

Overuse Shoulder Injuries In Swimmers

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Abstract

Shoulder injury is a significant barrier to the training regime and competition experience of the swimmer, both male and female. Both male and female swimmers have a unique potential for the onset of clinical shoulder symptoms. This review of shoulder symptom onset includes information related to growth, stroke biomechanics and signs and symptoms.

Introduction

Overuse shoulder injuries in swimmers are the most common and difficult to deal with because of the distance and repetition types of training. Most often the predisposing factors causing the injury are skeletal adaptation problems where the muscles have limited shoulder range of motion and the tendon interface or capsule is over stressed.

Frequency of Shoulder Injury

When examining female swimmers, shoulder syndromes are likely to occur approximately three times over a career span. The first occurrence is usually during early to mid adolescence (1) when the body weight is likely to increase, when arm strength is not fully developed, and when the swimmer is moving into a higher age group. The second period when problems occur is in the later stages of high school competition. Although body weight is almost settled, upper body strength, for the most part, is not sufficiently strong enough to withstand the harder training (2,4). The third period is during the transition from high school to college swimming. Collegiate swimming often entails dramatic increases in training volume and intensity. Freshmen unaccustomed to the increased training demands are often afraid to report initial episodes of pain because of peer pressure and the desire to compete in the collegiate environment (3,4).

In males, the two peak times for the onset injury occur first at the end of the second growth spurt, when body size increases but shoulder muscles are not yet large (2). The second time when injury occurs is the high training point of the freshman year in college, usually at the Christmas season because the yardage exceeds previous distances by several thousand meters, and these increases generally occur over a period of a few days (4).

In all of these cases the injuries can be prevented if dry land programs, designed to strengthen the intrinsic muscles of the deltoid and supraspinatus are initiated. In addition it is imperative that swimmer's stroke mechanics are well monitored by the coach (5). Secondary concentration needs to be placed on the scapular retractors and levator scapulae muscles. These two muscles usually become chronically strained when the anterior girdle muscles cause the shoulders to be pulled forward. Poor postural position then prevents proper stroke mechanics, which in turn increase the prevalence of overuse injuries (6,10,11).

The Causes of Tendonitis during Swimming

Freestyle:

The biceps muscle is very active during many facets of the freestyle. At the points of entry and initial catch the hand is forcibly supinated and followed immediately by the pull. Both actions are primary roles for the biceps and indeed find the long tendon to be at its most vulnerable position as it virtually presses almost out of its groove.

At the mid phase of the pull, from the start to the end of the pull, the biceps is active as a forearm supinator, elbow flexor and horizontal adductor. This is a critical point in the stroke because the arm is being rotated inward thus stressing the front of the shoulder as a fulcrum of force. As a result, the biceps long tendon located at the front of the shoulder sustains not only a muscular contractile force, but a stretching force as the front of the joint rolls open (7,12).

Butterfly:

The hand entry and pull are similar to freestyle with the exception that the bilateral pull requires more bicipital muscular work. Whereas the freestyle allows of some shoulder retention and more positive alignment of the large shoulder girdle muscles, particularly the pectoralis and latissimus, the butterfly stroke fixes the shoulder and stresses the biceps long tendon. The recovery is likewise stressful as the entire arm is levered around the fulcrum at the front of the shoulder (8).

Backstroke:

The biceps muscle is the initial contributor to the exit of the hands from the water during the recovery phase of the backstroke. In addition, the entry phase is potentially aggravating in that a poor shoulder roll will press the anterior shoulder tissues, with the biceps long tendon, up into the overlying bone structure causing an impingement between the humerus and the scapula. The next phase, the middle one third of the pull, further places the tendon at risk because the hand is being supinated, or turned outwards with a strong biceps contraction as the elbow is flexed. This portion of the stroke also stressed the front of the shoulder because the trunk is synchronously rolling away from the stroke side to prepare for the opposite hand entry (9).

Breaststroke:

The initial pull, from the end of the out-sweep to where the hands change direction, is the phase where most stress is placed on the biceps long tendon. This is caused by the supinated hand position and right angle elbow pull just prior to the hands being drawn together.

Injury: Stages & Symptoms

Stage 1

Inflammation of a tendon that produces a mild prolonged pain over the front of the shoulder is noticeable for several hours after exertion, and can be reproduced by a direct pressure over the tendon in question. During this stage there may be mild discomfort in the shoulder at the start of warm-up, but this subsides without notice, and may not be apparent until after the completion of the workout and up to several hours after the workout.

Special diagnostic tests used to identify discomfort and reproduce the symptoms at this stage, are not 100% reliable. The best source of information and basis for evaluation remains the swimmer's explanation of 'where it hurts' and 'when it hurts', sometimes coupled with noticeable stroke changes.

Stage 2

Pain exists during some aspects of the workout and is noticeable following the workout. Usually the swimmer needs a longer warm-up, and tends to avoid hard pulling sets as these aggravate the problem. Pain usually dissipates during the workout to the point of tolerance, but sprint and quality work intensifies the problem, and as a result, the swimmer may start developing a "dropped elbow" pull. Discomfort continues unabated several hours following practice, but does not limit daily activities at home or at school. Diagnosis is confirmed by specialized tests and history, along with observable changes in the stroke pattern.

Stage 3

Pain at this stage is noticeable during practice, immediately after practice, and is generally prolonged throughout the rest of the day. A slow gradual warm-up does not appear to dissipate the pain to any level of tolerance, and heavy arm work such as pulling is extremely aggravating. Swimming butterfly or backstroke also reproduces the pain, and kicking with the arms fully extended over the board does not seem to alleviate the problem. The pain may subside after practice, but discomfort can continue throughout the day.

Because this stage is accompanied by intermittent bouts of severe pain or a stabbing sensation, the swimmer may at this point, take several days off to rest. Unfortunately, resumption of workouts after this period of rest, produces exactly the same kind of pain and discomfort as before.

Because of the swimmer's facial expressions, apprehension behavior and body gestures, this stage is easily diagnosed by palpation and diagnostic tests. When the tests are performed the swimmer may close his or her eyes, grit the teeth, or vocalize the pain. It is not unusual for the swimmer to pull back by dipping the sore shoulder during the test, or withdraw completely from the test stimulus administered by the clinician.

The swimmer is generally aware of the advanced nature of the problem and will seek help only after discovering that he or she cannot swim through the pain, and that kicking an entire workout is both boring and an ineffective way of training.

Stage 4

The pain is chronic and generally unchanging which produces a disruption of normal activities, along with avoidance of regular practices and team functions. Feelings of inadequacy and fear of losing camaraderie of the other swimmers because of not being able to 'contribute' is common. Pain and discomfort are so severe that the swimmer awakens at night, or notes having difficulty in certain rest positions. Daily activities, such as carrying schoolbooks or a grocery sack, or reaching up to a high shelf, are painful and avoided. In general, there is a period of denial about the severity of the pain, but the day-to-day inability of the individual to reduce the symptoms causes a change in personality. This often results in the belief that no resolution or cure is possible, and swimming may have to altogether be stopped.

Identification of Stage One

Swimmers presented with discomfort in Stage 1, with no history of shoulder problems, should take into account that often a change in stroke technique may stress muscles that previously have presented no pain or discomfort. The problem may in fact be muscular strain. This type of shoulder pain is of particular importance to the swimmer who is resuming training after a long layoff, often seen when the swimmer returning to training after taking a break between the end of the summer season, and the beginning of Fall training.

The most frequently occurring muscle pain mistaken for tendonitis is in the anterior deltoid muscle, which covers the front of the shoulder just over the biceps tendon. Stress on the deltoid is imposed as the swimmer attempts to keep the elbow high when the arm is rotated toward the chest and brought into line with the shoulder. Because the anterior deltoid is partially responsible for the last half of the high elbow recovery before hand entry, it is understandable that changes in stroke mechanics will stress this muscle (4).

The characteristics of this type of muscular strain are tenderness over the muscle when moderate pressure is applied, heaviness or slowness in performing daily activities the next day, and a feeling that they didn't exist previously. When a swimmer continued the next day with another workout, while still feeling this

soreness, the symptoms may go away after the initial warm-up, but the muscle may retain some residual damage. Further hard activity may aggravate the condition. When the muscle does not function optimally due to fatigue, the underlying tendons and ligaments will accept an undue stress, which may then lead to the initial stage of tendonitis (6,11).

Progressive Deterioration

The majority of cases of tendonitis can be treated very quickly and effectively if they are diagnosed quickly and treated correctly. Unfortunately, most cases proceed beyond the Stage 1 phase into the Stage 2 because swimmers and coaches are unwilling or unable to deal with the problem soon after it begins. While it is more than appropriate to have swimmers ignore pain while working out, they must be made aware of the need to identify and report isolated anterior shoulder pain that persists following training sessions.

More often than not the overuse type of injury, of which tendonitis is one such example, will be ignored and muscular training pain will result in a typical progression of an increasing problem. As the stages progress, periods of rest may be tried that last anywhere from one to several days, but invariably the resumption of training will cause a resumption of symptoms. As described above, if the swimmer attempts to swim through the problem it only because more severe, and while therapy and medication can control the symptoms the cause persists, making the problem progress to a greater stage of disability.

Several attempts may also be undertaken to try alternate strokes and different competitive events, with varying degrees of success. The assumption here is that the tendonitis will resolve itself spontaneously. Unfortunately, this approach only prolongs proper diagnosis and treatment. The delay in securing a comprehensive rehabilitation plan and following an acceptable program of exercise, rest, and prescribed activity usually produces the inevitable need for a prolonged rest.

If a rest period is inevitable, it usually is unplanned and when the training resumes the pain often returns, sometimes suddenly, sometimes gradually, but with a greater degree of severity than on the previous occurrence. The pain of tendonitis always increases with succeeding bouts and is increasingly resistant to subsiding with each successive episode. In the final stages, the pain and associated inability to perform daily tasks convinces the swimmer to either retire, or undergo surgery, in the hope that the corrective process will bring about a quick and decisive solution. These latter measures are usually only mildly successful and require a long rehabilitation period for the symptoms to be completely resolved.

In the progression from one stage of inflammation to another the tendon and its underlying intrinsic layers will gradually undergo microscopic changes which will alter the tensile and elastic properties of tendon, placing it at risk of having a recurrence of the problem. This is a particularly important concept concerning

tendonitis, because the swimmer must be aware that preventing the problem will require a regular routine of maintenance exercised for the duration of their competitive careers (6,12).

Conclusion

The planning of rehabilitation programs for tendonitis should always be prepared with the swimmer's individual needs in mind. This is especially true for the younger swimmer, and those in collegiate programs, because so much of the problem has to do with the maturity and demands of the training regimes. Within the healing professions that deal with overuse shoulder syndromes it is known that those cases of tendonitis treated early on have shorter periods of training interruption and greater degrees of resistance to recurrence.

While the evaluation and diagnostic techniques are not foolproof, they are quick and effectual indicators of where the problem lies and how to proceed thereafter, be it training adaptations, or medical follow-up. Overall, the best prevention is through exercise and good stroke mechanics, and gradual increases in work load at all levels, but when the injury does arise, as surely it will, the best result occurs from quick, effective treatment.

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