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Effects of High-Volume Upper Extremity Plyometric Training in Shoulder Glenohumeral Internal Rotation Deficit (Gird) In Volleyball Players

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Abstract

Volleyball has become an extremity popular participation in sport worldwide. According to WHO, GIRD is glenohumeral range of motion decrease in internal rotation and increase in external rotation. In volleyball most of the injuries are related to repetitive jumping and hitting ball overhead.

Keywords

Volleyball,

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INTRODUCTION

Volleyball has become an extremity popular participation in sport worldwide. According to WHO, GIRD is glenohumeral range of motion decrease in internal rotation and increase in external rotation. In volleyball most of the injuries are related to repetitive jumping and hitting ball overhead [(1)].

Glenohumeral internal rotation deficit (GIRD) and posterior shoulder tightness (PST) are commonly reported in overhead sports such as baseball, volleyball& tennis. Volleyball players are prone for shoulder injuries as a result of the high forces placed on the shoulder during throwing motion repetitive throwing motion creates an increase external rotation and decrease internal glenohumeral joint [(2)]. Most common circumstances give rise to injuries were Spiking (33.70%), Blocking (24.15%), diving (17.41%) and setting (11.23%). The glenohumeral itself inherently unstable, losing stability at the expense of mobility. The sport of volleyball depended and physical qualities of power, speed, strength & muscular endurance, specifically in upper extremity [(4)].

Dynamic neuromuscular stabilization of the shoulder is imperative in the prevention of shoulder injuries in the overhead -throwing athletes. Dynamic shoulder stability is achieved primarily by the muscles of rotator cuff. Additionally, the rotator cuff acts concentrically &eccentrically to produce internal &external rotational torques during the overhead throwing motion.

Particularly, the study by Carter et al (2007) examined the effects of an 8 – week course of high volume upper extremity plyometric training which is commonly called as 'Ballistic six' this experiment was conducted on a functional eccentric external rotation to concentric internal rotation strength ratio and throwing velocity in a group of National Collegiate Athletic Association (NCAA) discussion[(28)].

Plyometric activity divided into three phases 1) The eccentric preload phase 2) The amortization phase 3) The concentric contraction. In contrast, another

study by Wilk, Hooks & Macrina (2013) found that the modified sleeper stretch & modified cross body stretch were very useful to shoulder internal rotation range of motion in the overhead throwing athlete [14]. Further, GIRD was defined as any loss of internal rotation range of motion in the throwing shoulder in comparison to the non-throwing shoulder. The maintaining optimal soft tissue flexibility of the posterior shoulder in throwing athlete is important in order to reduce risk of injuries [8].

Based on these studies, it is a reasonable to assume that GIRD & PST may contribute to shoulder pain due to subacromial or internal impingement. Overhead motion of the arm in sports make an athlete susceptible to various forms of injuries, including rotator cuff tears, and internal impingement [25].

In the course of volleyball competition using quality of spiking technique are often divided into three steps, i.e. run' up, stop' jump & stroke. Run up provides speed for stop jump, stop jump provide greater momentum arm swinging, and arm swinging provide power for stroke. Of the overhead volleyball skills, the spike is most explosive [28].

Spikes, or attacks, are typically high velocity shots (ball speed can approach 28 meter per second). The specific objective behind this commentary is mainly provide the treatment strategies& foundation sustaining optimal shoulder mobility in the overhead athlete.

Hence the present study is designed to determine the upper extremity of plyometric training increases the shoulder glenohumeral internal rotation deficit (GIRD) and the main aim of the study is to improve the range of motion, muscle strength and functional performance [33]

METHODOLOGY:

- Study. pre and post experimental study.
- Sampling Techniques: Randomized control trail.
- Study duration: 8 weeks.
- Study setting YMCA.

OUTCOME MEASURES:

- Universal Goniometer.
- Manual Muscle Testing.
- DASH Questionnaire.

INCLUSION CRITERIA:

- Collegiate volleyball player.
- Age group : 20 to 27.
- Male subjects were taken.
- Shoulder internal rotators (grade 3)
- Limited participation in training.
- Internal impingements

EXCLUSION CRITERIA:

- Undergone recent upper limb surgery
- Recent elbow injury.
- Un co-operative players.
- Cervical radiculopathy.
- Positive Hawkins-Kennedy or Neer test.

PROCEDURE

A study consists of 40 male volleyball players with glenohumeral internal rotation deficit, with the age group between 20-27 years were taken for the study & there be assigned into 2 groups. The subjects who fulfilled the inclusion criteria will be selected for the study and the written informed consent will be obtained from subjects. Subject's demographic data, onset duration assessment will be done. Subjects are given instruction for the exercises. All volleyball players among the group performed warmup 5 minutes before the main exercises. The total population group of (n=40) is divided into 2 groups in which two are experimental group, plyometric training (n=20) and stretching (n=20).The comparative study group A and group B, Rotator cuff strengthening exercise is given for both the groups. The subjects participating in this study will the informed about the study. GROUP A: Plyometric exercise and Rotator cuff strengthening exercise. GROUP B: Stretching (modified sleeper stretches, and modified cross-body stretch) and Rotator cuff strengthening exercise.

MATERIALS REQUIRED:

- GONIOMETER
- THERBAND
- MEDICINE BALL

GROUP A (Experimental group)

PLYOMETRIC EXERCISE:

The BALLISTIC SIX plyometric training.

EXERCISES:

a) Latex tubing external rotation.
b) Latex tubing 90/90 external rotation.
c) Overhead soccer throws using a 6-lb medicine ball.
d) 90/90 external rotation side throw using a 2-lb medicine ball.
e) Deceleration baseball throws using a 2-lb medicine ball.
f) Baseball throws using a 2-lb medicine ball.

Rotator cuff strengthening exercise.

PROCEDURE FOR EXERCISES:

a) Latex tubing external rotation:

Make the patient to stand erect & do internal rotation then adduct the shoulder done with flex the elbow to 90 degree initially then ask the patient to hold the latex tubing & the external rotation.

b) **Latex tubing 90/90 external rotation**:
Make the patient to stand erect with shoulder abduction 90degree & elbow flexion to 90degree & ask the patient to hold the latex tube and perform the external rotation.

c) **Overhead soccer throws using a 6-lb medicine ball:**
Make the patient to stand erect hold the medicine ball with the hands to overhead at the back and through the medicine ball backward (soccer throw).

d) **90/90 external rotation side throw using a 2-lb medicine ball:**
Make the patient to stand erect by hold the medicine ball with shoulder position in 90 degree of abduction and elbow in 90-degree flexion then the patient should perform external rotation of shoulder by throwing medicine ball sideways.

e) **Deceleration baseball throw using 2lb medicine ball:**
Make the patient to stand erect by holding the medicine ball in 90 degree then shoulder abduction & elbow in 90-degree flexion and then patient should perform throw the medicine ball backward with wrist extension and shoulder external rotation.

f) **Baseball throw using a 2lb medicine ball:**
Make the patient to stand erect by holding the medicine ball in 90 degree then shoulder abduction & elbow in 90-degree flexion and then patient should perform throw the medicine ball backward with wrist extension and shoulder external rotation.

Rotator cuff strengthening exercise:
Patient should hold the theraband and the wrist level then patient had to perform the shoulder flexion by maintain in abduction and perform movement in all direction.

Resisted shoulder external rotation:
Make the patient to stand erect and one end of theraband is fixed on door and other end hold by patient with shoulder in adduction and elbow in 90-degree flexion and perform the external rotation by keeping elbow in 90 degree flexion.

Resisted shoulder internal rotation:
Make the patient to stand erect and one end of theraband is fixed on door and other end hold by patient with shoulder in adduction and elbow in 90 degree flexion and perform the internal rotation by keeping elbow in 90 degree flexion.

side lying external rotation:
Make the patient inside lying and affected side shoulder goes for upside then the other hand shoulder should be adducted elbow flexed with dumbbell then the shoulder should be external rotator.

Scaption:
Make the patient stand with his feet and shoulder width apart with optimum posture and hold the dumbbell in each hand with your palm facing in neutral position.
Next bring both dumbbells up into a Y formation on a 45-degree angle. Be caution don't rise the dumbbell higher than yours since this would engage the upper trapezium.

Push up with a plus:
Make the patient in prone lying weight on knee instead of feet and perform has normal push up

REPITITION:
3 SETS/10-20 rep with 30 sec of rest between each set.

TOTAL DURATION:
Twice a week for 8 weeks.

GROUP B (Experimental group)

STRETCHING EXERCISE:
a) Modified sleeper stretches
b) Modified cross-body stretch
+
Rotator cuff strengthening exercise.

REPITITION:
8 to 10 times rep with 30 secand 10 sec rest between each stretch.

TOTAL DURATION:
Twice a week for 8 weeks.

Procedure for stretching:
The modified sleeper stretch is by rotating their upper trunk posteriorly 20-30degree inside lying, and rotating the dominant shoulder internally at 90degree shoulder flexion and 90degree elbow flexion using the non-dominant hand.
The cross-body stretch was performed by subjects actively in the seated position without a back rest for support.

Rotator cuff strengthening exercise:
patient should hold the TheraBand and the wrist level then patient had to perform the shoulder flexion by maintain in abduction and perform movement in all direction.

Resisted shoulder external rotation:
Make the patient to stand erect and one end of TheraBand is fixed on door and other end hold by patient with shoulder in adduction and elbow in 90-degree flexion and perform the external rotation by keeping elbow in 90-degree flexion.

Resisted shoulder internal rotation:
Make the patient to stand erect and one end of TheraBand is fixed on door and other end hold by patient with shoulder in adduction and elbow in 90-

degree flexion and perform the internal rotation by keeping elbow in 90-degree flexion.

side lying external rotation:

Make the patient in side lying and affected side shoulder goes for upside then the other hand shoulder should be adducted elbow flexed with dumbbell then the shoulder should be external rotator.

Scaption:

Make the patient stand with his feet and shoulder width apart with optimum posture and hold the dumbbell in each hand with your palm facing in neutral position.

Next bring both dumbbells up into a Y wide formation on a 45-degree angle. Be caution don't rise the dumbbell higher than yours since this would engage the upper trapezium.

Push up with a plus:

Make the patient in prone lying weight on knee instead of feet and perform has normal push up

REPITITION:

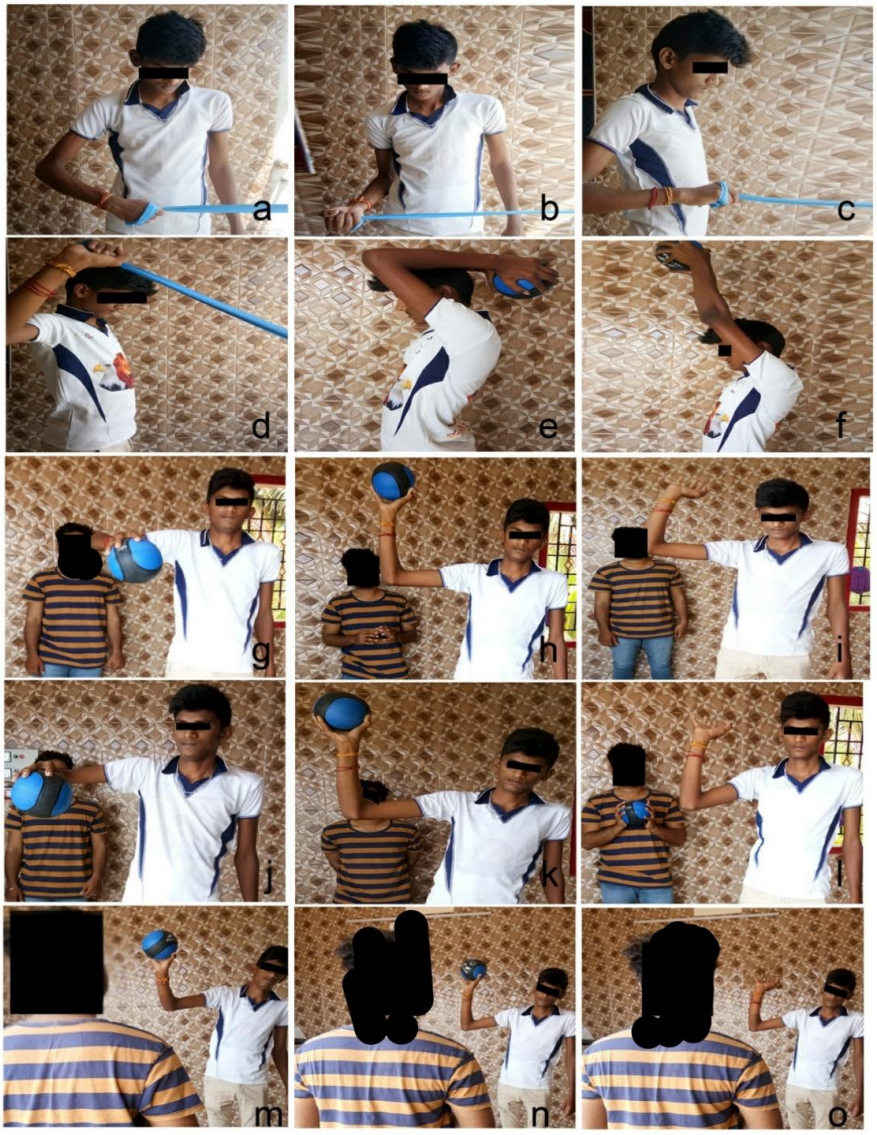
8 to 10 times rep with 30 secand 10 sec rest between each stretches.

TOTAL DURATION:

Twice a week for 8 weeks.

GROUP A PLYOMETRIC EXERCISE

BALLISTIC SIX
(PLYOMETRIC TRAINING)



The Ballistc six. (a-b) Latex tubing external rotation (c-d) latex tubing 90/90 external rotation (e-f) overhead soccer through using a 6-lb medicine ball (g-i) 90/90 external rotation side-throw using a 2-lb medicine ball (j-l) deceleration baseball throw using a 2-lb medicine balln(m-o) baseball throw using a 2-lb medicine ball.

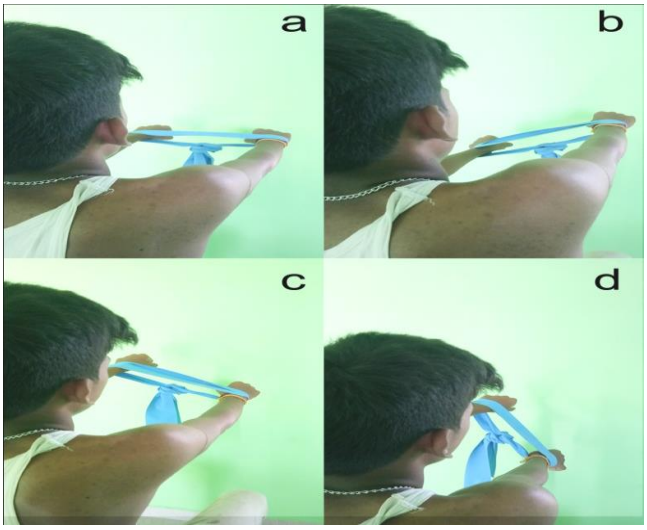
GROUP B STRETCHING

MODIFIED CROSS BODY STRETCH

MODIFIED SLEEPER STRETCH

COMMON EXERCISE FOR BOTH GROUP A & GROUP B

ROTATOR CUFF STRENGTHENING EXERCISE



ROTATOR CUFF STRAIN REHABILITATION EXERCISE

a) SCAPTION
b) SIDE LYING EXTERNAL ROTATION
c) RESISTED SHOULDER EXTERNAL &INTERNAL ROTATION
d) PUSH WITH A PLUS

DATA ANALYSIS AND INTERPRETATION

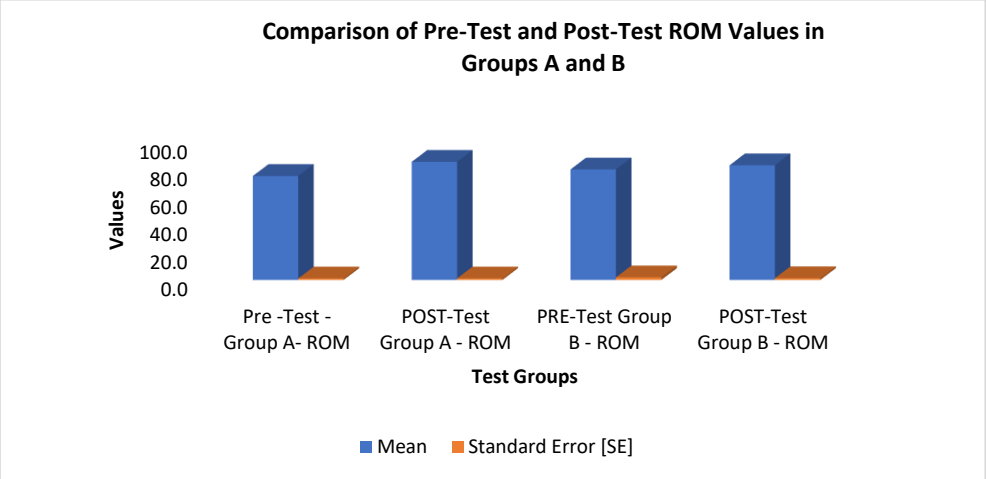
Statistical analyses were performed by using IBM SPSS for window version 20(IBM SPSS statistics for windows, version 20.0 IBM corp. Armonk, NY, USA). The means and standard deviation (SD) were used as continuous data.

Comparison of Pre-Test and Post-Test

ROM Values in Group A and B

EXERCISE GROUPS	MEAN VALUE		STANDARD DEVIATION		t-VALUE	p-VALUE
	PRE VALUE	POST VALUE	PRE VALUE	POST VALUE		
GROUP A (PLYOMETRIC EXERCISE)	75.50	85.75	1.14	1.10	11.105	p<0.01
GROUP B (STRETCHING EXERCISE)	80.25	83.25	1.87	1.27	3.943	p<0.01

TABLE 1: Shows the ROM, plyometric exercise mean value of 85.75, stretching (modified sleeper stretch & cross body stretch) mean value of 83.25.

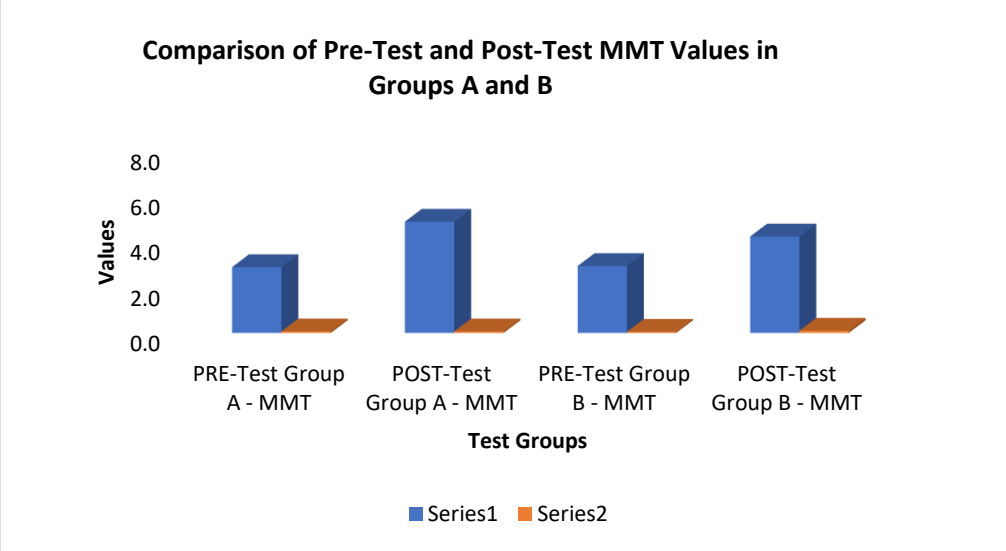


GRAPH 1: Shows that GROUP A & GROUP B mean value of ROM.

MMT Values in Groups A and B
MANUAL MUSCLE TEST I (table 2)

EXERCISE GROUPS	MEAN VALUE		STANDARD DEVIATION		t-VALUE	p-VALUE
	PRE-VALUE	POST VALUE	PRE-VALUE	POST VALUE		
GROUP A (PLYOMETRIC EXERCISE)	2.9	4.9	0.07	0.07	27.568	p<0.01
GROUP B (STRETCHING EXERCISE)	2.95	4.25	0.05	0.10	12.365	p<0.01

TABLE 2: Shows that manual muscle testing (MMT), plyometric exercises mean value of 4.9 & stretching (modified sleeper stretch, and cross body stretch) mean value of 4.25



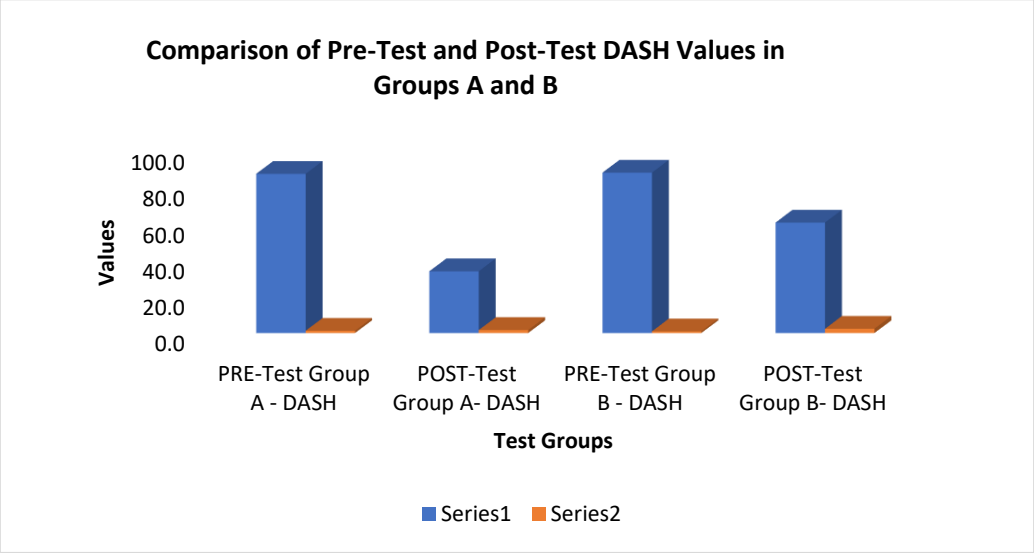
GRAPH 2: Shows that GROUP A& GROUP B mean value of manual muscle testing (MMT)

Comparison of Pre-Test and Post-Test

DASH Values in Groups A and B

EXERCISE GROUPS	MEAN VALUE		STANDARD DEVIATION		t-VALUE	p-VALUE
	PRE-VALUE	POST VALUE	PRE-VALUE	POST VALUE		
GROUP A (PLYOMETRIC EXERCISE)	88.05	34.15	1.25	1.65	-30.283	p<0.01
GROUP B (STRETCHING EXERCISE)	88.70	61.10	0.89	2.35	-9.760	p<0.01

TABLE 3: Shows the DASH questionnaire, plyometric exercise mean value of 34.15, stretching (modified sleeper stretch & cross body stretch) mean value of 61.10



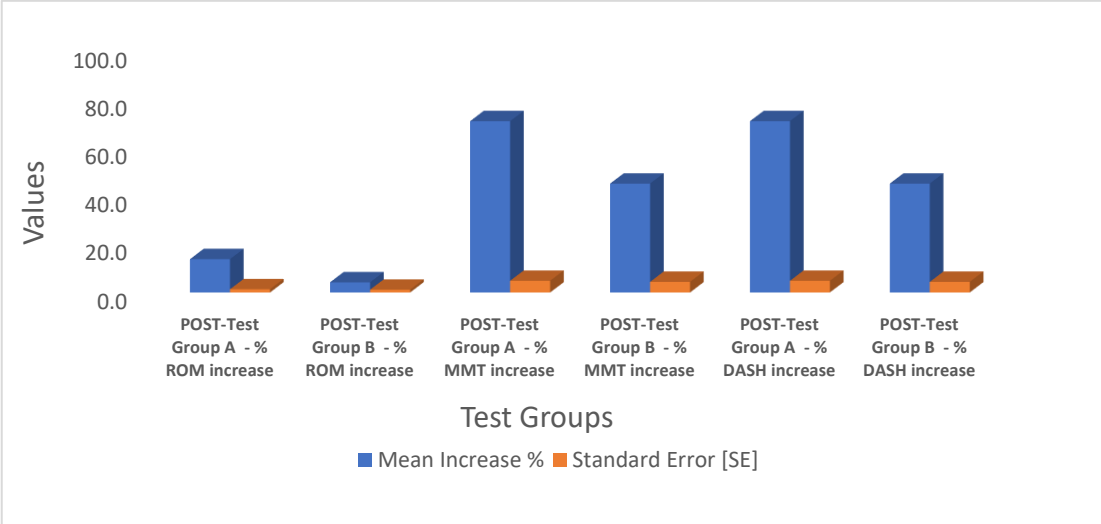
GRAPH 3: Shows the GROUP A and GROUP B mean value of DASH questionnaire

PERCENTAGE CHANGE IN GROUP A AND GROUP B COMPARISON

OUTCOME MEASURE	ROM	MMT	DASH
MEAN VALUE	9.599	25.833	30.184
P VALUE	<0.01	<0.01	<0.01
t-VALUE	5.530	3.969	8.769
SD ERROR	1.736	6.509	3.442

TABLE 4: Shows the percentage change in GROUP A & GROUP B comparison of (ROM, MMT&DASH)

COMPARISON OF PERCENTAGE INCREASE IN POST TEST VALUES IN GROUP A & GROUP B



GRAPH 4: Shows the percentage change in GROUP A & GROUP B comparison of (ROM, MMT&DASH)

DISCUSSION

The purpose of this study was to determine the high-volume upper extremity of plyometric training increases shoulder glenohumeral internal rotation deficit (GIRD) in volleyball players. Pre and post treatment values of the ROM, Manual muscle testing and DASH QUESTIONNAIRE were recorded.

In the present study subjects with Glenohumeral internal rotation deficit (GIRD), which shows that

GIRD occurs due to posterior capsular tightness and overhead throwing athlete.

A study done by ANDREW B. CARTER et.al (2007) state that, The Ballistic six training protocol can be a beneficial supplement to a baseball athletes by improving functional performance and strengthening the rotator cuff musculature.

Another study done by KOYA MINE et.al (2017) concluded that both the modified sleeper stretch, and the cross body stretch appear to be effective to treat GIRD and PST of asymptomatic subjects, when they are applied without provoking pain. The cross-body stretch might be more appropriate useful for patients with sub acromial pain compared to the modified sleeper stretch.

In this study 8 weeks program was conducted for plyometric and stretching. The mean difference was found to be both group A and B.

ROM (GROUP A-13.78 - GROUP B-4.18)
MMT (GROUP A-70.83 - GROUP B-45.00)
DASH (GROUP A-70.83 - GROUP B-45.00)

Although the study shows improvements in both group A and group B, but it shows more significant improvement in GROUP A (plyometric training) than GROUP B (Stretching) because plyometric refers to exercise that enables a muscle to reach maximum force in the shortest possible time. The muscle is loaded with an eccentric (lengthening) action, followed immediately by a concentric (shortening) action. In plyometric training there is repeated rapid stretching and contracting of muscles to increase muscle power and range of motion but in stretching it will lengthen the muscle group, improve flexibility and joint range of motion but not the muscle power. From this study, it is clear that plyometric exercises are effective and increases shoulder glenohumeral internal rotation deficit in volleyball players (GIRD). The final results of the experiment revealed a significant difference ($p<0.01$) between the 2 groups. Specifically, the results suggest that GROUP A subjects who receives high velocity plyometric training showed increased ability to throw, and exhibited high functional performance (Mean =13.782)

In contrast, subjects in GROUP B, who received modified sleeper stretch and cross body stretch showed decreased ability to throw with low functional performance (Mean =4.18). Thus, results suggest that high volume upper extremity plyometric training increases GIRD compared to the modified sleeper and cross body stretch for volleyball players. Overall, it can improve their throwing ability and functional performance

LIMITATION:

- Small sample size
- Only volleyball players were selected for the study
- Only 22-27 years age male were taken from the study
- Duration of the study is small

RECOMMENDATION:

- Further study can be conducted to large no of sample
- both the genders can be included male
- Duration of the study can increase for a better outcome

CONCLUSION

This study concluded that, although the study shows improvement in both group A and group B, but it shows more significant improvement in Group A (plyometric training) than Group B (modified sleeper stretch and modified cross body stretch).

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Appendix – I

CONSENT FORM

I..... hereby agree to provide my fullest consent and co – operation for the study titled "**IS HIGH VOLUME UPPPER EXTREMITY PLYOMETRIC TRAINING INCREASES SHOULDER GLENOHUMERAL INTERNAL ROTATION DEFICIT (GIRD) IN VOLLEY BALL PLAYERS."** By S.Shireen Afshan student on IVth Year School of Physiotherapy VISTAS Chennai

Date :
Place : Signature

APPENDIX – II

Assessment

SUBJECTIVE :

1. **Name :**
2. **Age/Sex:**
3. **Occupation :**
4. **Address:**
5. **Chief complaints** : _____
   _____
   _____
6. **History :** _____
   _____
   _____
7. **Past medical history:**
   OBJECTIVE:
8. **Pain assessment**:
   Side site
   Onset
   Duration
   Type of pain
   Aggrevating factors
   Relieving factors
9. **ON OBSERVATION:**
   Body build:
   Posture:
   Tropical changes:
   Topical changes:
10. **ON PALPATION:**
    Tenderness:
    Warmth:
    Swelling:

12. ON EXAMINATION:

ROM

Movement	Pre test	Post test

MUSCLE POSER:

Movement	Pre test	Post test

13. SPECIAL TEST:

Treatment

Home advices

Patient name	Pre-test score	Post test score

DISABILITIES OF THE ARM, SHOULDER AND HAND

		NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE	UNABLE
1.	Open a tight or new jar.	1	2	3	4	5
2.	Write.	1	2	3	4	5
4.	Prepare a meal.	1	2	3	4	5
5.	Push open a heavy door.	1	2	3	4	5
6.	Place an object on a shelf above your head.	1	2	3	4	5
7.	Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8.	Garden or do yard work.	1	2	3	4	5
9.	Make a bed.	1	2	3	4	5
10.	Carry a shopping bag or briefcase.	1	2	3	4	5
11.	Carry a heavy object (over 10 lbs).	1	2	3	4	5
12.	Change a lightbulb overhead.	1	2	3	4	5
13.	Wash or blow dry your hair.	1	2	3	4	5
14.	Wash your back.	1	2	3	4	5

15. Put on a pullover sweater.	**1**	**2**	**3**	**4**	**5**
16. Use a knife to cut food.	**1**	**2**	**3**	**4**	**5**
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	**1**	**2**	**3**	**4**	**5**
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).					
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	**1**	**2**	**3**	**4**	**5**
20. Manage transportation needs (getting from one place to another).	**1**	**2**	**3**	**4**	**5**
21. Sexual activities.	**1**	**2**	**3**	**4**	**5**

14. DASH QUESTIONER TEST:

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

DISABILITIES OF THE ARM, SHOULDER AND HAND

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? *(circle number)*	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? *(circle number)*	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. *(circle number)*	1	2	3	4	5

DASH DISABILITY/SYMPTOM SCORE = ____ ([(sum of n responses / n) - 1] x 25, where n is the number of completed responses.)

A DASH score may not be calculated if there are greater than 3 missing items.

GROUP A				
S.NO	**AGE / SEX**	**GONIOMETER (PLYOMETRIC EXERCISE) DASH QUESTION GROUP A – ROM**		
		PRE 1	POST 1	% Increase in ROM in POST TEST - A
1	25/M	70	80	14.29
2	22/M	75	80	6.67
3	20/M	70	75	7.14
4	21/M	75	80	6.67
5	21/M	80	85	6.25
6	21/M	85	90	5.88
7	22/M	70	80	14.29
8	23/M	75	90	20.00
9	26/M	80	90	12.50
10	25/M	85	90	5.88
11	24/M	70	85	21.43
12	20/M	70	85	21.43
13	22/M	70	85	21.43
14	21/M	75	90	20.00
15	21/M	75	90	20.00
16	26/M	80	90	12.50
17	21/M	80	90	12.50
18	20/M	80	90	12.50
19	21/M	70	80	14.29
20	20/M	75	90	20.00

GROUP A				
S.NO	**AGE / SEX**	**GONIOMETER (PLYOMETRIC EXERCISE) DASH QUESTION GROUP A – MMT**		
		PRE 2	POST 2	% Increase in MMT in POST TEST - A
1	25/M	3	4	33.33
2	22/M	3	5	66.67
3	20/M	3	5	66.67
4	21/M	3	5	66.67
5	21/M	3	5	66.67
6	21/M	3	5	66.67
7	22/M	3	5	66.67
8	23/M	3	5	66.67
9	26/M	3	5	66.67
10	25/M	2	4	100.00
11	24/M	3	5	66.67
12	20/M	3	5	66.67
13	22/M	3	5	66.67
14	21/M	3	5	66.67
15	21/M	3	5	66.67
16	26/M	3	5	66.67
17	21/M	3	5	66.67
18	20/M	2	5	150.00
19	21/M	3	5	66.67
20	20/M	3	5	66.67

GROUP A				
S.NO	AGE / SEX	GONIOMETER (PLYOMETRIC EXERCISE) DASH QUESTION		
		GROUP A - DASH		
		PRE 3	POST 3	% decrease in DASH in POST TEST - A
1	25/M	98	45	54.08
2	22/M	85	24	71.76
3	20/M	89	32	64.04
4	21/M	82	29	64.63
5	21/M	81	33	59.26
6	21/M	91	41	54.95
7	22/M	93	48	48.39
8	23/M	82	31	62.20
9	26/M	87	29	66.67
10	25/M	86	23	73.26
11	24/M	91	27	70.33
12	20/M	95	32	66.32
13	22/M	97	44	54.64
14	21/M	87	29	66.67
15	21/M	86	41	52.33
16	26/M	97	27	72.16
17	21/M	85	38	55.29
18	20/M	81	41	49.38
19	21/M	82	39	52.44
20	20/M	86	30	65.12

GROUP B				
S.NO	AGE / SEX	GONIOMETER (STICHING) DASH QUESTION		
		GROUP B - ROM		
		PRE 4	POST 4	% Increase in ROM in POST TEST - B
1	22/M	80	85	6.25
2	23/M	75	80	6.67
3	24/M	65	70	7.69
4	25/M	60	70	16.67
5	25/M	75	80	6.67
6	21/M	80	85	6.25
7	22/M	85	85	0.00
8	23/M	90	90	0.00
9	23/M	90	90	0.00
10	21/M	90	90	0.00
11	24/M	75	80	6.67
12	22/M	85	85	0.00
13	23/M	80	85	6.25
14	21/M	85	85	0.00
15	20/M	85	85	0.00
16	20/M	80	85	6.25
17	22/M	90	90	0.00
18	23/M	85	85	0.00
19	21/M	80	80	0.00
20	21/M	70	80	14.29

GROUP B				
S.NO	AGE / SEX	GONIOMETER (STICHING) DASH QUESTION		
		GROUP B - MMT		
		PRE 5	POST 5	% Increase in MMT in POST TEST - B
1	22/M	2	4	100.00
2	23/M	3	4	33.33
3	24/M	3	4	33.33
4	25/M	3	4	33.33
5	25/M	3	5	66.67
6	21/M	3	4	33.33
7	22/M	3	4	33.33
8	23/M	3	4	33.33
9	23/M	3	5	66.67
10	21/M	3	4	33.33
11	24/M	3	4	33.33
12	22/M	3	5	66.67
13	23/M	3	5	66.67
14	21/M	3	4	33.33
15	20/M	3	4	33.33
16	20/M	3	4	33.33
17	22/M	3	5	66.67
18	23/M	3	4	33.33
19	21/M	3	4	33.33
20	21/M	3	4	33.33

GROUP B				
S.NO	AGE / SEX	GONIOMETER (STICHING) DASH QUESTION		
		GROUP B - DASH		
		PRE 6	POST 6	% decrease in DASH in POST TEST - B
1	22/M	91	54	40.66
2	23/M	94	55	41.49
3	24/M	85	83	2.35
4	25/M	91	72	20.88
5	25/M	83	59	28.92
6	21/M	87	63	27.59
7	22/M	91	54	40.66
8	23/M	81	67	17.28
9	23/M	83	59	28.92
10	21/M	93	66	29.03
11	24/M	89	51	42.70
12	22/M	91	51	43.96
13	23/M	88	63	28.41
14	21/M	94	59	37.23
15	20/M	88	61	30.68
16	20/M	93	53	43.01
17	22/M	91	69	24.18
18	23/M	91	51	43.96
19	21/M	87	46	47.13
20	21/M	83	82	1.20