

Effectiveness of Strengthening Exercise for Serratus Anterior to Improve Upper Extremity Performance in Weightlifters with Shoulder Pain - A Pilot Study

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ABSTRACT

Background: The clean and jerk and the snatch are the two competition lifts in weightlifting. The primary function of the serratus anterior is to protract the scapula, meaning it pulls the shoulder blade forward across the rib cage, which is vital for arm elevation and reaching movements. This muscle also contributes to upward rotation of the scapula, necessary for lifting arms overhead. Weightlifting can be greatly impacted by a weak serratus anterior muscle because it limits shoulder stability, makes it harder to push or press heavy weights, and increases the risk of shoulder injuries.

Method: 12 male weightlifters of age between 18-25 years were included in this study. Intervention includes the use of dumbbells and theraband as a progressive resisted exercises for strengthening serratus anterior for 15 to 20 minutes, four days a week, for 10 to 12 repetitions using seated shot-put test as an outcome measure.

Result: On the dominant hand mean pre and post workout distance was 217.5 cm and 230.3 cm. On the non-dominant hand, mean pre and post workout distances are 201.3 cm and 211.3 cm. Paired t test was found to be 17.81 on the dominant hand and 16.13 on the non-dominant hand. The results suggest that the workout program has a slightly greater impact on improving dominant hand performance (mean increase: 12.8 cm) compared to non-dominant hand performance (mean increase: 10.0 cm).

Conclusion: The study concluded that the serratus anterior strengthening improved the upper extremity performance for weightlifting like snatching and clean and jerk ability.

KEYWORDS: Weightlifting, strengthening programs, exercise programs, upper extremities, pain, shoulder.

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INTRODUCTION

The snatch and the clean and jerk are the two competition lifts in Olympic weightlifting. With a wide grip on the bar, the lifter pulls the barbell off the floor and quickly bends their knees to get under it, supporting it over their head with their arms outstretched. This

is known as the “snatch,” a lift in which the athlete sweeps the barbell up and overhead in a single fluid motion. The lifter then holds the barbell overhead and rises to a standing position to complete the snatch. Athletes perform the clean and jerk, a combination lift, by raising the barbell into support on the front

of their shoulders first, then lifting it from shoulders to overhead (The jerk) [1,2].

The external rotation and abduction of the shoulder joint, which weightlifters perform during a snatch [3], increases the risk of shoulder injury. Weightlifting and overhead training frequently cause shoulder pain, particularly when performing exercises like the overhead press, snatch, clean and jerk, and dumbbell shoulder press [4]. Furthermore, posterior shoulder tightness is linked to a reduced acromiohumeral distance and appears to impact scapular and humeral head kinematics [5]. Sub acromial impingement may result from abnormal humeral head translations brought on by selective tightening of the posteriorinferior capsule, which can reduce the width of the sub acromial space. Therefore, in the overhead athlete, posterior capsule shortness may raise the risk of both internal and subacromial impingement [6-8].

Often referred to as the “boxer’s muscle,” the serratus anterior is essential for shoulder stability and good posture. This muscle helps rotate the scapula and stabilizes it against the thoracic wall. It extends from the upper nine ribs to the front of the scapula. The serratus anterior plays a complex role in a number of movements essential to upper limb mobility, such as posterior tilting, upward rotation, and scapular protraction. Understanding how the serratus anterior contributes to shoulder stability requires an understanding of force couples. Two forces acting in opposing directions that result in rotation without translation are referred to as a force couple. The serratus anterior and trapezius muscles cooperate to produce a force couple in the shoulder that stabilizes the scapula when the arm is raised. In order to avoid impingement or excessive strain on the shoulder joint, this coordination is essential for the scapula’s smooth glide over the thoracic cage.

This delicate balance can be upset by weakness or dysfunction in the serratus anterior, which can impair shoulder mechanics and raise the risk of injury. According to studies, shoulder impingement syndrome symptoms can be lessened and shoulder stability greatly increased by strengthening the

serratus anterior. Additionally, electromyography (EMG) analysis has shed light on the serratus anterior’s activation patterns during various exercises, recommending targeted interventions to improve its strength and functionality. Shoulder stability, scapular rotation, and general upper extremity function can all be enhanced by strengthening the serratus anterior muscle.

Scapular winging, reduced overhead mobility, and excessive shoulder shrugging to support the weight overhead are common movement deviations that occur when the serratus is not properly engaged or is especially weak.

Specific exercises to strengthen the serratus anterior can improve performance and lower the risk of shoulder injuries in athletes, particularly those participating in overhead sports [9].

MATERIALS AND TECHNIQUES

12 male weightlifters, ages 18 to 25, participated in a pilot interventional study. The study included participants who had shoulder pain during overhead presses such as snatch, clean, and jerk. The single arm seated shot-put test was used to evaluate the participants’ performance in the upper extremities. The study did not include participants with a history of rotator cuff injuries. The study was conducted for four weeks.

Procedure: All participants received a brief explanation of the study’s methodology. Participants were recruited using the inclusion and exclusion criteria, and a preliminary analysis was carried out that included demographic data. The primary element of the intervention was the use of dumbbells and theraband for progressive resisted exercises for 15 to 20 minutes, four days a week, for 10 to 12 repetitions.

Intervention

Serratus anterior strengthening: The participants were required to complete a four-week program of progressive resisted exercise for strengthening their serratus anterior that included four sessions per week under supervision, each lasting 15-20 minutes and requiring 10-12 repetitions of each exercise. A

starting weight of dumbbells weighing 2-5kg and theraband of 2.1kg are used. The dumbbell and theraband pull-apart exercise for serratus anterior strengthening are performed in the following manner. The ideal position will be sitting/standing and in prone (lie on your stomach) position by holding theraband or dumbbells. First will be the standing/sitting exercise performed with your arms at shoulder height, holding a dumbbell in each hand with your palms facing forward. Slowly pull the dumbbells apart, keeping the arms straight, and focus on squeezing serratus anterior muscles. Hold the dumbbells apart for a brief moment (about 1-2 seconds). Slowly return the dumbbells to the starting position. Perform 3 sets of 10-12 repetitions. Second exercise is performed in prone (lie on your stomach) with the arms extended in front, holding a dumbbell in each hand with palms facing down. Slowly pull the dumbbells apart, keeping arms straight, and focus on squeezing the serratus anterior muscle. Hold the dumbbells apart for a brief moment (about 1-2 seconds). Slowly return the dumbbells to the starting position. Perform 3 sets of 10-12 repetitions. - Use a weight or resistance level that allows to maintain proper form and control throughout the exercise and the weights will be increased progressively throughout every week. Focus on squeezing the serratus anterior muscles while pulling the dumbbells or theraband apart [10,11].

Outcome measure

Single arm seated shot-put test (SSPT): Using seated single arm shot put test, upper extremity performance and serratus anterior strength were assessed. SSPT is a reliable tool for measuring the functional performance of the upper limbs in regular exercise practitioners with chronic shoulder pain. The participant sits on the floor with their feet flat and knees bent at 90 degrees. A shot put (2- 4 kg) and a measuring tape is used for the test. The participant holds the shot put with both hands and starts with their arms at shoulder height. On command, the participant pushes the shot put forward, keeping their arms straight, and releases it at the maximum distance. Then the distance from the starting point to where the

shot-put lands is measured. Both dominant and non-dominant hand was tested. In this test 3 trials are performed, and the average distance is recorded. The normal distances before and after a four-week program of theraband strengthening exercises were compared and noted. The seated single-arm shot-put test (SSPT) is a valid and reliable tool for measuring the functional performance of the upper limbs in regular exercise practitioners with chronic shoulder pain, according to a study by Jocassia Silva that evaluated the SSPT's intra- and interrater reliability in relation to the upper limb functional performance of these individuals [12].

RESULTS

The present study was conducted among 12 male weightlifters to improve upper extremity performance.

Table 1: Pre and post SSPT of Dominant upper extremity

Group	N	Mean	SD	Df	t	P Value
Pre SSPT	12	217.5	14.19	12.8	17.81	<0.001
Post SSPT	12	230.3	13.49			

The seated shot-put test mean and standard deviation were 217.5±14.19 and 230.3±13.49, respectively, before and after the exercise, as indicated in Table 1.

Table 2: Pre and post SSPT of Non dominant upper extremity.

Group	N	Mean	SD	Df	t	P Value
Pre SSPT	12	201.3	11.49	10	16.13	<0.001
Post SSPT	12	211.3	10.59			

The seated shot-put test mean and standard deviation were 201.3±11.49 and 211.3±10.59, respectively, before and after the exercise, as indicated in Table 2.

DISCUSSION

One of the scapular upward rotation (SUR) muscles, the serratus anterior (SA), is thought to be crucial for preserving the scapulo-humeral rhythm and the shoulder complex's ideal function when raising the arm. The SA prevents anterior tilting and winging of the scapular bone by rotating it upwards while raising the arm. When the arm is moving, these SA functions enable the scapular bone to move in close proximity to the thorax. Because of this, some tests that have been

validated in the specialized literature can evaluate the functional performance of the upper limbs. One practical and easy method for evaluating upper limb functional performance (SSPT) is the seated single-arm shot-put test. A 6- pound (2.72-kg) ball is used in this open kinetic chain test, and the subject is instructed to throw the ball as far as they can while seated [13].

The present study conducted on male weightlifters and tested both dominant and nondominant hand. The results suggest that the workout program has a slightly greater impact on improving dominant hand performance (mean increase: 12.8 cm) compared to non-dominant hand performance (mean increase: 10.0 cm).

The reliability of the seated shot-put test (SSPT) was first evaluated in a sample of healthy, recreationally active adults, and the results showed excellent reliability. A previous study found moderate to strong correlations between SSPT and isokinetic peak forces for both limbs. The results of the test indicate that the functional performance of both upper extremities can be compared using the SSPT [14]. Additionally, the study found that the SSPT can be used to compare the functional performance of both upper extremities. This study used the single arm seated shot-put test as an outcome measure to strengthen the serratus anterior and enhance upper extremity performance in weightlifters. Eighty overhead athletes participated in a second cross-sectional study to confirm the relationship between the isometric strength of the serratus anterior and the performance on the seated shot-put test. The results showed that the isometric strength of the serratus anterior predicted the performance on the seated shot-put test and enhanced the overhead mobility [15].

Both dominant and non-dominant hands show significant improvements, indicating that the workout program is effective in improving overall Seated Single Arm Shot Put Test performance. The workout program can be used to improve upper extremity performance in individuals, particularly in sports that require throwing or pushing movements.

CONCLUSION

The study concluded that the serratus anterior strengthening improved the upper extremity performance like snatching and clean and jerk ability in weightlifters. During weightlifting, the scapula (shoulder blade) primarily moves through retraction and upward rotation, with the lower trapezius muscle playing a key role in facilitating this upward rotation and posterior tilt, ensuring proper shoulder stability and allowing for smooth arm movement throughout the lifting motion; essentially, the lower trapezius helps “hold” the scapula in the optimal position for lifting heavy weights. Strengthening the SA muscle also helped the lifters to relieve shoulder pain during these activities to an extent. SSPT tested on both dominant and non-dominant upper extremity.

Conflicts of interest: None

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