



EFFECT OF A SIX-WEEK SERRATUS ANTERIOR STRETCHING PROGRAMME ON SHOULDER FUNCTION IN YOUNG ADULTS WITH RESTRICTED SHOULDER MOBILITY

Original Research Article

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ABSTRACT

Background: The serratus anterior muscle is responsible for protracting and rotating the scapula and for maintaining the scapula against the thoracic wall. Repetitive overhead or desk-based activities can lead to shortening of the serratus anterior muscle and limited shoulder mobility. The purpose of this study was to investigate the effects of a six-week manual muscle stretching programme of the serratus anterior muscle on the range of motion of the shoulder among young adults with limited shoulder range of motion. **Methods:** Thirty young adults between the ages of 18 and 25 years with limited shoulder range of motion, tightness of the serratus anterior muscle (manual muscle test result of 1-2), and occupational requirements of performing overhead or desk-based tasks were randomly selected from the Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Chennai. Participants with grade 0 or grade 3 muscle power, pathological, inflammatory, or infectious shoulder conditions were excluded. A manual side-lying serratus anterior stretch was applied by a single therapist, who mobilised the scapula away from the thoracic wall while the participant performed a sustained deep-breath hold; each stretch was held for 30 seconds and repeated three times per session, delivered once daily on three alternate days per week for six weeks. Shoulder function was assessed before and after the programme using the Constant–Murley Outcome Score (CMOS), which combines pain, activities of daily living, range of motion, and strength to a maximum of 100. Data were analysed in SPSS v24; normality was confirmed using the Shapiro–Wilk test, and a paired *t*-test compared pre- and post-intervention scores. **Results:** The CMOS data were normally distributed ($p = 0.261$). The mean CMOS improved from 79.05 ± 8.71 before the intervention to 84.25 ± 5.54 afterwards, a mean gain of 5.20 points ($\approx 6.6\%$), which was statistically highly significant ($t = -6.73$; $p \leq 0.001$). Post-intervention scores were also less variable, indicating a more consistent functional response. **Conclusion:** A six-week manual serratus anterior stretching programme significantly improved shoulder function in young adults with restricted shoulder mobility, supporting its use as a simple adjunct for preserving scapular mechanics and shoulder range of motion.

Keywords: Serratus anterior; Shoulder range of motion; Muscle stretching; Scapular dyskinesis; Constant–Murley score; Shoulder function.



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INTRODUCTION

The serratus anterior is a broad, fan-shaped muscle that arises from the lateral surfaces of the upper eight to nine ribs and inserts along the costal aspect of the medial border of the scapula, spanning the superior angle, medial border, and inferior angle [1]. The muscle is conventionally divided into three functional portions: an upper portion attached to the ribs near the superior angle of the scapula, a middle portion that attaches to the medial border of the scapula, and a lower portion that is attached along the inferior angle of the scapula [1,2]. The serratus anterior has been divided into these portions through cadaveric analyses, which revealed that the lower portion of the serratus anterior contains the largest cross-sectional area of any portion of the muscle [3]. The upper portion of the serratus anterior functions in protraction of the scapula, while the lower portion is active in depressing the scapula, protracting the scapula, and rotating the scapula upwardly [2]. The serratus anterior is the primary muscle responsible for maintaining the scapula against the thoracic wall both at rest and during movement of the upper extremity [2,3]. The serratus anterior, along with the upper and lower trapezius muscles, is responsible for the dynamic stability of the scapula during arm movement [2,4].

Disruption of this force couple can produce scapular dyskinesis, an alteration in the normal position and motion of the scapula that is now regarded as a potential impairment to optimal shoulder function rather than a discrete diagnosis [4,5]. Imbalance within the scapular stabilisers underlies many of these altered patterns, which can be identified using established clinical assessment methods [6], and such altered scapular kinematics are associated with a range of glenohumeral joint pathologies [7]. Reduced serratus anterior strength and flexibility have been linked with posterior shoulder tightness and a forward scapular posture [8], and adaptive shortening of anterior scapulothoracic muscles can reproduce the loss of posterior tilt and increased internal rotation characteristic of impingement [9]. Scapular dyskinesis has been identified as a risk factor for shoulder injury in athletes [10], with a systematic review reporting a substantially higher prevalence in overhead athletes (61%) than in non-overhead athletes (33%) [11]; individuals with impingement also demonstrate measurable deficits in shoulder function alongside their altered scapular motion [12]. Together, these findings underscore the link between repetitive overhead loading, impaired serratus anterior function, and shoulder dysfunction. A variety of manual scapular techniques that mobilise the scapula relative to the thoracic wall have been shown to produce acute improvements in shoulder function [13]. The serratus anterior is active during rehabilitation exercises [14,15] and during exercises of varying strengthening intensities [16].

Thus, lengthening the serratus anterior is thought to alleviate muscular tightness and restore range of motion to the shoulder joint. However, little is known of the effect that lengthening the serratus anterior has upon the range of motion of the joint in young adults. Therefore, the main purpose of this study was to determine the effectiveness of a six-week manual serratus anterior stretching programme to improve the shoulder function of young adults with restricted shoulder mobility.

METHODS

Study Design and Setting

This study is a single group experimental study that seeks to evaluate the effect of the implementation of a manual therapy programme for the serratus anterior muscle on the shoulder function of young adults with tightness of the muscle. The study will be conducted at the Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi, Chennai, India. The study will run for six weeks from the date of recruitment of the participants.

Participants

The participants for this study will be young adults between the ages of 18 and 25 years old who present to the department with tightness of the serratus anterior and restricted range of motion of the shoulder joint.

Inclusion Criteria

Participants who satisfy the following criteria will be included in the study:

- Age between 18 and 25 years
- Grade of 1 or 2 on manual muscle test for serratus anterior muscle
- Restricted active range of motion of the shoulder
- Experience in activities that involve overhead movements or are primarily performed in a desk-based occupation

Exclusion Criteria

The following type of participants were excluded from the study:

- Grade of 0 or 3 for serratus anterior muscle power
- Any diagnosed condition of the shoulder
- Any condition that is inflammatory in nature
- Any infectious disease
- Age below 18 years or above 25 years old

Sample Size and Sampling Method

A total of thirty participants who satisfied the eligibility criteria were recruited using simple random sampling. Both male and female participants within the specified age range were included.

Ethical Considerations

Written informed consent was obtained from every participant before enrolment, and the stretching protocol, its purpose, and the assessment procedure were explained in full prior to commencement of the intervention. Participation was voluntary, and participants were free to withdraw at any stage.

Intervention Protocol

Each participant received a manual serratus anterior stretch delivered by the same therapist throughout the study to ensure consistency. The participant was positioned in side-lying with the shoulder to be treated uppermost and was instructed to relax. The therapist stood in front of the participant, stabilised the participant's arm in the therapist's axilla, and placed the thumb of the other hand horizontally beneath the scapula, in contact with the costal surface of the serratus anterior. The thumb was advanced beneath the scapula as far as the participant could comfortably tolerate, separating the scapula from the underlying ribs. Once the thumb engaged beneath the scapula, the participant was asked to take a deep breath and hold it for 8–10 seconds. Each stretch was sustained for 30 seconds and repeated three times per session. The intervention was delivered in a single supervised session per day, on three alternate days per week, for six weeks. A treatment table and a pillow were used for positioning.

Outcome Measures

Shoulder function was assessed using the Constant–Murley Outcome Score (CMOS), a 100-point composite scale developed to quantify shoulder function after treatment [17] and subsequently refined with standardised guidelines for its administration [18]. The score combines a subjective assessment of pain (15 points) and activities of daily living (20 points) with objective measures of range of motion (40 points) and shoulder strength (25 points); higher scores denote better function.

Statistical Analysis

The collected data were tabulated and analysed using both descriptive and inferential statistics in the Statistical Package for the Social Sciences (SPSS), version 24, with statistical significance set at $p < 0.05$. The Shapiro–Wilk test was used to assess the normality of the data; as the CMOS data were normally distributed ($p = 0.261$, $p > 0.05$), a parametric approach was adopted. A paired t -test was used to compare pre- and post-intervention CMOS values within the group.

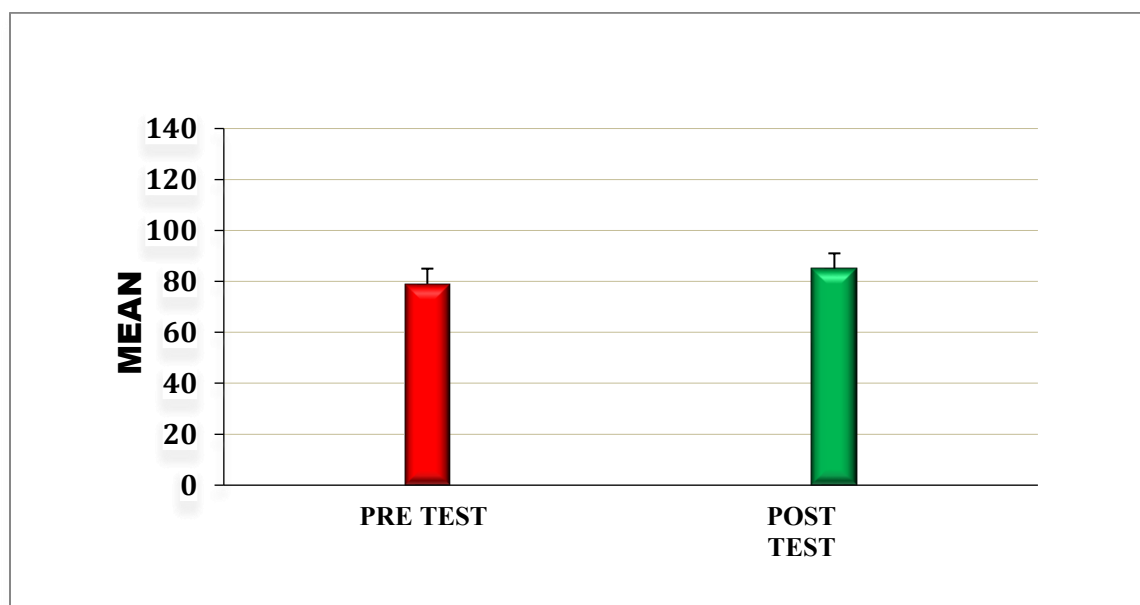
Results

The data for the Constant-Murley Outcome Score were normally distributed on the Shapiro-Wilk test ($p = 0.261$). The mean CMOS scores decreased from a pre-intervention score of 79.05 ± 8.71 to 84.25 ± 5.54 after six weeks of performing the serratus anterior stretching exercises. Thus, the mean improvement within the group was 5.20 points, or approximately 6.6% of the pre-intervention score. These results were statistically highly significant with a t -test ($t = -6.73$; $p \leq 0.001$), and each patient's score after the intervention was equal to or higher than their baseline score. Furthermore, the standard deviation of the scores within the group also decreased from baseline to the follow-up evaluation (from 8.71 to 5.54), indicating that the scores improved and became more uniform following the intervention. Thus, the null hypothesis was rejected.

TABLE – 1 COMPARISON OF CONSTANT MURLEY OUTCOME SCORE WITHIN GROUP BETWEEN PRE & POST TEST VALUES

#TEST	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP	79.05	8.71	84.25	5.54	-6.73	.000***

(***- $P \leq 0.001$)

GRAPH – I COMPARISON OF CONSTANT MURLEY OUTCOME SCORE WITHIN GROUP BETWEEN PRE & POST TEST VALUES

DISCUSSION

Results of this study demonstrate that a six-week manual serratus anterior stretching programme can lead to statistically highly significant improvements in the overall shoulder function of young adults with restricted shoulder mobility ($p \leq 0.001$). The possible reasons for these improvements may relate to the anatomy of the serratus anterior muscle itself; the middle and lower heads of the serratus anterior are the most powerful heads of the muscle, and are the primary muscles that control the gliding movement of the scapula along the thoracic wall [2,3]. Additionally, the serratus anterior works in a force couple with the trapezius muscles; Cools and colleagues reported that one of the primary causes of scapular dysfunction in those patients with scapular dyskinesis is the loss of flexibility and function of the serratus anterior and lower heads of the trapezius muscles [4]. Furthermore, scapular dyskinesis is considered to be a condition that should be managed in the treatment of shoulder dysfunction as a whole [5]. Related studies have demonstrated that altered scapulothoracic motion is associated with a variety of pathologies of the glenohumeral joint [7]. For instance, individuals with shoulder impingement have been reported to exhibit altered scapulothoracic motion [12]. Additionally, individuals with reduced strength and flexibility of the serratus anterior muscles exhibit posterior shoulder tightness; muscles with reduced flexibility exhibit scapular postures that tilt forward rather than laterally [8]. Furthermore, dyskinesis of the scapula is much more common among individuals that spend significant amounts of time

performing overhead activities [4,11]. Additionally, lengthening of the anterior scapulothoracic muscles, such as the pectoralis minor, which can lead to the adaptation of shortening of those muscles has been reported to lead to shoulder impingement; stretching of these anterior scapulothoracic muscles has been proposed as a method of improving scapular kinematics [9]. Finally, fatigue of the serratus anterior muscle has been associated with reduced posterior tilting of the scapula [19]. Thus, while the majority of existing literature indicates that impaired function of the serratus anterior leads to scapular dyskinesis, these results indicate that improving the function of the serratus anterior may lead to improved scapulothoracic motion.

The outcome measure for this study utilized the Constant-Murley Outcome Score to determine outcome of treatment; while the Constant-Murley Outcome Score is a commonly used scoring system that is low in measurement error [17,18], other studies using the same scoring system have indicated that it is imprecise with repeated measurements of the same individuals [20]. Furthermore, the score is a composite score, and does not reveal which component of the shoulder's function is improved; pain, range of motion, or strength may have been the component of function that was improved by the serratus anterior stretching programme.

Overall, though, these results indicate that providing a manual stretch to the serratus anterior muscles may be a beneficial technique for improving the shoulder function of young adults with restricted mobility, both as a preventive technique and as a therapeutic one.

CONCLUSION

These research results demonstrate that providing a manual stretch to the serratus anterior muscle may be effective in improving the shoulder function of young adults that have limited shoulder mobility. Furthermore, because the serratus anterior muscle is relatively easy to locate and stretch, and because the procedure is relatively low-cost, these findings support its use as a technique for improving scapular and shoulder mobility.

LIMITATIONS.

One of the limitations of this research is that it was performed with a single group of participants. Additional limitations include the fact that the population that was evaluated was asymptomatic young adults between the ages of 18 and 25 years, and was only evaluated for a period of six weeks; generalisations based upon these results cannot be made outside of these populations, and over time periods outside of the study, and any effects that might have been caused by the evaluation of the participants by the single therapist who performed the tests.

FUTURE SCOPE.

Additional research can be performed that is controlled in relation to this study, with blinded assessors; future studies could also evaluate the preventive value of serratus anterior muscle stretching for athletes that perform overhead activities, or evaluate the value of such a treatment in age-related or occupationally-related populations with reduced shoulder flexibility.

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