Original Article

Effects of 8-Weeks Throwers Ten Program Vs Plyometric Training on Shoulder Performance in Overhead Athletes-A Pilot Study

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How to cite this article: Abubacker Siddiq Anas Rahman, Vinodh kumar Ramalingam, Muthukumaran Jothilingam, Kotteeswaran K, Swathi Sridhar. Effects of 8-Weeks Throwers Ten Program Vs Plyometric Training on Shoulder Performance in Overhead Athletes-A Pilot Study. Indian Journal of Physiotherapy and Occupational Therapy / Vol 19 No. 4, October - December 2025

Abstract

Background: Thrower'sten exercise program evidenced in previous research to improve strength, power, endurance and has proved to be effective in rehabilitating the muscles of the shoulder complex and preventing injuries in overhead athletes. The main purpose of this present pilot study is to find out whether Thrower's ten exercise program is beneficial in improving the shoulder performancecomparing with plyometric training.

Methods: A total of 40 male athletes were screened between the age groups of 18 and 25 and randomly allocated to Throwers ten group and plyometric training group respectively. Shoulder strength and performance of the athletes is measured using seated medicine ball throw test and closed kinetic chain upper extremity stability test. Participants in Throwers ten group were trained for throwers ten program for a period of 8 weeks, Plyometric group participant were trained for plyometric training for 8 weeks.

Result: Throwers ten program showed substantial difference in improving the shoulder performance when compared to plyometric training. Post test values of throwers ten program in seated medicine ball throw test and closed kinetic chain upper extremity stability test had a significant difference ($p < 0.001$).

Conclusion: Throwers ten program is found to be more effective than plyometric training in improving the shoulder performance among overhead athletes.

Keywords: Throwers ten program, plyometric training, shoulder performance, seated medicine ball throw test.

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Submission: Jan 23, 2025 **Revision:** February 25, 2025 **Published date: October 16,2025**

Introduction

The shoulder joint facilitates a wide range of movements for the upper limb encompassing actions of the elbow, wrist, and hands. Muscles surrounding the shoulder joint play a crucial role in stabilizing this complex structure. Sports players, in particular, heavily rely on their shoulder joints during matches. [1,2]

For overhead throwers, achieving precise movements relies heavily on a delicate balance between stability and mobility.This balance is necessary to fulfill the functional requirements of repetitive actions on the shoulder complex.[3,4]

The act of throwing overhead demands exceptional skill and precision. During pitching, athletes engage the shoulder complex extensively, subjecting it to considerable forces. Over time, athletes develop adaptive changes in response to the repetitive stresses of overhead throwing, which should also be addressed in treatment.[5,6]

The Thrower's ten program(T10 program) demonstrated effectiveness in enhancing shoulder performance by enhancing both the shoulder joint's mobility and stability. The program typically consist of a set of exercises specifically designed to target the muscles and movements involved in overhead throwing activities.[7,8] By incorporating exercises that focus on strength, flexibility, and dynamic stability, it helps in optimizing shoulder function, mitigate the risk of injury and boost performance in athletes engaged in throwing activities.[9]

The T10 program encompasses a comprehensive range of movements, addressing various aspects crucial for throwing athletes which was established in 1991 by Wilk et al.[6,8] This program focuses on motions specific to throwing, advanced neuromuscular control, dynamic stabilization, strength, endurance, and coordination.This program's targeted exercises focus on strengthening the muscles involved in shoulder retraction, improving proprioception to reduce joint position error, and enhancing overall throwing mechanics.[10]

Plyometrics is a term used in both rehabilitation and conditioning literature to describe activities that leverage the stretch-shortening cycle.[11] These activities strive to optimize force generation or improve performance by tapping into the elastic energy stored within muscles during the eccentric phase of movement and swiftly transitioning to a concentric contraction. This training method is particularly effective in improving explosive power, speed, and agility in athletes.[12]

Plyometric training has also made its way into the field of rehabilitation. Recently published rehabilitation protocols incorporate plyometric exercises as a method to enhance function and aid in the return to sport.[13,14] These protocols recognize the value of plyometric training in rebuilding strength, coordination, and overall athleticism following injury, helping individuals regain the ability to participate in sports activities safely and effectively.[15,16]

The Closed kinetic chain upper extremity stability test(CKCUEST) serves as valuable tool for evaluating shoulder strength and function. This test provides clinicians with valuable insights into an individual's shoulder stability and functional capabilities, aiding in the diagnosis and treatment planning for various shoulder-related conditions and injuries.[17,18]

The seated medicine ball throw test(SMBT) provides a more detailed approximation of movement, closely mimicking the pushing mechanism found in the specific sports identified within this study. Consequently, the involvement of the muscular kinetic chain closely mirrors the coordinated movement patterns observed in the SMBT. Additionally, utilizing the SMBT for validation allows for a more sport-specific assessment of explosive power capabilities.[19] Hence, this present pilot study is to find out the effect of Thrower's ten exercise Vs plyometric training in improving the shoulder performance in overhead athletes.

Method

Study design and participant selection:

The research was conducted in the Physical Education Department of a university in the southern part of India.. Athletes engaged in lifting the hand above the head activities such as Volleyball, Handball, and Basketball were selected for this particular study. Prior to participant recruitment, the study proposal was presented to the Institutional Scientific Research Board (ISRB) and received approval. Ethical clearance was granted for the treatment protocol of the study and the study was approved by the Institutional Scientific Review Board on human subjects (01/035/ 2023/ ISRB/ PGSR / SCPT). [Date:18/04/2023]]."

Inclusion and Exclusion Criteria

Participants were chosen according to the SMBT and CKCUEST.Inclusion criteria included age of 18-25 years and gender - male. Exclusion criteria included of athletes having recent shoulder injury, who underwent recent shoulder surgeries. A thorough analysis has been conducted using prevalence studies and the sample size has been calculated at the beginning of the study using sample size calculator and derived with 40 participants for the study. After providing a detailed explanation of the study to each individual, informed consent was obtained from all 40 participants. Utilizing a closed envelope method, the participants were then randomly allocated into two groups, each consisting of 20 members.

Procedure

Two groups, Group A and Group B, were randomly assigned to participants. At the beginning of the study subjects from both group underwent pre-test which included SMBT and CKCUEST. Group A underwent eight weeks of T10 program Each week, there were three sessions, each lasting forty five minutes. Group B underwent eight weeks ofplyometric training. Each week, there were three sessions, each lasting forty five minutes.After the treatment, participants underwent assessment using the SMBT and CKCUEST. Data on post-test values were collected. Both pre-treatment and post-treatment scores were recorded and subjected to statistical analysis. The findings of this study are specific to a male population aged 18 to 25, which may influence the outcomes. As a result, the generalizability of these results to other age groups and female populations remains uncertain.

Table 1. The T10 program for the T10 group.[10]

	THROWERS TEN GROUP
	T10 PROGRAM
Week 1-4 (Red theraband) Week 5-8 (Green theraband)	1. D2 flexion and extension 2. Internal and external rotation at 90 abduction 3. Supraspinatus and deltoid strengthening 4. Prone shoulder abduction – D2 flexion 5. Prone shoulder extension 6. Biceps and triceps strengthening 7. Rowing 8. Wrist flexion and extension, forearm supination
Week 5-8	Pushups and pullups

Table 2. Plyometric training for the Plyometric group.

	PLYOMETRIC GROUP
	PLYOMETRIC TRAINING
Week 1-4 [2-lbs ball(1 hand drill) and 6-lbs ball (2 – hand drills)] Week 5-8 [2.5-lbs ball(1 hand drill) and 10 -lbs ball (2 – hand drills)]	1. Elastic external rotation 2. Elastic 90/90 external rotation 3. Overhead soccer throw 4. 90/90 external rotation side throw 5. Deceleration baseball throw 6. Baseball throw

Table 3. Parameters for week 1-4 for T10 and plyometric group

PROTOCOLS	WEEK 1-4				
	Repetitions	Sets	Rest interval(sec)	Duration (min)	Frequency (per week)
T10 program	8	3	30	45	3
Plyometric training	10	3	30	45	3

Table 4. Parameters for week 5-8 for T10 and plyometric group

PROTOCOLS	WEEK 5-8				
	Repetitions	Sets	Rest interval(sec)	Duration (min)	Frequency (per week)
T10 program	10	3	30	45	3
Plyometric training	15	3	30	45	3

Outcome Measure

SMBT: The participants were directed to take a seat on the surface with their head, shoulders, and back supported by the wall. Ask the patient to keep their legs without bending the knee on the floor, and they held a two kilograms medicine ball with both upper limbs in a 90° position of abducting the shoulder and flexing the elbows. To ensure consistency, the medicine ball was coated in chalk using in gym, leaving a neat mark on the surface after the throw. A tape which is used to measure was extended across a span of 10 meters on the surface. Athletes were required to propel the medicine ball straight ahead in a linear trajectory, aiming to achieve maximum distance while maintaining full contact with their head, shoulders, and back supported by the wall. Following three trial runs, four trial runs were conducted, 1-minute rest period between the trial runs. To accommodate variations in leth of the arm, the medicine ball was released with arms stretched out in front. The throwing span was calculated by subtracting the distance between the wall and the nearest end of the chalk mark relative to the overall distance achieved.

CKCUEST: Participants are required to assume a push-up position, with 91.4 cm distance between their hands and marked two strips of tape on the surface. Both shoulders should be perpendicular to each other, and the back and lower body should maintain alignment, while the feet are kept within the shoulder-width. From this starting position, participants are instructed to reach across their body with their dominant hand to touch their less used hand, then return to the initial position. Subsequently, the repeat the movement with the less used hand reaching across to touch the dominant hand. The goal is to execute the maximum number of alternating touches possible. within a 15-second timeframe While maintaining the proper form for a push-up. One submaximal familiarization trial is conducted initially, followed by three maximal performance trials and each trial is followed by a 45-second rest period.. Timing is controlled by the first investigator using a stopwatch, while the another investigator keeps track the number of touches aloud. The assessment commences when the second investigator says “go” and concludes when the same investigator says “stop”. This protocol is designed to assess upper body strength, endurance, and coordination under specific conditions, ensuring consistency and accuracy in performance evaluation.

Results

Data was collected using SMBT and CKCUEST before intervention as pre-test values and after intervention as post-test values and was tabulated and statistically analyzed. Pre-test and post-test SMBT and CKCUEST values were examined using paired-t test for T10 group and Plyometric group.

Both group post-test SMBT and CKCUEST values was analyzed using unpaired-t test.

Pre-test and post-test SMBT and CKCUEST values analyzed using paired-t test for T10 group shows a significant increase in shoulder performance. Table 5 showed the T10 group assessed using SMBT and CKCUEST. There is a significant statistical difference [P< 0.001] in the midst of the changes observed after treatment within the group and that would have happened randomly. It was found that SMBT and CKCUEST scores were improved significantly following T10 program.

Table 5: Mean and standard deviation of Throwers ten group(group A).

S NO	OUTCOME	THROWERS TEN GROUP				P VALUE
		Pre test		Post test		
		Mean	SD	Mean	SD	
1	Seated medicine ball throw test	211.3	5.858	311.4	6.073	p < 0.001
2	Closed kinetic chain upper extremity stability test	16.4	2.741	27.5	1.468	

Table 6 showed the Plyometric group assessed using SMBT and CKCUEST. Changes observed after treatment within the group significantly differ [P< 0.001] from those that would occur randomly. It was found that SMBT and CKCUEST scores were improved significantly following Plyometric training.

Table 6. Mean and standard deviation of Plyometric group (group B).

S NO	OUTCOME	PLYOMETRIC GROUP				P VALUE
		Pre test		Post test		
		Mean	SD	Mean	SD	
1	Seated medicine ball throw test	210.55	5.924	270.7	5.894	p < 0.001
2	Closed kinetic chain upper extremity stability test	16.25	2.593	17.8	2.375	

Both group post-test SMBT and CKCUEST values analyzed using unpaired-t test shows a significant difference. Table 7 showed the T10 group and Plyometric group's post test values assessed using SMBT and CKCUEST. Statistically significant difference exists between the mean and standard deviation values of the two groups, a difference that would not be expected by chance (p < 0.001).

Table 7. Post test Mean and SD of Throwers ten group and plyometric group

S NO	OUTCOME	Throwers ten group		Plyometric group		P VALUE
		Post test		Post test		
		Mean	SD	Mean	SD	
1	Seated medicine ball throw test	311.4	6.073	270.7	5.894	p < 0.001
2	Closed kinetic chain upper extremity stability test	27.5	1.468	17.8	2.375	

The T10 group demonstrated a notable improvement in the shoulder performance after 8 weeks, with a p-value of < 0.001. While both groups showed enhancement, the T10 program exhibited a more significant effect than Plyometric training within the 8-week protocol, particularly in improving shoulder performance among overhead athletes, as assessed by the SMBT and CKCUEST.

Discussion

The objective of the present study was to examine the shoulder performances among overhead athletes. The purpose of the study was to assess the efficacy of T10 program for shoulder performance among overhead athletes. Our result suggested that T10 program have a significant impact in improving shoulder performance in overhead athletes. For overhead throwers, achieving precise movements relies heavily on a delicate balance between stability and mobility. The T10 program and plyometric exercises have demonstrated effectiveness in enhancing shoulder performance by improving both mobility and stability of the shoulder joint.[10] These programs typically consist of a set of exercises specifically designed to target the muscles and movements involved in overhead throwing activities.[4]

Gokalp, Ozge MS et al. (2020) conducted a study investigating the impact of T10 exercises on upper limb performance. Their research indicated that the T10 The exercises prove to be effective in enhancing the strength of the muscles around the shoulder girdle and rotator cuff.[10] In a separate study, Nilesh Maharudra Andhare et al. (2018) examined the effect of the T10 program on performance in fast bowlers through a randomized control trial revealed that it is beneficial for improving the performance of throwing distance in fast bowlers.[11]

Plyometric training has also made its way into the field of rehabilitation. Recently published rehabilitation protocols incorporate plyometric exercises as a method to enhance function and aid in the return to sport.[20] Jeffery F. Vossen et al. (2000) conducted a study comparing the effects of Dynamic Push Up Training (DPU) and Plyometric Push-Up Training (PPU) on upper-body power and strength. Their findings revealed that both DPU and PPU training programs led to significant improvements in ball put and chest press tests, with the PPU program showing greater enhancements.[21]

The CKCUEST serves as an assessment tool in orthopedic and sports medicine clinics for numerous years.[22,23] Germanna Medeiros Barbosa et al. (2024) conducted a study focusing on the measurement properties for physical performance tests focusing on the upper extremities in athletes. They concluded that CKCUEST demonstrates adequate reliability between sessions and within sessions supported by evidence of moderate to high quality.[24]

The Medicine Ball Throw (MBT) or SMBT is cost-effective, straightforward to administer, and requires minimal equipment, making it suitable for field testing.George Beckham et al;(2019) concluded a study and stated that SMBT proves to be a dependable method for evaluating upper body explosiveness among college-aged individuals who are recreationally active.[25]

The statistical analysis of the present study suggests that the T10 program significantly improved the shoulder performance in overhead athletes. The strength of the study was that T10 program and plyometric training are simple, easy to administer and cost effective.

Limitation and Suggestion

The limited sample size in the study raises concerns regarding the comprehensiveness to which its results can be applied to broader populations. As a result, future studies should endeavor to overcome these limitations by incorporating larger and more diverse sample populations thereby facilitating a more comprehensive understanding of the phenomenon across a broader spectrum of individuals.

Conclusion

Throwers ten program is found to be more effective than plyometric training in improving the shoulder performance among overhead athletes.

Source of Funding: No sources of funding was obtained for the study.

Conflict of Interest: The authors disclosed no conflict of interest.

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