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Original Research Article

# Effect of thrower's ten exercise program on scapular dyskinesia and throwing accuracy in cricket bowlers

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## ABSTRACT

**Background:** 19.8–34.1% of Upper limb injuries are recorded of total injuries in cricket**.** Shoulder joint is the most affected joint in bowlers. Inadequate force generation due to improper position of scapula and less strength of shoulder muscle might affect the performance of the players. So the objectives of the study was to see the effect of Thrower's Ten Exercise Program on scapular dyskinesia and throwing accuracy .

**Methodology:** 30 cricket bowlers (district and state level) with scapular dyskinesia were selected. Pre and post evaluation for scapular dyskinesia and Functional Throwing Performance Index (FTPI) was done post intervention. The intervention was carried out for 6 weeks .

**Results:** There was significant improvement seen in scapular dyskinesia (p=0.0001) and in throwing accuracy (p=0.0002).

**Conclusion:** This study concludes that the Thrower's Ten Exercise Program when given for a period of 3dyas for 6 weeks showed highly significant improvement in scapular dyskinesia and throwing accuracy.

**KEY WORDS**: Scapular Dyskinesia, Cricket Bowlers, Throwing Accuracy, Thrower's ten program.

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## BACKGROUND

The shoulder complex is involved in a highly skilled throwing motion, which is a part of many sports such as baseball, handball, cricket etc. Wilk et al introduced the concept of the "thrower's paradox" in which the throwing shoulder must be sufficiently loose in order to throw but must have enough stability to prevent injuries [1]. Upper limb injuries accounted for 19.8–34.1% of total injuries in cricket [2]. Fast bowlers sustain 42% of the upper extremity injuries [3].

Catch-up phenomenon of throwing motion is referred to as a kinetic chain involving the entire body, whereby forces and kinetic energy are transmitted from the feet through the core and to the upper extremity. Inadequate force generation in the early parts of the kinetic chain alter the forces in the later segments predisposing them to injuries so as to attain the same

level of performance in terms of force, ball speed and accuracy [4].

Release components of throwing performance consist of implement velocity and accuracy, both of which contribute to successful performance [5]. A study done by Suzuki et.al demonstrated that isolated scapular-muscle fatigue and resulting kinematic changes caused a disruption in kinetic energy transfer that led to a 26% decrease in accuracy [6].

Kibler et al defined alteration in the static position or motion of the scapula during coupled scapula-humeral movements as "scapular dyskinesis." The position of the scapula in cricket bowlers during elevation show that the scapula is asymmetrically placed inferiorly and laterally, showing greater internal rotation, decreased upward rotation and excessive anterior tilt. This is usually associated with the weakness of scapular stabilizers (upper and lower trapezius, serratus anterior, deltoid, rhomboids) and rotator cuff muscles due to repetitive action of throwing [6,7]. DiGiovine et al found that all the scapular muscles are highly active during the arm acceleration phase and deceleration phase [8].

There is incidence of alteration of scapula position in bowlers without any functional disability at the shoulder joint [9].

The presence of scapular dyskinesis in asymptomatic overhead athletes indicated a 43% increased risk of developing shoulder pain [10]. The prevalence of scapular dyskinesis in healthy asymptomatic overhead athletes has been reported as 61% compared to 33% in non-overhead athletes [11].

Thrower's 10 exercise program which was established in 1991 by Wilk et al based-on EMG studies was designed to improve strength, power and endurance of the musculature of the shoulder complex and has proved to be effective in rehabilitating and preventing injuries in overhead athletes [12]. So, the need was to check if Thrower's ten exercise program would help in reducing the Scapular dyskinesia and improve throwing accuracy.

## METHODOLOGY

Institutional ethics committee approval was taken before commencing the study. 30 asymptomatic cricket bowlers, engaged in bowling for a minimum of 2 years and having scapular dyskinesia were included. Written informed consent was taken from the subjects after the explanation of the procedure. Subjects with any history of upper limb or lower-limb fracture, any spine or shoulder surgery in the past 3 months were excluded. Subjects were evaluated pre and

**Table 1:** Exercise protocol.

| Exercise | Week | Theraband | Repetition | Sets |
|---|---|---|---|---|
| D2 flexion and extension | $1^{st}$- $2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$-$6^{th}$ | Green | 10reps | |
| Internal and external rotation at 90 degrees of abduction | $1^{st}$- $2^{nd}$ | Red | 8 reps | 3 |
| | $3^{rd}$-$6^{th}$ | Green | 10reps | |
| Supraspinatus and Deltoid strengthening | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$-$6^{th}$ | Green | 10reps | |
| Prone shoulder abduction- D2 flexion | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$ -$6^{th}$ | Green | 10 reps | |
| Prone shoulder extension | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$ -$6^{th}$ | Green | 10 reps | |
| Prone shoulder extension | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$ -$6^{th}$ | Green | 10 reps | |
| Biceps and triceps strengthening | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$ -$6^{th}$ | Green | 10 reps | |
| Rowing | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$ -$6^{th}$ | Green | 10 reps | |
| Wrist flexion and extension, Forearm supination and | $1^{st}$-$2^{nd}$ | Red | 8reps | 3 |
| | $3^{rd}$ -$6^{th}$ | Green | 10 reps | |
| Push-ups | $5^{th}$-$6^{th}$ | - | 10 reps | 3 |
| Press-ups | $5^{th}$- $6^{th}$ | - | 10 reps | 3 |

post intervention for scapular dyskinesia and throwing accuracy using Lateral Scapular Slide Test and Functional Throwing Performance Index respectively.

**Procedure:** The thrower's ten exercise program was given thrice a week for 6 weeks. All open chain exercises were performed with red thera-band in the first two weeks. Progression was made by the use of green thera-band for the next 4 weeks. Closed chain exercises were added in the last two weeks. All the exercises were performed bilaterally in 3 sets for 8-10 repetitions with a rest interval of 30 seconds between each set.

## RESULTS

The data was analysed using MS Office Excel sheet and IBM - SPSS version 20. Paired t test was used for pre and post intervention comparison.

### LATERAL SCAPULAR SLIDE TEST

**Table 1:** Mean values of LSST in each position pre and post-training are compared using t-test ≤0.05.

| LATERAL SCAPULAR SLIDE TEST (LSST) (cm) | | | | | |
|---|---|---|---|---|---|
| Position | | Mean | ±SD | t-test | p-value |
| P1 | Pre- training | 1.11 | 0.34 | 2.3288 | 0.0234 (S*) |
| | Post-training | 0.92 | 0.29 | | |
| P2 | Pre- training | 1.26 | 0.33 | 2.4046 | 0.0194 (S*) |
| | Post-training | 1.07 | 0.28 | | |
| P3 | Pre- training | 1.70 | 0.15 | 7.4744 | 0.0001 (HS**) |
| | Post-training | 1.42 | 0.14 | | |

**Table 2:** functional throwing performance index **(FTPI)**

| FUNCTIONAL THROWING PERFORMANCE INDEX (FTPI) | | | | |
|---|---|---|---|---|
| | Mean | ±SD | t-test | p-value |
| Pre- training | 0.46 | 0.12 | 4.0376 | 0.0002 (HS**) |
| Post-training | 0.58 | 0.11 | | |

**Interpretation:** Post intervention the was statistical improvement seen in throwing performance ≤0.05

Only position 3 showed a greater mean (>1.5cm) in the pre-training test conducted. So, we can infer that scapular dyskinesia is much more evident in position 3 of the test. EMG evaluation has shown that very few muscles are working in the first position, that the serratus and the lower trapezius muscles are working at low levels in the second position, and that the upper trapezius, lower trapezius, serratus, and rhomboid muscles are all working at approximately 40% of maximum in the third position [15]. Various studies done on individuals with scapular dyskinesis often show hyperactivity of the Upper trapezius with reduced and delayed Middle and Lower Trapezius muscle activation, which is associated with decreased amounts of scapular upward rotation, external rotation, and posterior tilt. The serratus anterior and the lower trapezius muscles appear to be the first muscles and the dynamic stabilizers (rotator cuff muscles).

## DISCUSSION

The lateral scapular slide test done pre and post training to evaluate scapular dyskinesia showed that the training has statistically highly significant improvement (p=0.0001) on scapular distance from the spinous process in position 3 on the dominant side. This could be due to the gain in strength of scapular stabilizers (upper and lower trapezius, rhomboids, serratus anterior) involved in inhibition-based muscle dysfunction [7].

In this study, throwing accuracy was evaluated using Functional throwing performance index (FTPI) which showed statistically significant improvement (P=0.0002) post training. The improvement could be associated to the improved muscle strength of scapular stabilizers which create a stable scapular base for efficient

transfer of kinetic energy to the distal segments through rotator cuff muscles and hence, improving the throwing accuracy. The cumulative effect would have resulted in scapular upward rotation, abduction and posterior tilting hereby influencing the improvement in throwing accuracy in the present study.

The results are well supported by the significant improvement (P= 0.0001) seen in throwing accuracy in a study conducted by Ujwal Yeole et.al administering throwers 10 exercise programme in fast bowlers for 3 weeks [16].

The Throwers ten exercise given incorporates various scapular stabilization exercises and PNF pattern like throwing acceleration and deceleration phase of throwing. The increase in strength could be a result of increased neural response, increased motor unit recruitment, and synchronous motor unit firing after 6 weeks of training. PNF exercises are believed to enhance motor learning, increase dynamic stability and neuromuscular control [13,16].

Sakiko Oyama recommended that retraction exercises may be beneficial in improving scapular retractor strength and potentially scapular kinematics, and also have been shown to increase maximal voluntary isometric contraction (MVIC) of the medial scapular and rotator cuff muscle with these exercises [17]. A study done by Myers et al demonstrated that D2 flexion and extension, Internal Rotation(IR) and External Rotation(ER) at 90 degrees of abduction elicited at least moderate activation of all muscles except for the biceps and triceps muscles. Myers et al. suggested that exercises used in thrower's ten program are most effective in activating the muscle important to the throwing motion and may be beneficial for athlete's pre throwing warm-up routine [16,18].

Hawkes et al study reported that EMG measurements at 3 different shoulder IR exercises showed that at 90° abduction, the middle and lower trapezius muscles, the rotator cuff and deltoid muscles, as well as the serratus anterior and rhomboid major muscles, achieved highest activation level [19]. Hughes et al reported that external rotation exercises with thera-band show 21-38% increase in electromyographic activation of scapular retractor muscle [20]. Reinold et al reported that the best exercise for supraspinatus muscle was the "full can" exercise [21]. Prone rowing exercises are clinically recommended to strengthen the scapular stabilizers while minimally activating the rotator cuff [22]. Push ups elicits high muscle activity in the serratus anterior (SA), triceps and pectoralis major, moderate activity of middle and lower trapezius and low activity in the upper fibers of the trapezius (UT), which may be helpful in restoring scapula-thoracic muscle dysfunction [23].

As throwing action is considered to be a series of events forming a kinetic chain, scapula helps in transferring kinetic energy and force generated by the core and lower-limbs to the upper extremity. Therefore, strengthening of serratus anterior, rhomboids, middle and lower trapezius muscle as well as the distal segment musculature is crucial for accurate kinematics of the scapula during the phase of bowling [4].

## CONCLUSION

So, the study concludes that the thrower's ten exercise program when given for a period of 6 weeks showed significant improvement in scapular dyskinesia and throwing accuracy in bowlers.

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**Conflicts of interest:** **None**

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