# EFFECT OF STRENGTH TRAINING PROGRAMS ON SHOULDER AND SCAPULAR MUSCLE AMONG ELITE SWIMMERS

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**Abstract:**
On previous Olympic Games, swimming was one of the most popular events and it has encouraged improvement in conditioning, technical advances, and the use of sophisticated training equipment, but escalations in the level of competition and training have been allied to a concurrent rise in shoulder damages. Competitive swimmers exercise almost every day and swim on average 12000 meters each day, approximately 16000 times of shoulder rotation. Strength imbalances of the shoulder musculature and shoulder pain are suggestively correlated in swimming athletes and Shoulder instability can lead to pain, impingement, and decreased functioning in overhead athletes. Literatures have tried to examine whether changes occur in shoulder girdle muscle performance and strength by using the appropriate strengthening exercise. This study reviews those previous studies intervention and explains the result of each exercise protocols on rotator cuff muscles. All of previous studies commonly suggested that exercise interventions might encourage the proper posture of swimmers. They are recommending that their program had a protective effect pain but so far few studies have planned a prevention program design specifically for swimmers shoulder that addresses the weaknesses and changed movement pattern of swimmers.

**Keywords:** Strength training programs, Swimmers, Shoulder and scapular muscles

## Introduction:



The most common orthopedic pathology such as rotator cuff tendinitis, shoulder instability and shoulder impingement in swimmers is called "swimmer's shoulder" and it leads to unusual pains like postural misalignments, altered scapular kinematics and muscular imbalances, that interferes with training and performance (Beach, Whitney & Dickoff-Hoffman, 1992; Greipp, 1985). On previous Olympic Games, swimming was one of the most popular events and it has encouraged improvement in conditioning, technical advances, and the use of sophisticated training equipment, but escalations in the level of competition and training have been allied to a concurrent rise in shoulder damages (Richardson, Jobe & Collins, 1980). Competitive swimmers exercise almost every day and swim on average 12000 meters each day, likely 16000 times of shoulder rotation (Scovazzo et al, 1991). It is not shocking that competitive swimmers are overwhelmed by varied levels of shoulder pain, which may or may not bind their normal and professional life routine (Bak & Faunø, 1997).

As a result of the great rates of shoulder pain in swimmers, researchers tried to discover the factors that involved to the development of swimmer's shoulder and to come up with effective methods to prevent and to rehabilitate the injury. There are numerous variables that could cause the symptoms of shoulder injury and one of them is strength imbalance. Strength imbalances of the shoulder musculature and shoulder pain are suggestively correlated in swimming athletes (Von Eisenhart-Rothe et al, 2005). The overdevelopment of the anterior musculature encourages shoulder instability by generating an anterior displacement force on the humeral head and inhibiting the humeral head to remain centered within the glenoid fossa (Von Eisenhart-Rothe et al, 2005). Shoulder instability can lead to pain, impingement, and decreased functioning in overhead athletes.

Lynch et al, (2009) research is established based on the assumption of head and shoulder postural misalignments that can cause Forward Head Posture (FHP) and Rounded Shoulder Posture (RSP) but Kluemper (2006) focused on RSP and he mentioned it as forward shoulder posture.

The forward shoulder posture or (RSP) can triggered by the stronger internal rotator and adductor muscles dragging the clavicle and scapula forward, over the weaker external rotator and abductor muscles (Pink & Tibone, 1991). The scapular muscles have an essential function in swimming. In the general population, a bond has been founded between impingement syndrome and changes in scapular kinematics (Lukassiewicz et al, 1999). This is an alarm to the competitive swimmer owing to the important role the scapula plays in providing a stable base for the glenohumeral joint in swimming (Pink et al, 1991).

Although there are several muscles those contributes with scapular motion, the seven muscles that are usually attributed as upward rotators are the upper trapezius, lower trapezius, and serratus anterior, infraspinatus, and deltoid, coupled with, pectorals and levator scapula (Pink et al, 1991). Patients with shoulder injuries demonstrate weakened posterior tilting of the scapula during humeral elevation, an element that decreases subacromial space (Ludewig & Cook, 2000).

All mentioned literatures have tried to examine whether changes occur in shoulder girdle muscle performance and strength by using the appropriate strengthening exercise.

**Resistance tube exercises Sets:**



Ultimately researchers hypothesized that training reduces the incidence of shoulder pain and increases shoulder strength among swimmers. Swanik et al (2002) choose 26 competitive swimmers to exercise with elastic-tube with 3 sets of 10 repetitions in standing position during 6 consecutive weeks of exercise, same repetition and duration has been used for Kluemper (2006) with 39 elite swimmers but Hibberd (2012) choose 2 sets of elastic-tube exercise with 15 repetitions for 44 swimmers and they all had a common exercise for shoulder external/internal rotation.

**Swiss ball and dumbbell exercise intervention:**

On one hand, some other researchers employed the Swiss ball strengthening exercise method to improve shoulder strength for 28 national swimmers in 8 weeks (Lynch et al, 2010) and on the other hand, Van de Velde et al (2011) implement exercise with dumbbell shoulder external rotation. He used 18 adolescence swimmers on this regard.

**Findings:**

Swanik et al (2002) findings shown that after 6 weeks of strength training internal-rotation had significant improvement in both control and experimental group, without any significant increase in external-rotation but they couldn't find any meaningful result on the strength difference between groups and they suggested that the lack of significant strength differences mentioned between groups could be the result of larger increases in strength at the beginning of a training cycle than during the middle or at the end of a competitive season can lead to this indifference between groups.

Same result has been published for Kluemper (2006) and Hibberd (2012) they hypothesized that the strength of the scapular stabilizing muscles would improve by following the intervention program. The results of the study indicated no differences

in scapular strength of the intervention group compared with the controls. But the mean and peak forces have increased for both groups in Kluemper research and it can be caused by subject length of the intervention, compliance, intensity of subjects' swim training or type of exercises performed but Hibberd conclude that these trends caused from a modest strength improvement in the intervention group and a minor strength loss in the control group. Those changes in flexion and abduction strength bigger than the calculated minimum measurable difference suggest that the strengthening program generated meaningful changes in glenohumeral muscle strength.

In contrast to the previous researches, Van de Velde et al (2011) has found that resistance-training program favors adaptations in strength so Protraction/retraction ratios were changed as a result of the training program. From comparison of pertaining testing, the strength ratio remained the same for the dominant side but diminished on the no dominant side. Increased peak force for retraction on the non-dominant side clarifies the altered protraction/retraction ratio. These ratios can be reflected satisfactory because of the lack of large muscular imbalances. Kluemper (2006) findings revealed that the swimmers who participated in the 6-week stretching program had more of an upright posture, with the acromion procedure closer to the wall in post exercise testing. Based on their results, they think that the exercise routine chosen for this study was suitable to improve posture. Earlier work with a different population, using a different series of strengthening exercises, showed an increase in strength and it could support the use of the exercises to alter shoulder posture and this change might be effective on glenohumeral and scapular muscles.



**Conclusion:**

All of previous studies commonly suggested that exercise interventions might encourage the proper posture of swimmers and implication of specific shoulder muscle strengthening is essential to prevent the shoulder injuries. Despite of the result that most of them got from their investigation and no significant difference in examined variables. They are recommending that their program had a protective effect but with the knowledge of the high volume of practice yardage combined with the significant contribution of shoulder and rotator-cuff muscles (glenohumeral rotator muscles and scapular muscles), swimmers may depose to shoulder instability and it can lead to pain, decreased functioning, and impingement in swimming exercises (Von Eisenhart-Rothe et al, 2005; Van de Velde et al, 2011). Establishing a balanced strength index in swimming athletes may decline shoulder instability and pain but so far few studies have planned a prevention program design specifically for swimmers shoulder that addresses the weaknesses and changed movement pattern of swimmers.

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