



# Update on Rehabilitation Strategies for Swimmers' Shoulder: A Narrative Review

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## Abstract

Swimmers' shoulder is one of the common overuse injuries having multifactorial causes with a gradual onset. Swimmers' experience pain in the pull-through phase, during the mid-stroke wherein the arm is maximally internally rotated and adducted. This occurs due to a significant amount of force generated by the pectorals, latissimus dorsi, subscapularis, serratus anterior, rhomboids, and supraspinatus for this movement. The repetitive use of shoulder muscles during the swim strokes predisposes it to overuse injuries among which shoulder impingement is common. It hinders participation of athletes in competitive events and reduces the efficiency of the swim performance. This review aims to provide a consolidated overview and identify various rehabilitation strategies and exercise programs for swimmers' shoulder. A thorough search was done on PubMed, ScienceDirect, Web of Science, Cochrane, CINAHL, and Clinical Key to find relevant articles in relation to the rehabilitation strategies available for swimmers' shoulder. Overall, this review suggests that aquatic concentric-eccentric exercise, Kinesio taping, land-based strengthening exercises, and rhythmic stabilization exercises significantly improve pain and functional activity in individuals with swimmers' shoulder.

## Keywords

- ▶ swimmers' shoulder
- ▶ shoulder impingement syndrome
- ▶ shoulder pain
- ▶ rehabilitation

## Introduction

Swimming, quite popular as a recreational activity, recognized worldwide as a competitive sport has gained recognition in the rehabilitation setup. In those individuals intolerant to land-based exercises it is an efficient method to improve cardiovascular fitness. Due to the water's property of buoyancy, swimming minimizes the risk of injuries by offloading the joints and provides an overall holistic development.<sup>1</sup> In terms of training, competitive swimmers train twice a day covering roughly 42 km a week, while recreational swimmers swim regularly, approximately 5 days a week for an average of 1 to 2 hours per session.<sup>4</sup> A study indicates a prevalence of shoulder pain rates as high as 91% are relevant among swimmers. "Swimmers' shoulder," a condition among swimmers, proposed by Hawkins-Kennedy

arises from repetitive compression of the supraspinatus tendon beneath the coracoacromial arch, due to recurring periods of avascularity.<sup>5</sup> This occurs in competitive swimmers due to altered movement patterns, often caused by muscle fatigue or laxity. Shoulder range of motion (ROM) in swimmers is quite similar to other overhead athletes leading to adaptations like limited internal rotation and excessive external rotation. These mechanisms can be clinically related to shoulder impingement syndrome which manifests in similar pathomechanical patterns. In shoulder impingement occurring at the subacromial level, rotator cuff impinges under the coracoacromial arch occurring during the recovery phase of the stroke whereas during intra-articular impingement the biceps tendon or the rotator cuff impinges against the glenoid and the labrum occurring

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during the hand entry phase of the stroke.<sup>6</sup> As compared with land, water provides a medium in which mobility is challenging. Due to buoyancy anybody submerged in water will float but the hydrodynamic drag provides resistance against forward motion.<sup>7,8</sup> The swimmer has to overcome this pressure with the help of the extremities propelling the entire weight of the body forward.<sup>8,9</sup> Based on the stroke chosen, that is, freestyle, backward, etc., swimming has two key phases: the pull-through and the recovery. Swimmers' experience pain in the pull-through phase, during the mid-stroke wherein the arm is maximally internally rotated and adducted. This occurs due to a significant amount of force generated by the pectorals, latissimus dorsi, subscapularis, serratus anterior, rhomboids, and supraspinatus for this movement.<sup>10,11</sup> The repetitive use of shoulder muscles during the swim strokes predisposes it to overuse injuries among which shoulder impingement is common. These constant motions lead to pain and slow down their performance.<sup>12</sup> Swimmers' shoulder, a condition causing pain and dysfunction of the shoulder complex, is not a distinct diagnosis but it arises due to various contributing factors such as the competitive level, muscular imbalances between the internal and external rotator strength, overuse, glenohumeral joint laxity, instability, biomechanical errors in the stroke technique, scapular dyskinesia, and previous history of injury or pain.<sup>13,14</sup>

The rehabilitation for swimmers' shoulder follows a structured pattern which spans across several weeks with focus on muscle strengthening, ROM, and endurance.<sup>15</sup> There is a dearth of reviews that provides a concise idea of all the exercises that can be administered for swimmers' shoulder. This article aims to provide a consolidated update on the various rehabilitation strategies available for swimmers' shoulder.

## Methods

To conduct this narrative review of literature, electronic databases of Google Scholar, PubMed, Science Direct, Clinical Key, CINAHL, and Cochrane Library were searched, using keywords such as: "Swimmers' Shoulder," "Rehabilitation," "Shoulder Impingement Syndrome," "Shoulder pain," and "Shoulder Rehabilitation." The search yielded 36 articles which were narrowed down to 9 articles relevant to the study. The studies were included in the narrative review if they studied a population with a confirmed diagnosis of swimmers' shoulder which included individuals having shoulder pain for at least 2 months, painful arch during arm elevation, and positive clinical tests for shoulder impingement syndrome. Randomized controlled trials, systematic reviews, and literature reviews, published between 2014 and 2023 were selected. The studies were excluded from the narrative review if, the study involved medical/surgical interventions, if it involved traumatic shoulder injuries such as subluxation, dislocation, and acute injuries and surgical operation performed on the neck or limbs, and finally if full text document of the study was not available for analysis. Case studies, editorials, commentaries, letters to

the editor, and research on water sports such as water polo, other than swimming were also excluded.

## Results and Discussion

This literature review was aimed to find out the effectiveness of rehabilitation strategies for swimmers' shoulder. Studies included in this review present a heterogeneous outcome due to a wide range of outcome measures employed. Among the 9 selected studies, 6 were randomized controlled trials, 1 was an explorative study, and 2 were systematic reviews. The sample sizes ranged from 28 to 76 patients diagnosed with swimmers' shoulder who complained of shoulder pain, had a painful arc during arm elevation, and diagnostic imaging confirmation using X-ray and magnetic resonance imaging was performed.

An efficient approach to prevent swimmer's shoulder has been a topic of debate due to the number of factors responsible for its cause. This review has brought to light several approaches that collectively improve the condition of the swimmer. Studies emphasize the importance of core stabilization exercises for swimmers. A strong core with proximal stability is crucial to ensure distal mobility across the shoulder joint. Strong trunk extensors effectively transfer forces from the lower limbs through the core thereby reducing stress on the shoulder joint. Since the center of buoyancy lies above the center of gravity, while swimming core muscles are crucial to keep the body aligned. Weak core muscles require the upper extremities to generate greater internal forces to move the body ahead, increasing stress on the shoulder musculature. Effective swim techniques require coordinated core stability and limb mobility.<sup>16-18</sup>

A couple of studies have shown a significant improvement through open and closed chain exercises. These exercises isolate specific muscle groups and correct the muscle imbalances. A common imbalance that occurs is the reduction in the torque of the external compared with the internal rotators, leading to impingement. Open chain exercises improve muscle function by progressively loading the muscle. By achieving targeted movement on a single joint, they minimize the stress on other joints. Closed kinetic chain exercises produce compressive forces on joints, improving coordination and retraining proprioception by working on posture, dynamics, and stability. These exercises, when performed in the initial stages of rehabilitation, produce fewer injuries, are easier to carry out, and prevent early fatigue. However, closed chain exercises have been shown to be unable to generate muscle torque effectively when compared with open chain exercises.<sup>16,17</sup>

Pain, functional disability, and internal external rotation ratios improved with rhythmic as well as scapular stabilization exercises, among which rhythmic stabilization exercises were found to improve scapular muscle function along with trapezius to serratus anterior ratio providing a stable base for the shoulder movements to a greater extent. Studies have demonstrated positive outcomes from plyometric program followed by stretching and strengthening which significantly works on enhancing proprioception. An improvement of

strength and endurance was observed in those exercise programs which included five or fewer exercises on the external rotator strength.<sup>17</sup>

Aquatic exercises have shown significant changes in correcting muscular imbalances, reducing pain, improving ROM, and joint position sense. An increase in strength and muscular hypertrophy was observed within 2 to 3 weeks of the aquatic exercise program. Aquatic exercises resulted in quicker pain reduction and enhanced stability in contrast to land-based exercises.<sup>15,19,20</sup>

Pooled evidence also suggests Kinesio taping was found to enhance the functional stability of a swimmer. Pain levels seem to decrease between 20 minutes of application with effects lasting for 72 hours. Improved performance was experienced within the first 45 minutes of application. Muscle stiffness and contraction amplitude improved leading to better performance. In comparison with local modalities taping was effective in the initial and subsequent week in individuals with shoulder impingement when rapid results were required. Improved rhythm and pattern of motion in the glenohumeral joint along with muscle performance and recruitment were observed. Taping modified the inflamed and painful region by restoring superficial blood flow and reducing the pressure. Pain reduction was achieved by stimulating mechanoreceptors which blocked the free nerve endings, increasing proprioceptive feedback to avoid further exacerbations.<sup>21,22</sup>

## Conclusion

The findings of this literature review revealed that aquatic exercises, core stabilization exercises, open and close chain exercises, rhythmic and scapular stabilization exercises, land-based and aquatic strengthening exercises, and Kinesio taping resulted in notable reduction in pain and enhanced strength and endurance of the rotator cuff. This was found to be effective due to reduction in parameters like pain intensity and an improvement in the strength of the muscles. Based on this review, it is safe to conclude that swimmers' shoulder has been vastly researched and the various rehabilitation strategies developed for this condition have a comprehensive and wholesome impact on the swimmers. This review will help physiotherapists to plan and design goal-specific rehabilitation protocol for patients with swimmers' shoulder.

### Authors' Contributions

S.D. did the literature search and manuscript preparation and A.N. completed the results analysis, editing, and checked grammar.

### Conflict of Interest

None declared.

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