

## Scapular stabilization and muscle strength contribute to subacromial impingement in manual wheelchair users with spinal cord injury.

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Current physical therapy protocols for subacromial impingement are based on observed muscle imbalances in overhead workers and overhand athletes. Manual wheelchair users with spinal cord injury (SCI) who have subacromial impingement may have a different pattern of muscle imbalance due to the demands of wheelchair propulsion, which is not an overhead activity.

**Purpose:** To determine if the pattern of muscle imbalance and impaired scapular stabilization observed in shoulders of able-bodied adults with impingement is different from the shoulders of manual wheelchair users with SCI and impingement. **Methods:** 22 adults with subacromial impingement (11 SCI, 11 able-bodied (AB)) performed isokinetic dynamometry in 6 directions: abduction, adduction, internal rotation, external rotation, push and pull. The ratio of normalized muscle electrical activity of upper and lower trapezius (UT:LT) during arm abduction and force ratios were calculated for abduction to adduction (ABD:ADD), internal to external rotation (IR:ER) and push to pull (PUSH:PULL). **Results:** A significant Impingement x SCI/AB interaction was shown for UT:LT ( $p=0.016$ ). Shoulders with impingement had a significantly higher UT:LT activation ( $1.46 \pm 0.52$ ) compared to shoulders without impingement ( $0.93 \pm 0.45$ ) ( $p = 0.004$ ), regardless of if the person was a wheelchair user. A significant Impingement x SCI/AB interaction was also shown for ABD:ADD ( $p=0.01$ ) and PUSH:PULL ( $p=0.043$ ), but not for rotation or any absolute differences in strength. Shoulders of participants with SCI had a significantly greater ABD:ADD ratio ( $1.37 \pm 0.36$ ) than able-bodied participants ( $1.04 \pm 0.22$ ) ( $p=0.005$ ) and a significantly greater PUSH:PULL ratio ( $1.53 \pm 0.36$ ) than able-bodied participants ( $1.26 \pm 0.18$ ) ( $p=0.004$ ) which were due to decreased strength in adduction ( $p = 0.044$ ) and pull ( $p=0.04$ ) in SCI. **Conclusions:** Rehabilitation strategies targeting the posterior shoulder girdle that are employed for able-bodied adults are also appropriate for manual wheelchair users with SCI who have impingement. **Future Directions:** It would be beneficial to determine the change in scapular stabilization and muscle balance after posterior shoulder strengthening, and its effect on shoulder pain.

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