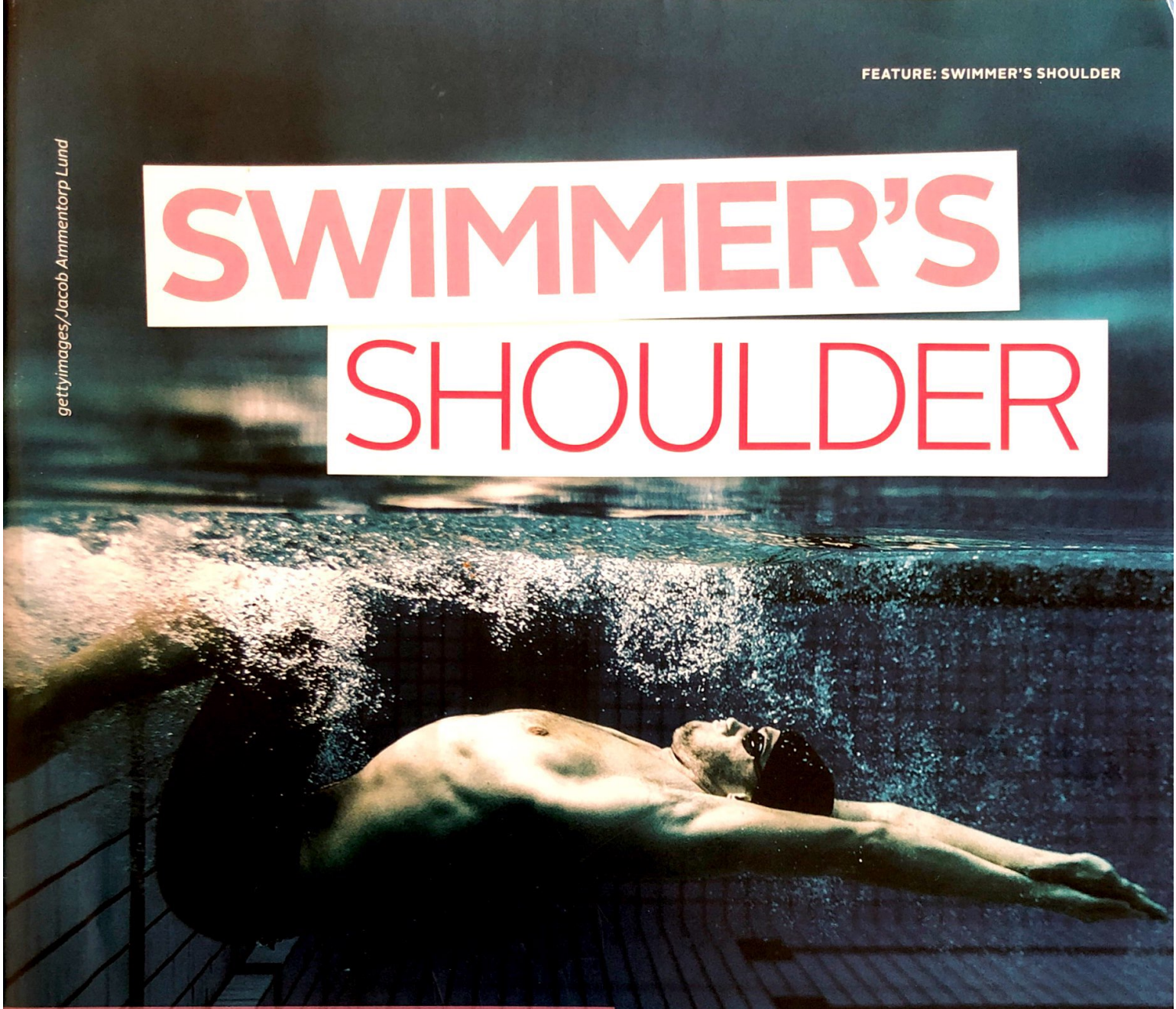
SWIMMER'S SHOULDER



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SWIMMING IS ONE OF THE HIGHEST PARTICIPANT SPORTS ACROSS ALL AGES IN AUSTRALIA AND YEAR-ON-YEAR, THE NATIONAL TEAM HAS ENJOYED CONSIDERABLE SUCCESS ON THE INTERNATIONAL STAGE. WITH SWIMMING BEING CLASSIFIED AS AN 'OVERHEAD SPORT' – THAT IS, ANY SPORT WHERE THE ATHLETE'S UPPER ARM AND SHOULDER ARC OVER THE ATHLETE'S HEAD – PRESENTS CHALLENGES FOR CLINICIANS IN MANAGING SWIMMERS' SHOULDER PAIN. IN THIS SPECIAL FEATURE, DR HELEN WALKER AND KYLIE HOLT DISCUSS THE CAUSES OF SWIMMER'S SHOULDER AND STRATEGIES FOR REHABILITATION.

HOW DOES SWIMMING UNIQUELY LOAD THE SHOULDER?

1. High repetitive training loads

Swim training for most competitive swimmers is intensive with 8000 – 14000m completed across two swim sessions per day, 6 days per week, with most (80%) of training performed in freestyle. There is no distinct swim 'season' and competitive swimmers train intensively 10-12 months annually. Given these loads, it is not surprising that shoulder pain incidence in competitive swimmers is 38-91%.

2. Acute effects of swim training on the shoulder

Immediately post-swim training, scapular kinematics are altered, external rotation ROM and pectoralis minor length decreases, and shoulder joint position

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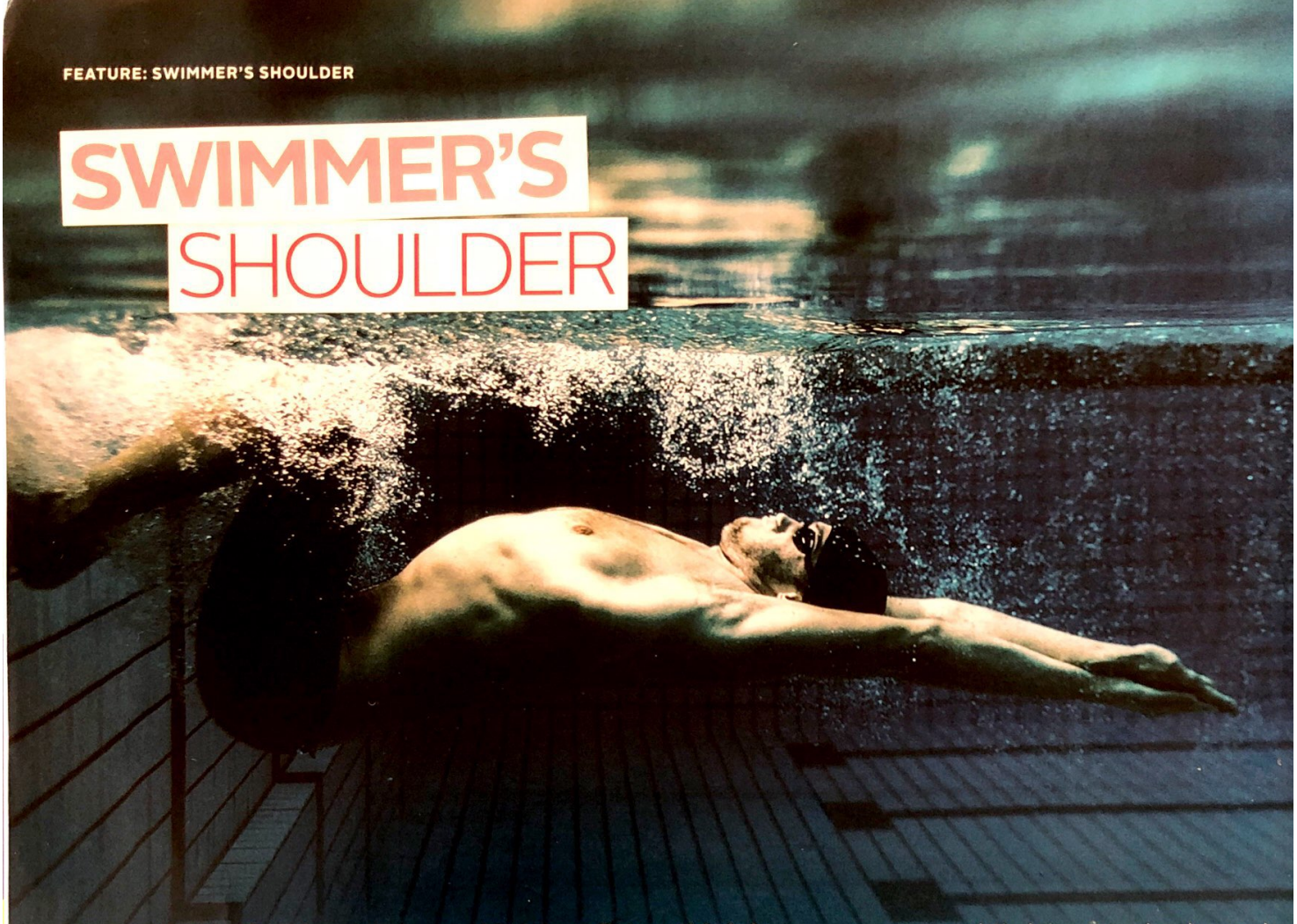


sense is adversely affected. Increased supraspinatus tendon thickness post-swim training has been demonstrated in preliminary research, using real-time ultrasound measurement within the subacromial space. The time course to recovery for these acute training effects is unknown.

3. Potential long-term effects of swim training on the shoulder

Imaging studies point towards swim training induced rotator cuff tendon changes over the long-term. An MRI study of elite swimmers reported that 86.2% of symptomatic participants had abnormal shoulder changes. The most common MRI finding in competitive swimmers' shoulders is supraspinatus tendinopathy (69%), believed to be swim volume induced. Other reported findings include subscapularis tendinosis, subacromial, subdeltoid fluid and AC joint changes. Ultrasound studies report similar findings with supraspinatus tendon changes significantly correlated with shoulder pain in marathon swimmers.

4. Rotator cuff strength imbalance

Swimmers develop imbalances of shoulder internal rotation to external rotation strength, with stronger internal rotation strength due to its dominance during the pull through. An ideal ratio of internal to external rotation strength is be IR:ER= 1.46. Swimmers with generalised joint hypermobility may demonstrate shoulder internal rotation strength deficits. Hand-held dynamometry is an excellent tool for prescribing targeted strengthening programs for the shoulder external and/or internal rotators.

5. Shoulder Laxity

Competitive swimmers commonly demonstrate generalised joint hypermobility. This hypermobility is beneficial, allowing swimmers the necessary range of motion for a long, efficient stroke. Generalised shoulder joint laxity is a common, normal finding in competitive swimmers' shoulders with up to 62% incidence. When investigated prospectively, laxity is not associated with the development of swimming shoulder pain. It is hypothesised that swim training may cumulatively increase glenohumeral joint laxity over time, however, it is uncommon for swimmers to present with distinct shoulder instability symptoms.

6. Flexibility requirements

During all swim strokes, swimmers utilise the unique 'high elbow catch position' to generate propulsive and lift forces and the 'streamline' to minimise hydrodynamic form drag. The high elbow 'catch' comprises by shoulder elevation and near maximal internal rotation. Most swimmers presenting with shoulder pain describe symptoms at the 'catch'. During freestyle arm recovery, shoulder external rotation and thoracic rotation mobility is critical to avoid hyperextension of the shoulder. Similarly, during backstroke, thoracic rotation is necessary and required during the pull. All strokes require full shoulder elevation at hand entry. Biomechanical analysis of freestyle swimming revealed shoulder ROM approaching 'impingement positions' during arm recovery, hand entry and the pull through. Importantly, incorrect body alignment and an inefficient kick will increase the work of swimming at the shoulder.

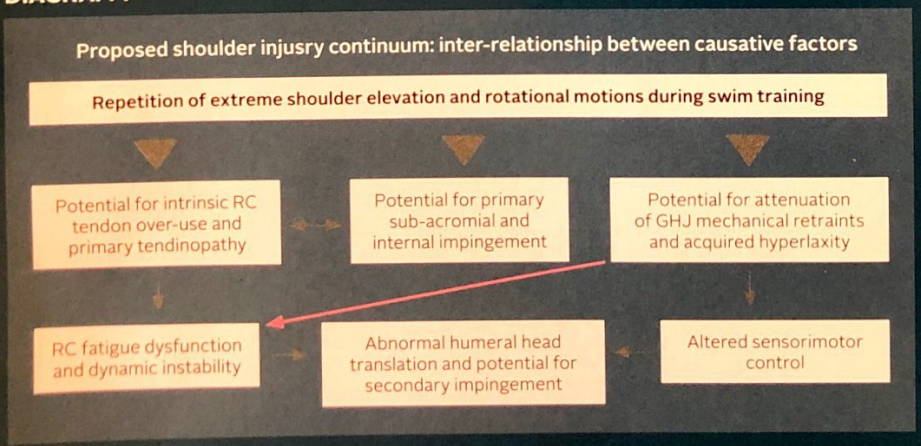
Freestyle high elbow 'catch'

Butterfly streamline arm position, characterised by bilateral end of range shoulder elevation

7. Kinetic chain: shoulder-hip connection

Swim coaches highlight the importance of maintaining 'connection' between the pulling shoulder and the hip, via latissimus dorsi and abdominal muscle engagement. This connection is underpinned by precise control of scapula upward rotation, which allows optimal shoulder position to generate power. Correct timing of long axis rotation of the thorax and pelvis is essential to allow 'hip rotation' to drive propulsion. From an injury perspective, if the hips (pelvis) over-rotate, the opposite shoulder is inefficient during the catch. During butterfly and breaststroke, the abdominal muscles are recruited to avoid excessive spinal extension and shoulder hyper-elevation during the catch. Improving core strength for all strokes can reduce work at the shoulder.

DIAGRAM 1



INJURY CAUSATION

The theories for development of swimmer's shoulder include impingement, glenohumeral joint hyperlaxity and more recently, primary rotator cuff tendinopathy. These potential causative factors may interact as part of an injury continuum (Diagram 1).

For example, rotator cuff tendinopathy may be primary in origin, however, the associated increased tendon thickness may increase the likelihood of impingement, which, in turn, may exacerbate the tendinopathy via compression. Subsequent rotator cuff dysfunction may reduce dynamic shoulder stability. Swim-stroke shoulder positions may contribute to primary impingement and rotator cuff tendinopathy development. Acquired GHJ hyperlaxity, may alter sensorimotor control, contribute to dynamic stabiliser fatigue, altered antero-superior humeral head translation and secondary impingement.

The location and type of neural receptors in the shoulder is important when

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Streamlined position and long axis body rotation to keep the hips & shoulders "connected" during Freestyle

considering potential pain generation. The supraspinatus tendon (animal studies), subacromial bursa and the connective, fat and bursal tissue adjacent to the coracoclavicular ligament, are potential drivers of pain, given the distribution of nociceptors in these structures. Importantly, the subacromial bursa is more densely innervated than the cuff and biceps tendons. The glenohumeral joint capsule and labrum has mechanoreceptors and free nerve endings densely located in areas consistent with their protective role. Whilst understanding in this area is still developing, the rotator cuff tendons and subacromial bursa are key structures to consider when planning rehabilitation strategies.

REHABILITATION FOR SWIMMER'S SHOULDER

Rehabilitation should consider both intrinsic (ROM, strength) and extrinsic variables (training loads/technique). Load modification may include reducing swim distance or intensity, using fins or performing 'kick only' for several sessions. Gradual return to full training should be well-planned in terms of distance and intensity.

Where primary rotator cuff tendon pain is suspected, moderately high load isometric exercises (low range) are well tolerated and may assist with pain modulation. Later, eccentric, low-range ER and IR exercises embedded within dryland programming, are equally well-tolerated and may improve tendon load tolerance. Swimmers may find regular post-session icing helpful for pain relief. Dynamic control problems of shoulder-hip connection or the 'catch' should be rectified with sensorimotor re-training exercises. Finally, swim technique should be corrected in consultation with the coach.

In summary, management of swimmer's shoulder is complex and an exact 'diagnosis' is often elusive. Despite this, knowledge of the specific demands of the swim strokes and implementation of targeted rehabilitation and load management strategies will lead to resolution of pain in the majority of cases.

References available on request by emailing sport.health@sma.org.au

ABOUT THE AUTHORS

Dr Helen Walker is a Sports Physiotherapist at Physio4athletes, Melbourne and consults to Melbourne Vicentre Swimming Club, a Swimming Australia High Performance Centre. She completed her PhD investigating risk factors for shoulder pain in Australian swimmers in 2010. Helen has consulted to the Australian Swim team at the Montreal 2005 World Champs, Melbourne 2006 Commonwealth Games and worked as a sports physiotherapist at the Sydney 2000 Olympic Games and the 2018 Gold Coast Commonwealth Games.

Kylie Holt is a Sports Physiotherapist with Swimming Australia and has worked with the Australian Swim Team for the past 10 years. She is currently completing her PhD looking at the pathoanatomy of an elite swimmer's shoulder on MRI. Kylie has also attended the London 2012/Rio 2016 Olympic Games and Delhi 2010/Glasgow 2014/Gold Coast 2018 Commonwealth Games as a Sports Physiotherapist with the Australian Headquarters Medical Team.