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Effect of Proprioceptive and Plyometric Exercise versus Throwers Ten Exercise on Shoulder Stability and Throwing Accuracy in Fast Bowlers: A Pilot Study

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ABSTRACT

OBJECTIVES: Bowlers play wider role in cricket. Fast bowlers have high risk of injuries which may be caused by number of factors, such as postural defects, poor bowling technique, as well as high physical demands. Thrower's Ten program are most effective in activating of scapular retractor muscle and may be beneficial for athlete's pre throwing warm-up routine. Plyometric exercise are very popular in upper-body strengthening muscular cycle.

METHODS: 20 subjects who were meeting inclusion criteria are taken and randomly assigned into two group. Group A underwent proprioceptive and plyometric exercises where as Group B underwent thrower's ten exercise program for 4 weeks. In this study, for shoulder stability closed kinetic upper extremity stability test is used. For throwing accuracy, A square of 9 inches with its centre is drawn at a distance of 3 metre from the popping crease.

RESULT: There was statistical significant improvement shown by Wilcoxon Mann Whitney test in shoulder stability and throwing accuracy post intervention ($p < 0.05$). On comparison of pre and post intervention mean difference of closed kinetic upper extremity and throwing accuracy test show significant improvement in shoulder stability (4.04 ± 2.236) and (6.12 ± 2.551), throwing accuracy (1 ± 0.885) and (0.85 ± 0.732) for group A and group B respectively.

CONCLUSION: This study concludes that both groups show improvement in both shoulder stability and bowling accuracy but group B showing more significant improvement in shoulder stability as compare to bowling accuracy and group A shows more significant improvement in bowling accuracy.

KEYWORDS: Fast bowlers, Proprioceptive and plyometric exercise, Thrower's ten exercise, Shoulder stability, Throwing accuracy

I. INTRODUCTION

The shoulder is structurally and functionally complex as it is one of the most freely movable areas in the human body due to the articulation at the gleno-humeral joint. It contains the shoulder girdle, which connect the upper limb to axial skeleton via the sterno-clavicular joint.^[1]

Bowlers play wider role in cricket. Bowling in cricket involves an initial run-up, numerous rotations and circumduction of straight arm about the glenohumeral joint to propel a ball at batter. The velocity at which bowler can deliver ball contributor to high level fast bowling performance. However, there is limited studies shows characteristics which relate to fast bowling ball speed.^[2]

Fast bowlers have high risk of injuries which may be caused by number of factors, such as postural defects, poor bowling technique, as well as high physical demands.^[3] During match many bowlers are placed to field in the outfield and thus have tendency to develop 'thrower's arm' and other injuries. Fast bowlers with front-on bowling action are more susceptible to an injury to shoulder^[4]. During bowling in cricket, the internal shoulder rotators are involved in acceleration phase of arm through concentric contractions, while the external rotators are involved during the deceleration phase. The nature of fast bowling requires arm to be rotated at around 6000/second placing great demands on shoulder's integrity.^[2]

Researchers identify four specific phases of movement that occurs during throwing ball.^[5]

1. Wind up
2. Cocking
3. Acceleration
4. Deceleration

A form of exercise called plyometrics employs quick, powerful movement involving prestretch of the muscle, followed by shortening, concentric muscular contraction, thus utilizing the stretch-shortening muscular cycle.^[6] A burst of concentric muscular contraction is observed due to stretch shortening cycle, when elastic loading, through an eccentric muscular contraction is provided. Plyometric exercises are very popular in upper-body strengthening muscular cycle.^[3,4]

Thrower's ten program was designed by Kevin E. Wilk (2011) to exercise major muscles necessary for throwing. The exercise included are specific to thrower and designed to improve strength, power and endurance of the musculature of shoulder complex. Thrower's Ten program are most effective in activating of scapular retractor muscle and may be beneficial for athlete's pre throwing warm-up routine. Throwers Ten program was effective on improvement of retractor. During this time both intrinsic and extrinsic shoulder muscles fire at significant percentages of their maximum, attempting to develop in excess of 500 N to slow the arm down.^[5] This phase lasts approximately 350 milliseconds and constitutes approximately 18% of the total time.^[5] muscle strength, joint position error, throwing distance and throwing accuracy in recreational overhead activities.^[2,7]

In this study, for shoulder stability closed kinetic upper extremity stability test is used. This test is highly reliable for shoulder stability. This is easy to use test with scores ranging from 0 to infinite points (where 0 denotes no stability). This test takes 45sec 1min to complete by subjects.^[6] For throwing accuracy, A square of 9 inches with its centre is drawn at a distance of 3 metre from the popping crease. The back line of the square must be perpendicular to the leg stump that represent the four (4) point area, and is as per the standard measurement of the distance of cricket stumps i.e. 9 inches. A square of 9 inches is also drawn on the batting crease (i.e block-hole of the batsman) just in front of the stumps that also represent the four (4) point area. Three (3) point area is drawn by extending 9 inches from above, below and front side of the four (4) point area. Two (2) point area is made by extending 9 inches from above, below and front side of the three (3) point area. Similarly, one (1) point area is drawn by extending 9 inches from above, below and front side of the two (2) point area. All lines are 3cm thick and included in their respective point areas. The foregoing marking areas shall be the target zones for the bowlers.^[8]

II. METHOD OF COLLECTION OF DATA

In the comparative study, the sample size was 20 participants, and the intervention duration was four weeks. The sample allocation method used was the odd and even method, which involved assigning participants to either the odd or even group based on their participant number. This approach helped to ensure that there was an even distribution of participants between the two groups. The study aimed to compare the effectiveness of two interventions over a four-week period to determine which intervention was more effective. The researchers carefully analysed the data collected from both groups to draw meaningful conclusions about the interventions.

INCLUSION CRITERIA:

The study population for this research project will consist of male individuals between the ages of 18 to 30 years old who identify with the Asian classification. These participants will have at least 1 year but no more than 3 years of practice in a particular skill or field of study. Additionally, the study will only include individuals who are willing to participate and can commit to the full duration of the study. By focusing on this specific demographic, the study aims to control for factors such as age, gender, and level of expertise, which may influence the results of the study. This will allow for a more accurate assessment of the effectiveness of the intervention and ensure that the results are applicable to the targeted population.

EXCLUSION CRITERIA:

Participants for this study will be excluded if they have had any previous injury or trauma to the shoulder and shoulder girdle area, as this may affect their ability to perform certain exercises and may also impact the outcomes of the study. Additionally, individuals who have been diagnosed with any cardiovascular or metabolic diseases, such as hypertension or diabetes, will also be excluded from the study. This is because such conditions can impact an individual's ability to participate in physical activity and may lead to complications during the study period. By excluding individuals with pre-existing injuries or health conditions, the study can ensure that the results are not confounded by external factors and can provide a more accurate assessment of the effectiveness of the intervention.

TOOLS AND MATERIALS USED

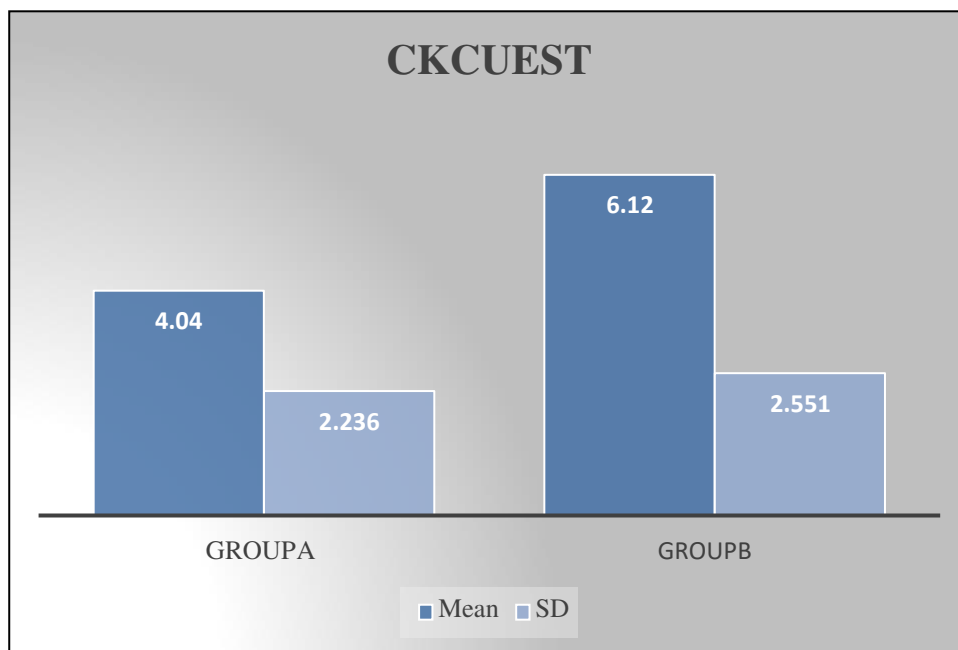
Pen
Informed consent form data
Paper
Medicine ball
Theraband
Dumbbells

OUTCOME MEASURES

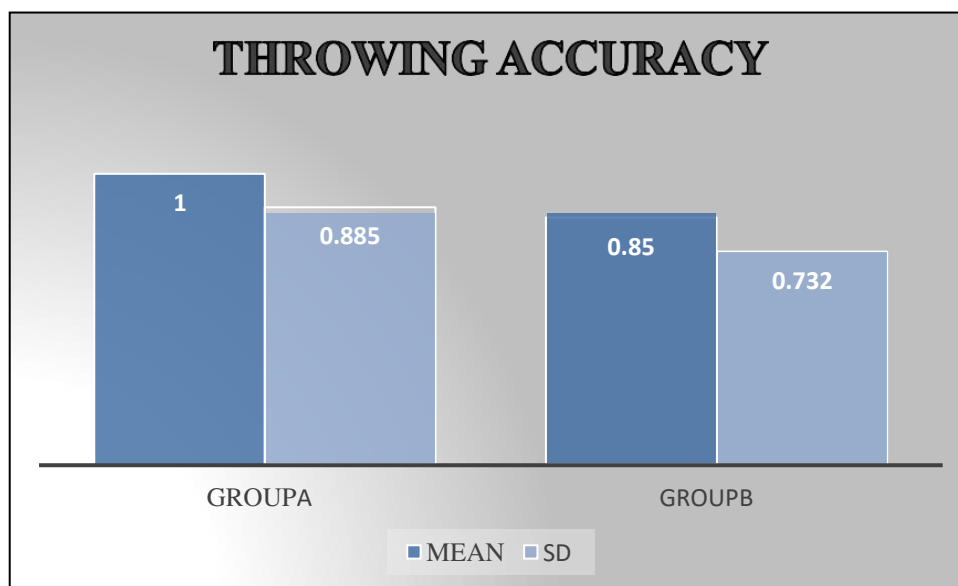
Closed kinetic chain upper extremity stability test
Bowling accuracy test

III. RESULT

Graph demonstrate the pre and post intervention MEAN difference of the Close Kinematic Chain Upper Extremity Stability Test for Groups A and B. The data was analysed using the Mann-Whitney test. Pre- and post-test MEAN \pm SD values for GROUP A were 4.04 ± 2.236 and 6.12 ± 2.551 for GROUP B, respectively. The p value considered was > 0.05 , indicating that there was a not statistically significant difference between GROUP A and GROUP B after the intervention, however, clinically GROUP B's results demonstrated a higher increase in close kinematic chain upper extremity stability test score than GROUP A's.



Graph demonstrate the pre and post intervention MEAN difference of the Throwing Accuracy Test for Groups A and B. The data was analysed using the Mann-Whitney test. Pre- and post-test MEAN \pm SD values for GROUP A were 1 ± 0.885 and 0.85 ± 0.732 for GROUP B, respectively. The p value considered was > 0.05 , indicating that there was a not statistically significant difference between GROUP A and GROUP B after the intervention, however, clinically GROUP A's results demonstrated a higher increase in Throwing Accuracy Test score than GROUP B's.



IV. DISCUSSION

One of the most widely practiced sports in the world is cricket. The crucial elements for a player are muscular strength, muscular endurance, power, speed, agility, flexibility, balance, and coordination. The fast bowlers has to face more repetitive stress on shoulder joint .

The purpose of the study was to compare between two interventions such as effect of proprioceptive and plyometric versus thrower's ten program on shoulder stability and throwing accuracy in fast bowlers. Data screened by assessing shoulder stability with closed kinetic chain upper extremity stability test and throwing accuracy with bowling accuracy test. Intervention was applied for 4 weeks . post intervention the result were obtained.

In the study , Group A received proprioceptive and plyometric and Group B received Thrower's ten program. Statistical analysis done post intervention , and it was shown that both the groups showed statistically significant improvement in the form of shoulder stability and throwing accuracy.

The data was analysed using the Mann-Whitney test. This indicating that there was a statistically significant difference between GROUP A and GROUP B after the intervention, however, GROUP B's results demonstrated a higher increase in closed kinetic chain upper extremity stability test than GROUP A's and GROUP A shows higher increase in bowling accuracy score than GROUP B.

Previous study has the same effect in their study and suggest that thrower's ten program was showing highly significant in improvement in speed and accuracy calculated from Tacho meter and coin test was respectively as compared to the control group in which there is no improvement seen in arm speed and accuracy , the study we concluded that Throwers ten program improves performance in fast bowlers.

Kevin e walk et al, studied on Youth Throwers Ten Exercise Program for enhanced dynamic shoulder control in the youth overhead throwing athlete where the high velocity and repetitive nature of this activity places immense pressure on the entire body, which can frequently result in injury to the throwing arm and it is well understood that a multiphasic approach is required to return an individual to prior level of play.

Ketki ponde ponkshe et al , had done study on cricket bowlers of thrower's ten exercise program on scapular dyskinesia and throwing accuracy which concluded 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 .



The exercise program described in this study can be put into normal clinical practice for any sports team, with the aim of improving glenohumeral stability in athletes. For sports with high involvement of the shoulder joint, these exercises can become a working tool to improve joint stability.

V. CONCLUSION

Above study concluded the proprioceptive along plyometric and thrower's ten program were showing improvement in both shoulder stability and bowling accuracy but thrower's ten program showing more significant improvement in shoulder stability as compare to bowling accuracy and proprioceptive and plyometric shows more significant improvement in bowling accuracy.

LIMITATIONS

The sample size of study was small.

Female population was not included.

The data was collected only from Parul university.

FURTHER RECOMMENDATION

The study can be further continued with another population.

Further studies can be performed on novice player and in larger population.

INFORMED CONSENT PROCESS

A written and informed consent about enrolment in the study and maintaining adequate privacy and confidentiality were taken from all the participants recruited for the study.

CONFIDENTIALITY ISSUES AND DATA SAFETY

Adequate privacy and confidentiality of participants were also maintained by the researcher.

SOURCE OF FUNDING

This study was not funded by any public, commercial, or not-for-profit agencies.

ETHICAL APPROVAL

Ethical clearance is obtained from ethical committee of institution and institution where the subjects belongs at Parul University of Physiotherapy, Waghodia, Vadodara.

CONFLICT OF INTEREST

None

CONSENT FOR PUBLICATION

Prior to the study, participants received information about it. After receiving consent, we maintained proper privacy and confidentiality for all of the study's patients.

AUTHORS CONTRIBUTION

SS: conceptualization, project administration, methodology, reviewing, writing, and editing; methodology, formal analysis, and reviewing; KB: writing, and editing; methodology, formal analysis, and reviewing; MS: writing, and editing; methodology, formal analysis, and reviewing; MD: writing, and editing; methodology, formal analysis, and reviewing; MV: writing, and editing; methodology, formal analysis, and reviewing; SK: reviewing and editing. The final draft of the manuscript has undergone critical review and approval by all authors, who take full responsibility for its content and similarity index.



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