

A strength and conditioning investigation to improve muscular imbalances at the shoulder joint in water-polo players: Implications for injury prevention

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Shoulder injuries are common in sports with frequent overhead motions



(Annett, *et al.*, 2000; Franić, *et al.*, 2007; Witwer & Sauers, 2006)

Differences in Swimming Posture *(Elliot, 1993)*



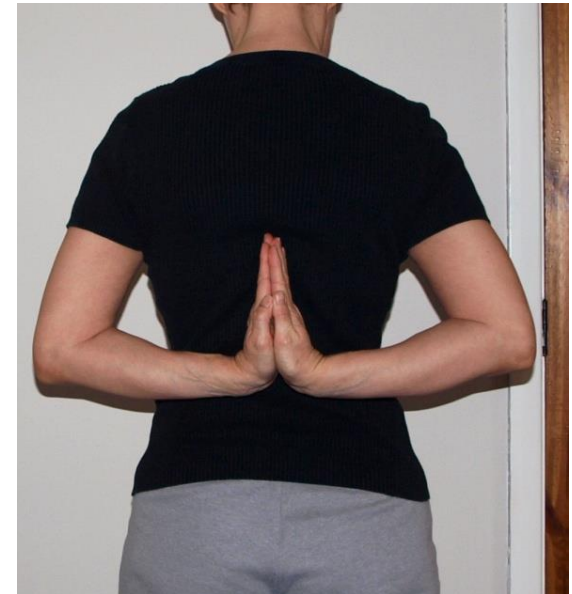
Differences in Playing Surface

(McMaster, *et al.*, 1991; Smith, 1998; Whiting, *et al.*, 1985)



❖ **Shoulder hyper-mobility** (*Witwer and Sauers, 2006*)

❖ **Muscle strength imbalance** (*McMaster, et al., 1991; Mota & Ribeiro, 2012; Noffal, 2003; Stickley, et al., 2008*)



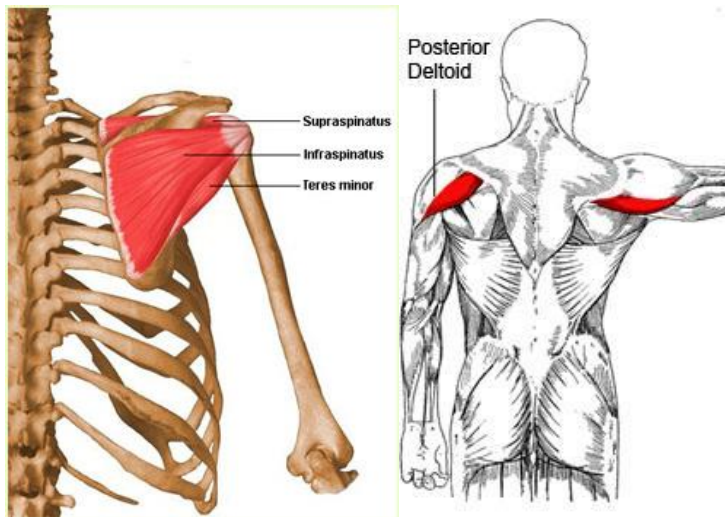
Muscle Strength Imbalance

- ❖ **Imbalance between opposing muscle groups.**
- ❖ **Also know as the agonist-antagonist muscle pair.**
- ❖ **Agonists initiate a specific movement (Concentric).**
- ❖ **Antagonists acts opposite to that specific movement (Eccentric).**

Rotator Cuff Musculature

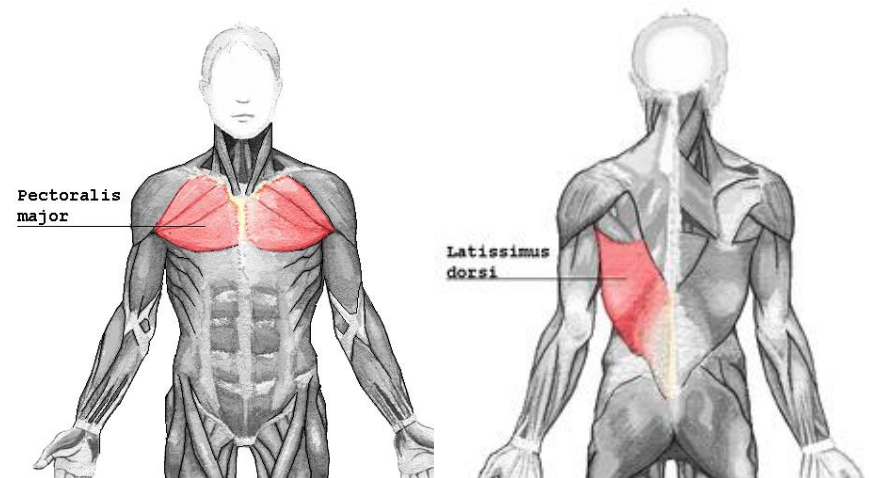
External Rotators

1. Supraspinatus
2. Infraspinatus
3. Teres Minor
4. Post. Deltoid



Internal Rotators

1. Subscapularis
2. Pectoralis Major
3. Latissimus Dorsi



Throwing Biomechanics



- 1. Cocking Phase**
- 2. Acceleration Phase**

Testing Protocol

- **18 male participants**
- **10 with injury history (medically diagnosed grade 1 or worse to the shoulder)**
- **8 without injury history**
- **18-31 years old**
- **Singapore National Water Polo team**
- **All injury-free and active in water polo at time of testing**



Testing Protocol



- **Concentric and Eccentric**
- **Internal and External**
- **180°/sec**

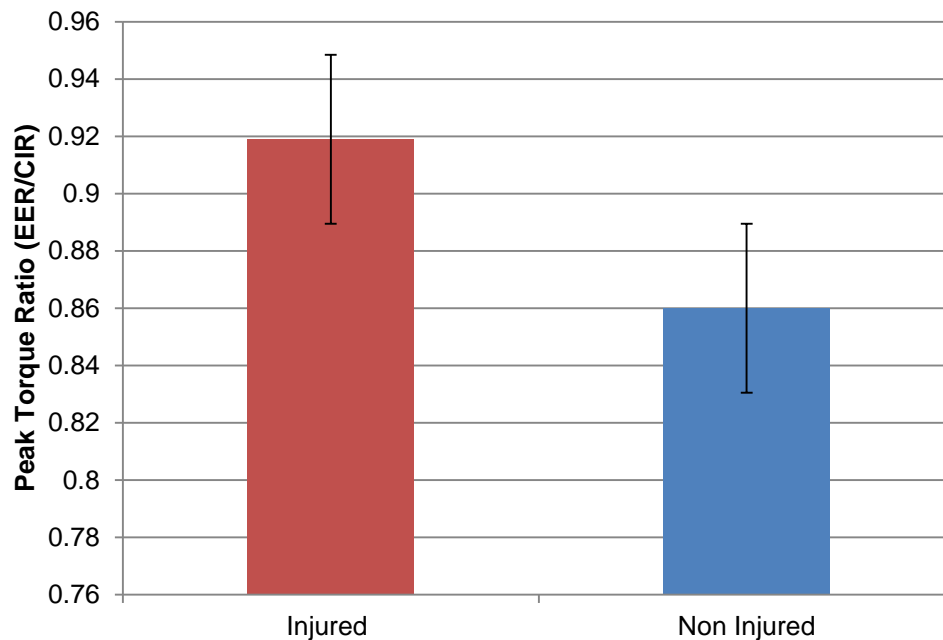
Testing Protocol

- A Functional Ratio was determined.
- Ecc. External Rotation (EER) : Con. Internal Rotation (CIR)
- Indicated EER strength in relation to CIR strength.

• E.g.
$$\frac{\text{Peak Torque (Ecc Ext)}}{\text{Peak Torque (Con Int)}} = \frac{73.3}{88.3} = 0.83$$

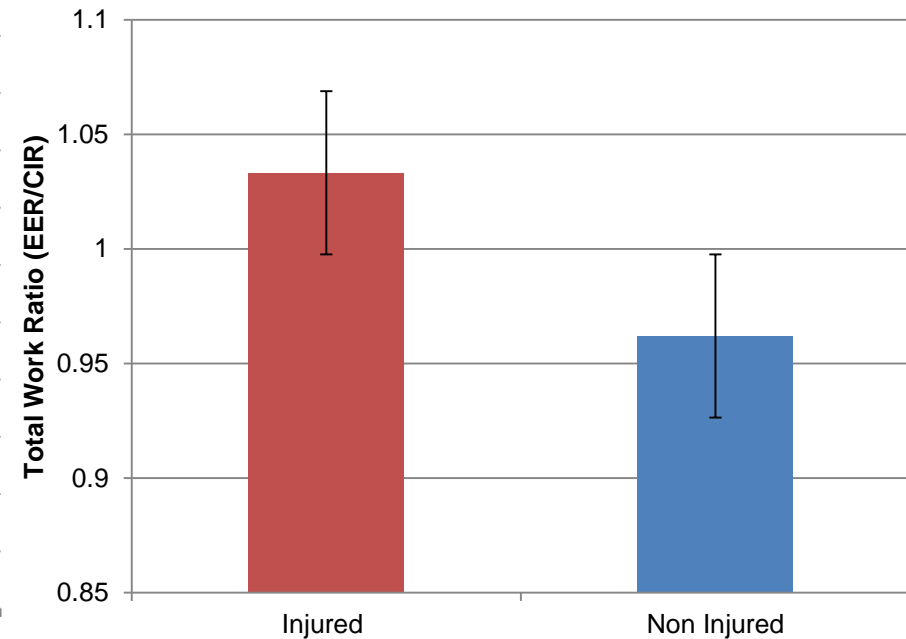
Results

Mean Peak Torque Ratio (EER/CIR)



$P > 0.05$, $p = 0.443$

Mean Total Work Ratio (EER/CIR)



$P > 0.05$, $p = 0.525$

Observations

- **Previously injured athletes underwent a rehab program.**
- **Injury free athletes have a poorer attendance record.**
- **No significant difference between injured and non-injured.**
- **Disproved our hypothesis.**



Moving Forward...

- **A second bout of testing is being arranged with the team.**
- **Other overhead throwing sports should have their athletes tested.**
- **May not be able to find that “magic number”, but more so a range to fall into.**
- **Prospective tracking should be done**
- **Should be used as a screening tool for new players.**
- **Useful in providing a means to assess injury risk.**
- **Managed to keep shoulder injuries at bay since.**



Training Intervention



- 2x/week
- 3 sets of 8 reps/arm
- 8-week intervention

THE END

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