted trunk swing condition resulted in decreased trunk extension strength compared to the more supportive seating condition restricting trunk swing, however, seating condition had no significant impact on rowing

performance measures. Conversely, PR2 and NE rowers showed the same measures of trunk extension strength regardless of whether the trunk was supported, however, displayed significant increase in rowing-specific performance measures in the unrestricted trunk swing condition.

Study funding: Funded by World Rowing