Original Article

A Study to Compare the Effectiveness of Serratus Anterior Training Versus Subscapularis Training in Improving Performance in Swimmer's Shoulder

Saravanan. V.S[1], Jeyakumar.S[2], Senthilkumar.S[2], Shabiethaa.D[3], Vicent Prabhakaran Sekar[4]

[1]Ph.D Research Scholar –School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore, and Professor/Principal – Mohamed Sathak AJ College of Physiotherapy, Nungambakkam, Chennai, [2]Professor and Research Supervisor,School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore, [3]Ph.D Research Scholar – School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore, and Assistant Professor YMT College of Physiotherapy, Kharghar, Navi Mumbai, [4]Ph.D Research Scholar – School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore.

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Abstract

Background: The purpose of this study was to investigate the effectiveness of 6-week Serratus Anterior training Versus Subscapularis training in improving the performance in a Swimmer's Shoulder.

Purpose: To compare the effect of Serratus Anterior strength training versus Subscapularis strength training on shoulder pain in terms of performance in Swimmer's.

Materials and Methods: Subjects were randomly assigned into two groups i.e. Group A and B. The subjects were assessed using an assessment form, UQYBT, DASH score, and 50 meters (m) freestyle sprint for disability and evaluate performance before the commencement of treatment and also reassessed after 6 weeks of treatment. The sample of 40 subjects has been randomized into either Group A (Serratus Training) or Group B (Subscapulis Training) in a 1:1 ratio.

Results: The study results suggest that Group B has an effect on performance improvement in Swimmers with shoulder pain after a 6-week intervention. The mean 50m sprint scores in Group A before treatment is 29.9960 and it is decreased to 29.0425.

Conclusion: Hence, this study concludes that the mean difference of Group B is slightly more effective than Group A in terms of performance in swimmers' shoulders in all standard measures.

Key Word: swimmers shoulder, serratus anterior training, subscapularis training, performance.

Introduction

Swimming is a unique sport combining endurance, strength and control in a non-weight-bearing environment. Elite swimmers may swim up to 14,000 meters(m) each day, which requires more than 2500 shoulder revolutions per day or

Corresponding Author: Saravanan. V.S, Ph.D Research Scholar – School of Health Sciences, Department of Physiotherapy, Garden City University, Bangalore, and Professor/Principal – Mohamed Sathak AJ College of Physiotherapy, Nungambakkam, Chennai.

E-mail: 22papt103@gcu.ac.in

up to 16,000 shoulder revolutions per week.[1, 2] The competitive swimmers are plagued by varied levels of shoulder pain, which may or may not limit their regular activity.[3] The propulsive forces responsible for total body displacement, especially in front crawl, back stroke and butterfly, are mainly produced by the upper limbs, through arm adduction and shoulder internal rotation.

The term "Swimmer's Shoulder" was created by Kennedy and Hawkins to characterize anterior shoulder soreness during and after exercise. At first, it was assumed that the rotator cuff tendons' outlet impingement under the coracoacromial arch was the source of the pain. However, when shoulder discomfort was further investigated, it became clear that there are other factors to consider, including stroke biomechanics and/or shoulder muscle overuse and fatigue, scapula, and upper back and/or glenohumeral laxity with subsequent shoulder instability.[1, 4] In a recent study, 91% out of 80 young elite swimmers (13-25 years old) reported an episode of shoulder pain. 84% showed positive impingement sign, and the 52 swimmers who had magnetic resonance imaging (MRI) testing showed evidence of supraspinatus tendinopathy in 69% of cases.[1,]

AIM

To compare the effectiveness of Serratus Anterior training versus Subscapularis training in swimmers with shoulder pain in terms of performance in subjects with Swimmer's shoulder.

Material and Method

It is an experimental study conducted in YMCA Chennai and in the swimming pools in and around Chennai. All subjects were clinically diagnosed as Swimmer's shoulder. Subjects were chosen depending on whether they met the inclusion criteria. Subjects were evaluated using an assessment form, Upper Quarter Y Balance Test (UQYBT), Disabilities of Arm, Shoulder and Hand score (DASH) and 50m sprint for disability and evaluate performance. Subjects were informed about the procedure, merits and demerits of the treatment. Consent is obtained from each patient for voluntary participation. Subjects were randomly assigned into two groups i.e. Group A (n=20)(Serratus Anterior training) and Group B (n=20)(Subscapularis training). Subjects were assessed before the commencement of treatment and also reassessed after 6 Weeks of treatment. This study was conducted from January, 2023 to July, 2023.

The treatment duration was 3 times a week for 6 week, totally 18 training sessions per group.

Material used for this study includes Inch tape, Wooden block, Stopwatch, Goniometer, Pen, paper, TheraBand (Blue colour), Swiss ball, Stepper, Mat, Medicine ball (2lb, 6lb), Trampoline. Similarly parameters used here (Group A) serratus anterior training and (Group B) subscapularis training as independent variable, dependent variable are UQYBT, DASH and 50 meters Sprint test for measuring swimming performance.

Inclusion criteria:

- High school, college swimmers with shoulder pain past 3 months, not with a 6 weeks of formal rehabilitation.
- Age 16 to 22 years with minimum 8 hours training per week.
- Positive Hawkins test

Exclusion criteria:

- Previous shoulder injury
- upper limb disorders
- Cervical, thoracic conditions and rints[2].

Procedure

Group A: Serratus Anterior Training:

Intermediate phase:

1. **Diagonal PNF using TheraBand:**

The subject was asked to perform a diagonal PNF pattern (shoulder flexion, extension, and external rotation) toward the end of the subject's range of motion.

2. **Shoulder abduction in the plane of scapula:**

The subject arm straight at the side, and ask to turn their palm so that it is facing forward, then to lift their arm out to the side in the scapular plane.

3. **Serratus Anterior punch:**

With the theraband still tied to a fixed surface, turn away from the surface and the Subject hold the band and punches forward.

4. **Dynamic hug:**

With the shoulder abducted at 60º, internally rotated at 45º, and elbow flexed at 45º then they were asked to horizontally flex their shoulder described by their hands (huggingaction) till reaches maximum protraction, then return slowly to the starting position.

5. **Wall slide:**

Fig 1: Wall slide.

With the theraband tied, the forearm should remain parallel and in the form of the number 11. Subject protracts the shoulder blades by pushing the upper back away from the wall and sliding up and down against the wall.

Advance phase:

1. **Push-up plus:**

From standard push-up position, continue to rise up by protracting scapula and return to starting position.

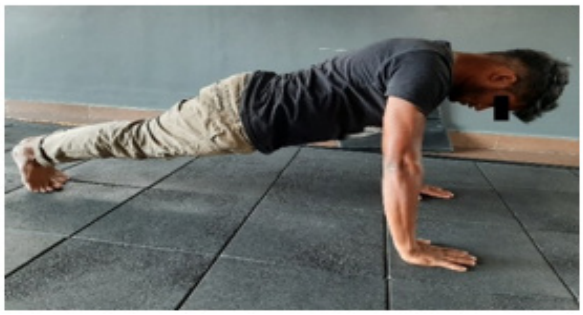


Fig 2: Push-up Plus

2. **Plyo push-ups:**

Subject's were advised to lower their body until the chest almost touches the ground. When pushing up, then asked to clap their hands, then return to starting position.

3. **Medicine Ball Reverse Throw and Catch:**

Shoulder abducted to 100º and rotates externally, then asked to throw the medicine-ball reverse and catch.

Fig 3: Medicine Ball Reverse Throw & Catch

4. **Step over:**

From high plank position and stepper is placed in front of the subject and asked to step up and down.

5. **Swiss ball walk outs:**

From high plank position with legs supported on a Swiss ball, hands shoulder-width apart, chest near the ground, torso in straight line. The subject was asked to take a step walk-forward for 5 to 7 steps and return to starting position.

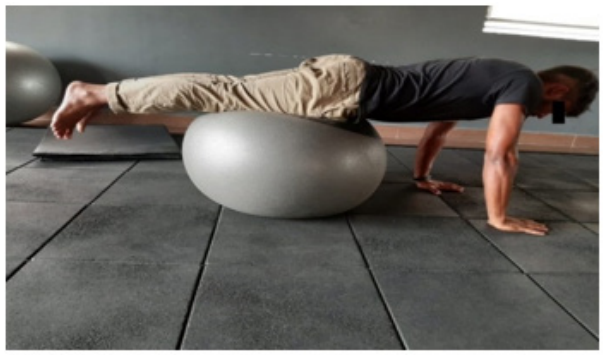


Fig 4: Swiss ball walk out

Group B: Subscapularis Training:

Intermediate phase:

1. **Internal rotation (90º of abduction):**

Theraband still tied, arm abducted 90º, elbow flexed, Subject was asked to internally rotate the arm by pulling the band forward and return to starting position.

Fig 5: Internal Rotation (90° of abduction)

2. **Internal rotation (90° of forward flexion):**

Theraband still tied, arm forward flexed 90°, elbow flexed. Then internally rotate the arm by pulling the band forward and inward and return to starting position.

3. **Diagonal internal rotation:**

With elbow flexed 45°, shoulder abducted 90°. Then slowly horizontally flexed, adducted, internally rotated the humerus until the hand reached the anterior superior iliac spine opposite to resistance.

4. **Rhythmic stabilisation:**

Subject in "Statue of Liberty position" and challenged to maintain this position against resistance while throwing and catching in the opposite hand.

5. **Extension from 90° to 0°:**

Subject in standing and grab theraband with arm flexed 90°, internally rotated then pulls the band downwards until hand reaches the thigh.

Advance Phase:

1. **Ball throw Rebound:**

With shoulder abducted 90°, elbow flexed 90°, holding medicine-ball of 2lb, then asked to bounce the ball by throwing it against the trampoline.

2. **Wall Dribble:**

Asked to stand by holding medicine-ball of 2lb in hand with shoulder abducted 90°, elbow flexed 90°, band was tied to shoulder height, then Subject dribbles the ball against the wall for 10 to 12 counts.

Fig-6 Ball throw rebound &Fig-7 Wall dribble

3. **Overhead throw:**

Standing by facing wall and shoulders 90-90 position, subject throws the ball overhead against the wall.

4. **Side throw:**

Standing side of the wall, grabs the ball of 6lb and throws it against the wall in side way.

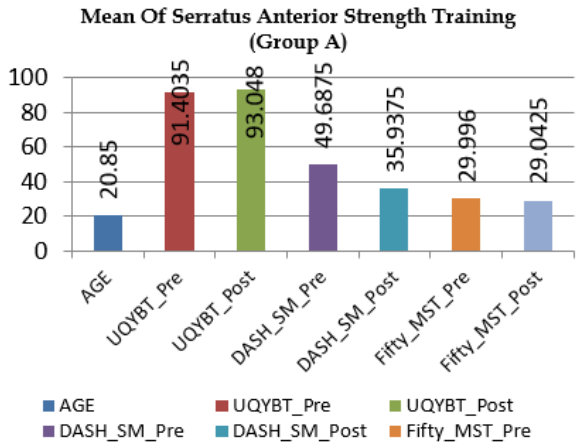
5. **TheraBand diagonal acceleration:**

Standing and grabs theraband with elbow flexed 45°, shoulder abducted 90°, quickly horizontally flexed, adducted, and internally rotated the humerus until the hand reached the anterior superior iliac spine opposite to the resistance.

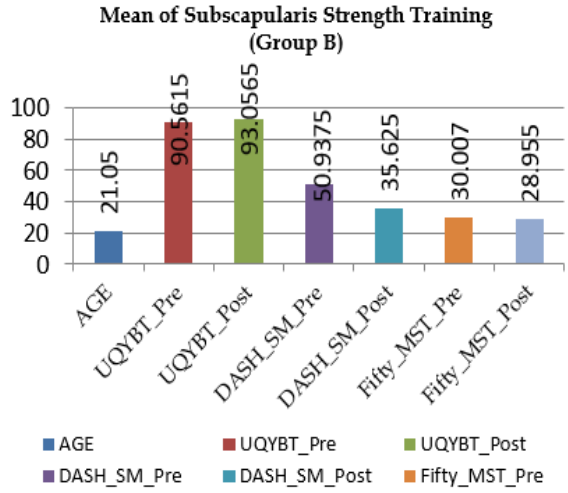
Repeat all the exercise for 3 sets of 10 repetitions per set.

Data Analysis

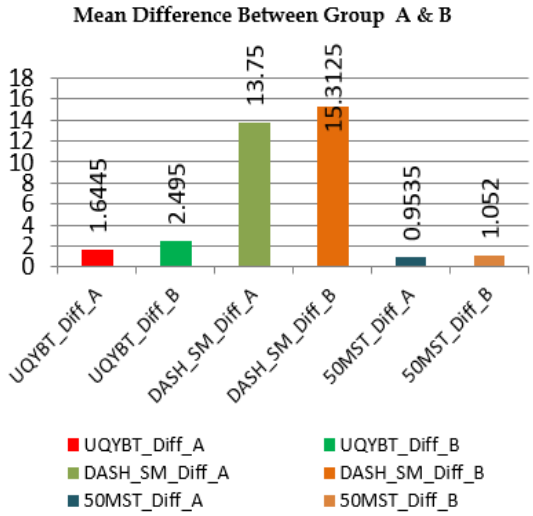
Totally 40 only male subjects involved in this study and randomized into Group A and B in 1:1 ratio. The descriptive statistics for age and for all standard measures (before and after treatment) have been calculated separately for treatment groups.



Graph No. 1 shows Group A pre and post-test values



Graph No. 2 shows Group B pre and post-test values



Graph No. 3 shows mean difference between group A and B values

Result

The study was conducted on 40 subjects, each group 20.UQYBY Score ($t(38)=3.975, p= 0.000<0.05$) shows a significant difference between the Groups, by mean values, we conclude that the average increase in UQYBT Score due to "Subscapularis Strength Training" (M=2.4950,SD=.77772) was greater than that of "Serratus Anterior Strength Training" (M=1.6445,SD=.55735).

For DASH_SM Score ($t(38)=1.035, p= 0.307>0.05$) shows No significant difference between the Groups, by mean values, we conclude that the average decrease in DASH_SM Score due to "Subscapularis Strength Training" (M=15.3125,SD=5.15986) was greater than that of "Serratus Anterior Strength Train ing" (M=13.7500,SD=4.34908).

For 50MST Score ($t(38)=2.687, p=0.011<0.05$) shows significant difference between the Groups, by mean values, we conclude that the average decrease in this 50MST Score due to "Subscapularis Strength Training" (M=1.0520,SD=.14763) was greater than that of "Serratus Anterior Strength Training" (M=.9535,SD=.07125).

Discussion

In India, swimming has become a highly competitive sport and, as a result, shoulder overuse injuries are a growing concern. Swimming increases the risk of shoulder tendinitis and tenosynovitis.[5] This study utilized an experimental design to investigate the effectiveness of 6-week Serratus Anterior training Versus Subscapularis training in improving the performance of Swimmer's Shoulder. Validating a strengthening program for high school and collegiate swimmers that modifies suggested specific rehabilitation program for shoulder pain provide coaches and PTs to incorporate into their training and potentially reduce the incidence of shoulder pain during a competitive season.

Swimmers can be identified by the curve of their shoulders and tappers to slim waists and hips. Competitive swimmers swim 10-14km per day, six to seven days per week, which equates to 2500 shoulder rotations every day.

Shoulder pain is directly related to age, training intensity, training interval, and proficiency of swimming with respect to their ranks.[6]

Scov and colleagues performed an EMG study on painful shoulder during front crawl swimming. Their results demonstrated subscapularis had significantly less EMG activity. Also dysfunction of the serratus anterior contributes to impingement syndrome. All the above research implies that subscapularis and serratus anterior play a major in stabilizing the shoulder during front crawl swimming and the fatigability nature of the muscles makes the swimmer more susceptible to impingement.

In the present study, results suggest that Group B has an effect on performance improvement in Swimmers with shoulder pain after a 6-week intervention. The improvement was slightly more significant in group B than in group A. The difference between Group A and B has been found to be a statistically significant in UQYBT score, DASH SCORE, and Performance timing. However, the mean difference of Group B is slightly more effective than Group A in terms of UQYBT Score and Performance timing.

Dr. Ranjeet Singh Sandhu(2017)[8] conducted a study to compare the Effectiveness of Aquatic Exercises Versus Dry Land Concentric Eccentric Exercises on a Swimmer's Shoulder. They concluded that Dry-land Functional training improves the 50m freestyle sprint performance, reduces pain and disability in Swimmers with shoulder pain.[18]In this study the mean difference of 50m freestyle sprint scores results concludes "Subscapularis Strength Training is more effective than "Serratus Anterior Strength Training in improving the performance timing.

Dr. Dabholkar Ajit S et al(2015) conducted an RCT to evaluate the Effects of scapular muscle strengthening on shoulder function and disability in shoulder impingement syndrome. They concluded that strengthening scapulothoracic muscles decreases disability and improves function in patient with SIS. In agreeing with the study, DASH score results shows significant difference within the group but there is no difference between the groups.

Zeynep Hazar et al (2014) studied on UQYBT test on shoulder impingement patients and found that patients with shoulder impingement syndrome will perform worse on the UQYBT in the medial and inferolateral directions. In correlation with this study, swimmers performed worse on UQYBT scores in the medial and inferolateral directions. And post rehabilitation the score improved in both directions in both groups. But the mean difference is slightly more effective in Group B than in Group A.

There hasn't been an interventional study on swimmers' shoulders, despite research being done on the treatment of swimmers' shoulders and the comparison of aquatic and dry land rehabilitation. Therefore, this study implies hosting an advantage in rehabilitation for Swimmer's shoulder athletes as they are bound with time for treating their condition.

Functional Training in Swimmer's Shoulder:[7]

The dynamic stabilizers of the shoulder complex must activate consistently and in unison for best athletic performance. Strengthening exercises should replicate the functional requirements associated with sport-specific skills. Unfortunately, most traditional weight-training programs fail to address the dynamic strength and endurance requirements of swimming, thus promoting shoulder dysfunction. Functional exercises were incorporated in daily dry-land training in this study to train specific muscle groups in positions relative to the demands of the sport. Several researchers agree that exercises should be implemented in positions of vulnerability, thus inducing neural adaptations for dynamic restraint.

The objective nature of any swimming race is to complete the race in the shortest possible period. Dry land exercises can help swimmers with both their swim technique as well as their overall endurance. This study emphasized training deep stabilizers of the shoulder that are more susceptible and common causes for impingement in swimmers. The study found that swimmers with Subscapularis training have higher mean values as compared to swimmers with Serratus Anterior training showing statistically significant differences ($p<0.05$) for UQYBT score and 50m freestyle sprint performance. The purpose of the study is to provide a brief and a better idea of the Rehabilitation program of deep stabilizers for athletes with Swimmer's Shoulder.

Conclusion

The difference between Group A and Group B was found to be statistically significant in terms of

the UQYBT Score and 50MST Score except DASH_SM Score. On the whole, this study concludes that the mean difference of Group B "Subscapularis Strength Training" is slightly more effective than Group A "Serratus Anterior Strength Training" in terms of performance in the swimmer's shoulder in all standard measures.

Ethical Clearance: Taken from the institutional ethical committee.

Funding: Self

Conflict of Interest: Nil

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