Original Research Article

Diagnosis, Treatment & Rehabilitation of Rotator Cuff Acute & Chronic injury in Throwing Sports athletes (Cricket & Baseball) by Isometric, Isotonic and Theraband Exercises

Abstract

The present research aimed at the diagnosis, treatment and rehabilitation of rotator cuff injury (RC) in national and university level athletes of cricket and baseball who belonged to the five different cities of Punjab (Lahore, Multan, Gujranwala, Faisalabad & Sialkot) having confirmed Acute and Chronic injury. The data was collected from 5 major cities of Punjab and a total of (N=125) athletes were taken as a sample size and a diagnosis based on physical assessment tests used to identify the level of the injury which belonged to five major cities of Punjab. Another group of Control injured with N=25 selected for further comparison. Pre and post-test data were taken to compare the values before and after the execution of rehabilitation plan. A survey questionnaire was also used to gather the feedback of the athletes to give them a rehab plan and utilized Rest, Ice, Compression & Elevation (R.I.C.E) principle (if required). A comprehensive conditioning rehabilitation plan implemented for 8 weeks as per the severity of the rotator cuff injury. The rehab plan integrated several isometric, isotonic & theraband exercises. The reliability calculated through Cronbach Alpha and its value was 0.82. The statistical analysis completed with the help of SPSS-26, paired sample t-test utilized and results showed statistically significant values. The conditioning rehab plan was effective and satisfactory and all the athletes returned to their sport after the completion of the rehabilitation and recovery program.

Key words: Rotator cuff, rehabilitation, treatment and trauma, Isometric and theraband.

Introduction

The importance of the organized sports has been grown up in popularity for the last few decades, resulting in an increase in the number of overuse injuries among children and adolescents. The injuries have an important impact on playing career and limited to the athlete's ability to participants in pressure sport. The rotator cuff is one of the commonest injuries among injuries of sports which generated pain and dysfunction in throwing athletes to different levels of competitions of all sports. It is also a primary dynamic stabilizer of the

glenohumeral joint which is placed under significant stress during contact sports. The rotator cuff injury has been diagnostically confirmed and physical activity becomes altered (activities of daily living or work/athletic tasks), therapeutic exercise which might be beneficial for attempting to restore the lost function as long as all contributing factors have been considered (Millett *et al.* 2006).

Shoulder difficulties are known to be affect 26% of wheelchair athletes, 36% of high-level water polo players, 50% of elderly tennis players, 60% of swimmers, and perhaps much more among high-level baseball pitchers. Following a direct impact injury to the shoulder, rotator cuff-related to shoulder discomfort and dysfunction which have also been described (Blevins, 1997). Throwing sports, notably baseball, have increased the occurrence of such injuries in skeletally immature players, with long-term impairments and deformities are possible. The causes of rotator cuff tears in young athletes have been linked to overuse and repetition of overhead movements. Abduction coupled with external rotation is thought to press on the rotator cuff, notably the supraspinatus, causing articular-sided fraying and eventually rotator cuff tears. Even asymptomatic throwing athletes have been reported to experience impingement (Weiss *et al.*, 2013). A prospective epidemiologic study among college-level baseball players, which sought to establish an injury pattern in collegiate-level baseball players, reported that the overall incidence of any related complaints or injuries was 19%. Fifty-eight percent of the injuries occurred in the upper extremity, with shoulder injuries among the most prevalent. Because of the mechanics of pitching, there was a higher incidence of shoulder injuries among pitchers which was resulted in 69% of the total injuries. There is no such evidence of rotator cuff injuries in overhead injuries but cadaveric, radiographic and arthroscopic research had clear proof of that. Shaffer and Huttman (2014) observed in twenty rotator cuff injured have a problem in throwing shoulder as compared with non throwing one which is forty percent of their subjects (Connor *et al.*, 2019). Shaffer and Huttman (2014) cited in his research while they worked on a group of young athletes that

articular tears found to be (91%) of partial tears, especially the rupture muscles, the true incidence of that among the shoulders injured was probably overlooked. Rehabilitation is one of the major factor to come back to replay condition. A rehabilitation plan of sports injuries required extra care, healing process, restore range-of-motion, strength, kinetic chain restoration highly structured exercise and sports specifically approach which prepared both athlete and the injured tissue as per requirement of psychological and physical demands at highest level of competition (Kibler et al., 2006; Gill *et al.*, 2021).

Significance of Study:

The study focuses on the proper diagnosis, treatment and rehab of rotator cuff injury with efficient rehabilitation exercises plan (Cricket & Baseball) through proper technique and treatment by using isometric, isotonic and theraband exercises to help the athletes to recover rapidly, effectively and economically from the rotator cuff injury.

Objectives of the Study

- Importance of rehabilitation for athletes suffering from rotator cuff injury.
- To regain strength & also strengthen the weak muscles through rehabilitation exercises.
- To return to play after complete recovery through isometric, isotonic and theraband exercises.

Research Question

- Does rehabilitation had an important technique in the recovery of the throwing muscle injury?
- The implemented isometric, isotonic and theraband exercises rehab plan is helpful & effective for the athlete.

Research Hypothesis

- Rehabilitation plays a vital role in the recovery of athletes suffering from a rotator cuff injury (RC).

The following Figure 1 shows the anatomy of the rotator cuff muscles

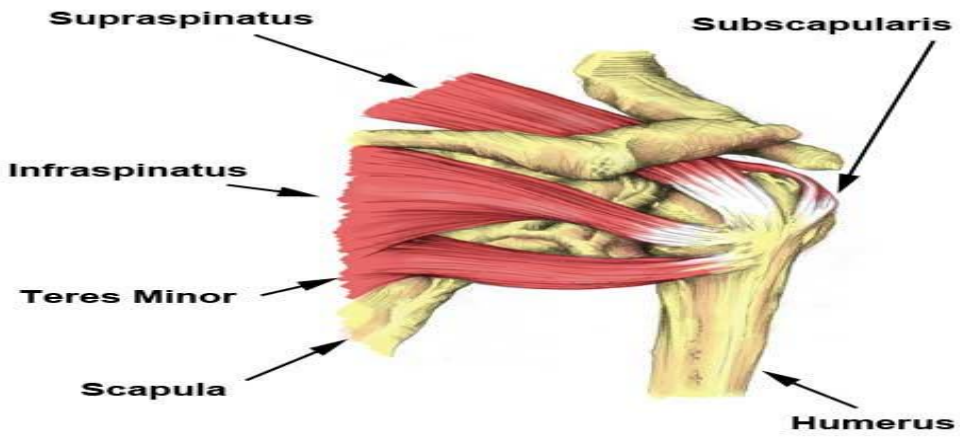

Figure:1 (Anatomy of the rotator cuff muscles)
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Assessment of Rotator Cuff Injury

In examining the athlete with shoulder complaints, comprehensive medical history and nature of the symptoms is required. In addition to specific inquiries concerning shoulder symptomatology, it's crucial to ask the athlete about cervical spine symptoms and injuries that could lead to referred shoulder discomfort, particularly in older athletes. In overhead athletes, rotator cuff disease commonly presents as pain during the throwing motion. Internal impingement and anterior instability have been linked to pain during the early stages of acceleration. The location of discomfort may be useful in determining the injury's location. Anterior pain from a subscapularis injury, anterolateral superior discomfort from supraspinatus pathology and posterior pain from an infraspinatus injury are all possibilities. Internal impingement may be the cause of posterior-superior pain during overhead activities. Athletes with modest anterior instability and subsequent cuff disease may experience signs of instability like the arm becoming dead or a sensation of subluxation. They will usually complain of a general loss of pitching or throwing speed, power, or endurance. Athletes who have a total rotator cuff injury frequently experience pain during rest and at night. With increasing overhead activity, those with rotator cuff tendonitis experience pain. Early internal impingement throwers frequently complain of stiffness and a prolonged warm-up time (Blevins, 1997). Furthermore, says when the rotator cuff is injured as a result of a direct hit to the shoulder, the chronic injury with not properly treated or installed rehabilitation, the symptoms are usually severe pain and weakness. Because the supraspinatus is the most usually implicated muscle, discomfort and weakness are most noticeable when performing overhead movements (Blevins, 1997; Shaffer and Huttman, 2014). Athletes nearly usually remember a specific event that triggered their symptoms as they complain of discomfort and dysfunction that limits their ability to return to sport with on rare occasions, daily activities.

Prior to their contact injury, athletes under the age of 40 years often have no history of shoulder difficulties; however those over 40 years may have had some chronic symptoms due to impingement and cuff tendonitis. Although the rotator cuffs disease after an acute glenohumeral anterior dislocation is uncommon in young athletes. The chance of a cuff tear after a dislocation rises with age, becoming particularly high in people over the age of 40 (Blevins, 1997).

Treatment

The athlete's initially causes, level of disability, relevant action to injury, duration of the recovery timing, R.I.C.E principle, hydrotherapy, exercises for rehabilitation and associated diagnoses all have a role in treatment along with categorization of incomplete Cuff injuries is also important for treatment. Additionally, the medicines prescribed by the doctors have a great importance in recovery and regaining strength. Any management strategy must take into account the results of past investigations, treatments, and the retort to old history output (Shaffer and Huttman, 2014; Gill *et al.,* 2019; Gill *et al.,* 2021).

Non Operative

According to Shaffer and Huttman (2014) mostly the management of rotator cuff injury is non operative. This is because the high incidence of rotator cuffs injury in sports especially in throwing events. The previous used management techniques are not guarantee for successful execution recovery and replay as well. The primary defended against cuff throwing athletes to stop playing and get rest as soon as possible, try non-steroidal anti-inflammatory medicines (NSAM) and go through a physical therapy programmed. Stretching with the arm mobilization is used to treat posterior capsular contractures (Sciascia & Karolich, 2013; Tallat, S., Arshad, S. A. G, 2018). To create strength in shoulder joint, core muscles (abdomen), and thoracic muscles are used to reinstate normal scapulothoracic and trunk rotation mechanics as reduce pain, regain rotator cuff strength and recital functional improve. A gradual short distance throw or movement activity planned with a game specific and postural specific spotlight aids in the restoration of good mechanics, food supplementation along with use of subacromial corticosteroid injections occasionally (Gill et al., 2022). The length of non-operative treatment also depends on the causes, the depth of the disease, and the athlete's circumstances. While three months is an acceptable time frame for a complete programmed, some rehab plans take long time to recover, particularly for athletes who have a full rupture. A comprehensive literature, non-treatment therapy of partial tears regarded as reasonably beneficial for a large number of over head throwers (Shaffer and Huttman, 2014).

Methodology

125 male athletes belonged to five major cities of Punjab (Lahore, Multan, Gujranwala, Faisalabad & Sialkot) were part of this study. The study was cross sectional studies in which qualitative and quantitative approach along with purposive sampling with deductive approach utilized and a total of 25 subjects each from all cities. The athletes belonged to cricket and baseball sports only as most cases are seen in these activities. The age range was identified from 18-40 years respectively. Another group of Control injured RC with N=25 selected for further comparison. All the players were either novice with acute or chronic symptoms RC injury, as they not properly treated results in chronic. Principal of specificity, overloading, rest & restoration and progression implemented right through the research. The activity of all research is shown in flow chart as Fig.2.

Flow Chart

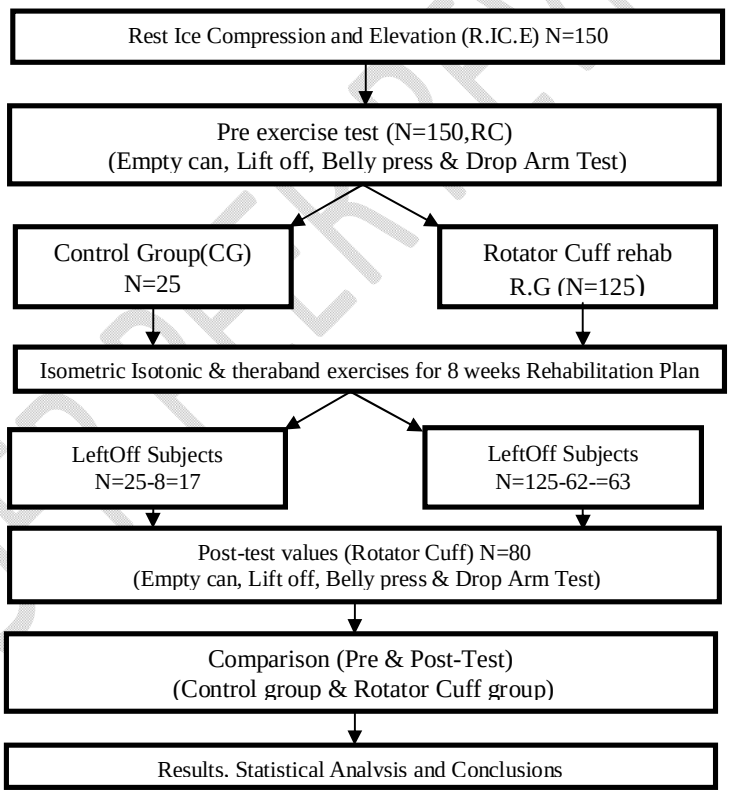


Fig. 2 Shows the Flow Chart of RC

Subjects Selection

Diagnosis of the Injury

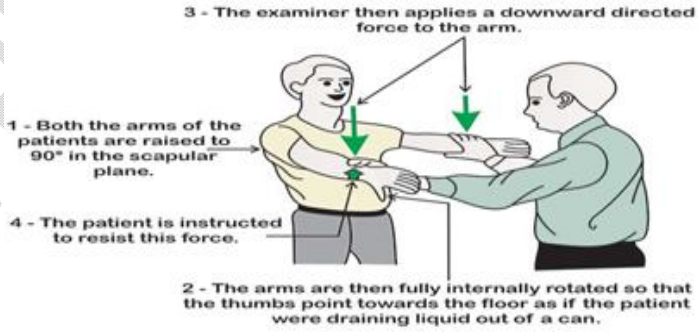
The diagnosis was done by conducting a physical assessment on the shoulder of the athletes. A number of tests were performed to detect the severity of pain and immobilization

of the rotator cuff muscles at pre test procedure. The tests used by the researcher have high validity and reliability and it have been used in numerous researches done in the past. Some of the tests used by the different researcher are:

Jobe Test (Empty Can Test)

The supraspinatus test has also a second name as "**Jobe test"**. The test should be executed in the plane of scapula which is 30°. The arm is placed at 90° (abduction) and 30° (Horizontal, abduction) in the plane of scapula as the thumb position in downward direction to execute medial rotation of the shoulder. The Asser pushes the arm in downward direction to put pressure as a result the athlete while asking to resist the pressure. If it resulted in pain and no strength in muscles so it's an indication of a optimistic test. N=15 athletes tested positive by doing the empty can test. There was minor to major pain and this varied from athlete to athlete (Longo et al., 2011).

- Both arms of athlete are raised to 90° in the plane of scapula
- both the arms are positioned in such a way so that thumb should be pointed towards floor as if the athlete were draining liquid out of a can.
- The examiner than applies a downward direction power to the arm
- The athlete asked to oppose the power.



Drop-Arm Test (Supraspinatus)

The famous researcher Codman described this test. The athlete is asked to raise the arm with maximum elevation and gradually come down in movement in same arch direction. The condition should be considered as positive as if the athlete dropped the arm quickly and having pain, a total of N=18 athletes showed signs of pain and discomfort. Athlete unable to lower arm further with control (Longo et al., 2011).

Drop- Arm Test (Rotator Cuff Test)

Abduction arm gradually lower

May be able to lower arm slowly to 90°(deltoid function)

Arm will then drop to side if rotator cuffs tests

Positive Test

Patient unable to lower arm further with control

If able to hold at 90° pressure on waist on waist will cause arm to fall

Lift-off Test (Subscapularis)

Gerber and Krushell1 in 1991 introduced this test and executed in that way to place the effected arm on the back (right behind the mid lumber region) and said the athlete to internally rotate the arm in raised (lift) position in posterior back off of the back or if the athlete performs the lifting position by extending the elbow or the shoulder. The position was executed on athletes & N=16 showed signs of soreness and affected ROM (range of motion) of the shoulder (Longo et al., 2011).

Belly Press Test

In 1996 a researcher Gerber executed the arm test at the side and the elbow flexed to straight 90°, by having the athlete to press the palm towards his belly by internally rotating the shoulder. The test is optimistic as:

(1) The athlete feels a pain or weakness as compared with other shoulder

(2) The athlete pushes the hand in the opposite direction of the abdomen in the direction of shoulder extension, showed that unable to apply power reverse to the abdomen by dynamic internal rotation formed by the subscapularis. The test was conducted on the athletes and N=14 had problems when doing internal rotation with pain and inability to rotate the arm properly indicating weakness in the rotator cuff muscle (Longo et al., 2011).

Belly Press Test

For: Subcsapularis Integrity

- Posture: Patient seated with arm 45° & full internal rotation

- Test: Resist further internal rotation
- Positive Weakness present

Treatment of Rotator Cuff (RC) injuries

The injured athletes who suffered from different complications of the rotator cuff muscle have been given a proper care along with special protocol of rehabilitation plan executed and it was observed preciously that safety and prevention from further deterioration of the affected area. The athletes who has been suffered the immobilization issues were given proper rehabilitation plan of isometric and isotonic strength exercise, range of motion exercises (flexibility exercises), mobilizing exercises along with theraband exercises. The athletes who had a pain or discomfort in the shoulder treated with the Rest, Icing, compression and Elevation (R.I.C.E) principle as per required by researcher, trainer, coaches and doctors (Collin *et al.*, 2015; Edwards *et al.*, 2016;Rosa & Robert 2022; Reinholz *et al.*, 2023).

Table1: Physical Assessment Tests for RTCuff Injury (Checklist)

Test	+ve	-ve	Remarks
Subscapularis			
1. **Lift-off test**	**16**	**7**	**Pain with affected ROM(range of motion) of the shoulder**
2. **Passive lift-off test**	**-----**	**5**	**----------**
3. **Belly-press test**	**14**	**4**	**Unable to rotate the arm internally.**
4. **Belly-off sign**	**-----**	**3**	**----------**
5. **Bear Hug**	**-----**	**6**	**----------**
Infraspinatus and Teres Minor			**----------**
6. **External rotation lag sign at 0°**	**-----**	**3**	**----------**
7. **External rotation lag sign at 90°**	**-----**	**4**	**----------**
Supraspinatus			
8. **Jobe's test** (empty can test)	**15**	**5**	**Minor to major pain detected in the shoulder**
9. **Drop arm test**	**18**	**6**	**Extreme pain and discomfort**
Other			
10. **Neer's sign**	-----	----	----------
11. **Hawkin's sign**	-----	----	----------
12. **Speed's test**	-----	----	----------

Rehabilitation Training Plan

Rehabilitation is one of the major factor to come back to replay condition. A rehabilitation plan of sports injuries required extra care, highly structured exercise and sports specifically approach which prepared both athlete and the injured tissue as per requirement of

psychological and physical demands at highest level of competition (Gill et al., 2019: Gill et al., 2021; Gill et al., 2022; Zhang et al., 2022). The target rehabilitation plan was executed as mentioned in the table 2 below:-

Table 2: Showed 8 weeks rehabilitation training plan for rotator cuff injury

Week	1	2	3	4 Unload week	5	6	7	8 Unload week
No of Days	1-3 Days	2-3 Days	3-4 Days	2-3 Days	3-5 Days	4-5 Days	4-6 Days	5-6 Days

Target Muscles: The muscle groups targeted which supported the shoulder joints in this conditioning program include:

(a) Teres (minor & major) (b) Supraspinatus (c) Infraspinatus (d) Subscapularis

Table 3: Rehab Exercises (Isometric, Isotonic & theraband)

Isometric hold on wall	Passive Internal & external Rotation (front movement) with & without theraband
Cross arm stretch hold with/without movement	Passive internal & external Rotation (back movement) with & without theraband
Pendulum Exercises with/without movement	Standing rows with and without theraband Abduction and medial rotation exercises with or without theraband
Sleeper stretch	External rotation 90° with and without theraband
Side lift at shoulder height & return	External rotation Arm abduction with and without theraband
Isometric hold at 90°	Side lift hand through theraband up and down
Standing isometric square with hands	Side lift arm diagonally up and down

Note: After completion of every exercise there should be 30 sec rest.

Length of the Treatment Program

This rotator cuff conditioning program was continued for 8 weeks under the proper supervision of the qualified rehab specialist and support staff as available in five major cities of Punjab (Lahore, Multan, Faisalabad Gujranwala and Sialkot). After the recovery phase, these protocols utilized as a maintenance plan for further recurrence and increase life span of rotator cuff muscles. 3 to 5 days a week exercise conditioning program was done regularly by the athletes using different methods of shoulder stretching, exercises that would strengthen the shoulder and the use of rubber bands for mobilization of the muscles (Ellenbecker and Cools 2010; Gill *et al.*, 2021). The non-surgical rehabilitation treatment is showed in table 3:-

1. Pendulum

Prime movers Movements (muscles): Deltoids, supraspinatus, infraspinatus, subscapularis

Sets/Reps: 2 X 8 Reps

Weekly workout: 4 to 5 days

Step-by-step directions

- Put yourself as a lean forward and place your hand on a support and your other arm hand freely at your plane.
- Slowly sway your limb to and fore position. Do it again exercise movement as your arm movement side –to-side and redo it in a round movement.
- Do it again this all exercise plan cycle with other arm as well.

Tip: Don't bend your back (round position) & your knees should be flexed.

Note: 30 sec rest in every exercises before performing

2. Crossover Arm Stretch

Prime movers Movements (muscles): Posterior deltoid

You should feel this stretch at the back of your shoulder

Sets/Reps: 4 reps (each side)

Weekly workout : 5 to 6 days

Step-by-step directions

- Put your shoulder in relax position & pull your arm in crossway direction, pull your elbow with straight arm as far as you can while holding your arm.
- The exercise should be done as hold for 30 sec
- Do it again and redo with the other arm as well.

Tip: Don't pull or put pressure your elbow.

Note: 30 sec rest in every exercises before performing

3. Passive Internal Rotation

Prime movers Movements (muscles): Subscapularis

There should be a feel of anterior shoulder muscle stretch

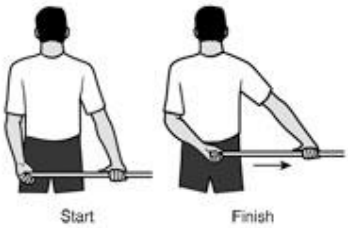
Tools : Stick of length 2 feet

Sets/Reps: 4 reps (each side)

Weekly workout : 5 to 6 days

Step-by-step directions

- Put your hand on a stick on the back with your one hand and slowly grasp the next end to the other hand.
- Place the stick in horizontal direction in such a way as your shoulder is feeling stretch at the point of stretch there should be no pain
- The position should hold for 30 sec.
- Do it again and do it on other side as well



Tip: Don't bend yourself or in a twist side position.

Note: 30 sec rest in every exercises before performing

4. Passive External Rotation

Prime movers Movements: Infraspinatus, teres minor
There should be a feel of posterior shoulder muscle stretch

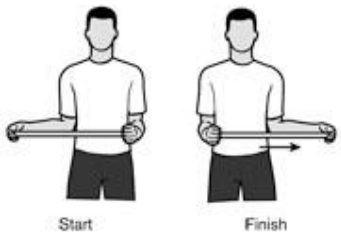
Tools : Stick of length 2 feet

Sets/Reps: 4 reps (each side)

Weekly workout : 5 to 6 days

Step-by-step directions

- Hold the stick in you one hand and grab the other end of the stick with another hand
- Put your elbow on the side of your body and push the stick horizontally as shown in the figure feel the pull without pain.
- The position should hold for 30 sec.
- Do it again and do it on other side as well



Tip: Your hip should be in forward direction with no twist position

Note: 30 sec rest in every exercises before performing

5. Sleeper Stretch

Prime movers Movements (muscles): Infraspinatus, teres minor
There should be a feel of stretch in your rhomboid muscle stretch

Sets/Reps: 3X4 Reps (3 times a day)

Daily Routine

Step-by-step directions

- Lie on a hard or flat surface on the effected shoulder under your bent arm as in the figure
- You should push best arm to push down. The arm should push the effected arm at that situation downwards when you feel stretch on your effected shoulder
- The position should hold for 30 sec

Tip: Don't bend your waist or press downwards.

Note: 30 sec rest in every exercises before performing

6. Standing Row

Prime movers Movements :Middle and lower trapezius
There should be stretch feel in the upper back and back of your shoulder

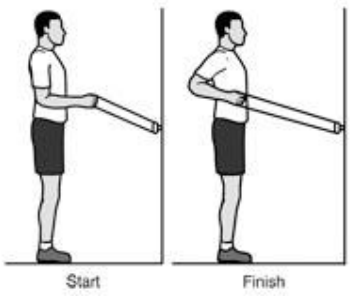
Tool: Theraband at your ease to do 3X12 exercise.

Sets/Reps: 3X8reps

Weekly: 3 days

Step-by-step directions

- Take a theraband and fixed it on a wall
- Stand parellal to the wall and pull the theraband as attached below to your waist height
- Your elbow should be within your body and pull your elbow in backward direction
- Return gradually to the start position and redo it



Tip: Press your shoulder both blades as you pull the theraband

Note: 30 sec rest in every exercises before performing

7. External Rotation with Arm Abducted 90°

Prime movers Movements: Infraspinatus and teres minor.

There should be stretch feel in the upper back and back of your shoulder

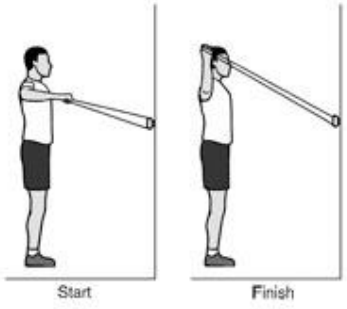
Tool: Theraband at your ease to do 3X12 exercise.

Sets/Reps: 3X8reps

Weekly: 3 days

Step-by-step directions

- Take a theraband and fixed it on a wall
- Stand parellal to the wall and pull the theraband as attached below to your waist height
- Your elbow should be within your body and pull your elbow in backward direction
- Return gradually to the start position and redo it



Tip: Be sure that elbow should be in line with your shoulder.

Note: 30 sec rest in every exercises before performing

8. Internal Rotation

Prime movers Movements (muscles): Pectoralis, subscapularis

There should be a direct exercise stress on chest and shoulder.

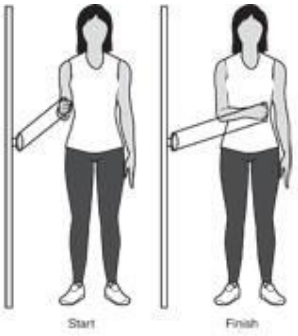
Tools: Theraband with ease resistance,

Sets/Reps: 3X8reps

Weekly: 3 days

Step-by-step directions

- Take a theraband and fixed it on a wall
- Stand parellal to the wall and pull the theraband as attached below to your waist height
- Bend your elbow at 90 and move towards your waist position
- Put your elbow close to your side and bring your arm Keep your elbow crossways to your body.
- Gradually redo the exercise and come to the starting position & repeat



Tip: Put your elbow pressed into the side.

Note: 30 sec rest in every exercises before performing

9. External Rotation

Prime movers Movements (muscles): Infraspinatus, teres minor, posterior deltoid

There should be feel stretch in the back of shoulder and upper back

There should be a direct exercise stress on chest and shoulder.

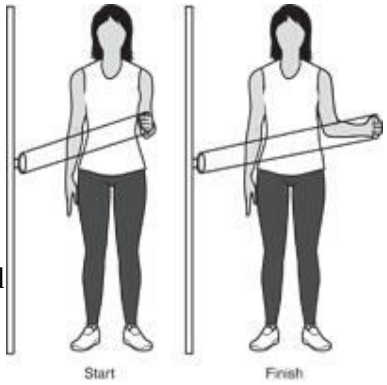
Tools: Theraband with ease resistance,

Sets/Reps: 3X8reps

Weekly: 3 days

Step-by-step directions

- Take a theraband and fixed it on a wall
- Pull the theraband in away direction as much as you can as shown in the figure
- Keep your elbow close to your side and slowly rotate in outward direction
- Gradually redo the exercise and come to the starting position & repeat



Tip: Press your shoulder both blades as you pull the theraband Backwords

Note: 30 sec rest in every exercises before performing

Table 4. Nonsurgical rehabilitation protocols for RTC in national or university level athletes

Phase	Goals	Rehabilitation strategies
Acute	Reduce pain and inflammation Protection of RC Painless full Range Of Motion	Activity modification Physical modalities Medications PROM to AAROM to AROM in scapular plane Periscapular muscle strengthening Cross-training Cardiovascular exercises Core strengthening
Recovery	Normal RC strength Normal flexibility Correct KC abnormalities	Advanced periscapular muscle strengthening Stretching (posterior capsule, pectoral muscles) RC strengthening exercises: Isometrics to CKCE to OKCE to OKCME
Functional	Adequate KC function Return to sports-specific activities	Multi angle functional exercise Plyometric exercises Eccentric exercises Return to practice (sports-specific exercises and drills)
Return to sports	Return to previous sport activity	Return to Throw/Swing/Serve program Injury Prevention Program

RC=Rotator Cuff, KC= kinetic chain; CKCE, Closed Kinetic Chain Exercises; OKCE, Open Kinetic Chain Exercises; OKCME, Open Kinetic Chain Multi-angle Exercises.

Results

The results from the rehabilitation plan conducted on the (N=150) of different male athletes from the five major cities of Punjab ((Lahore, Multan, Gujranwala, Faisalabad & Sialkot). The plan executes for 8 weeks and the resulted showed significant through paired sample t-test analyzed by SPSS-26. Multan showed immense recovery after the completion of the

rehab plan and 62 subjects left the study due to their personal reasons. The result of pre-tests indicated loss of function, mild to severe pain and joint mobility issues in the 4 muscles of the rotator cuff. After the complete treatment protocols including tharaband exercises, stretching drills and throwing mechanics, it was seen in the post-tests that there was an improvement in the overall functioning of the muscles, range of motion as well as reduced pain and discomfort in the post tests. It was observed that the training exercises were beneficial for the athletes recovering from a rotator cuff injury to a great extent. The following table 5 shouws the results as assessed through paired sample t-test by Statistical Package for Social Science (SPSS).

Table 5 shows the analysis results

Groups	N	t-value	p-value
Control Injures	N= 17	----------	----------
Rotator Cuff (RC)	N= 63	t=-8.2	*** P=0.000

Pre & Post Test Evaluation

Empty CAN Test:

The empty can test was used to detect the severity of the pain which was seen as mild to severe in the (N=15) athletes when these athletes first appeared for a physical assessment. All of these athletes belonged to baseball and were pitchers. It was a pre-test diagnosis on the basis of which the researcher worked on the supraspinatus muscle of the rotator cuff muscle. Various exercises were included along with rest and recovery protocols and after the completion of the rehab plan a post-test was conducted on which the athletes reported little or no pain in the supraspinatus muscle of the rotator cuff. These (N=15) athletes showed positive results and it was observed that they had no pain while doing pitching and it was evident that the rehab plan worked for these athletes and they seemed to enjoy the pitching once they went back to the sport after the injury.

Drop arm test:

The drop arm test was used to detect the severity of the pain when the shoulder was elevated and then dropped abruptly. The pain was observed as mild to severe in the (N=18) athletes when these athletes first appeared for a physical assessment. (N=15) athletes were fast bowlers and (N=3) were batters who were habitual of fielding in the deep which affected their rotator cuff muscle. It was a pre-test diagnosis on the basis of which the researcher worked on the supraspinatus muscle of the rotator cuff muscle. A number of exercises were included along with rest and recovery protocols and after the completion of the rehab plan a post-test was conducted on which the athletes reported little or no pain when they elevated their shoulder. The major focus was on gaining the strength and resistance of the rotator cuff muscle and especially for fast bowlers; rubber bands were consistently used as part of their rehab plan. These (N=8) athletes showed positive results and it was observed that they had no pain while doing bowling or throwing from the deep and it was evident that the rehab plan worked for these athletes as they returned back to their respective sports.

Lift Off Test

The lift off test was used to diagnose the affected range of motion in the athletes along with discomfort when asked to move the arm posteriorly. It was observed in the pre-test that (N=16) athletes who were all baseball pitchers had mild to severe affected range of motion and their subscapularis muscle of the rotator cuff was affected. A number of mobility exercises including shoulder mobility drills, increased range of motion through rubber bands and controlled range of motion through rubber bands were aimed in the rehab plan of these athletes. There were positive results in the post- tests after the completion of the rehab plan and the players were able to use their arm more efficiently and effectively and there were an increase in the range of motion as well as pitching speed was improved once they returned to the sport.

Belly Press Test:

The belly press test was used to diagnose the pain when moving the arm internally. The pre- test was conducted on the athletes and (N=14) athletes reported pain and discomfort when moving the arm internally which indicated a clear weakness in the rotator cuff muscle. The strengthening exercises of the shoulder were used to develop the strength as most of these athletes were beginners and lacked strength. Strength was developed through easy mode to hard mode of the rubber bands as the players showed progress. The results of the post-tests showed developed

Discussion

Rotator cuff injury can be prevented easily if at an early age proper techniques of throwing or bowling are taught, afterwards passed through the rehabilitation process which is an essential part of sports injuries. According to Browning & Desai (2004) overuse in the young athletes may have placed these patients at risk for their injuries with decreased stability and strength; in many studies same result had been achieved before and improved through rehab plan executed 8 weeks which is inline with Weiss et al. 2013. There is an increased recognition of overuse injury to the upper extremity in the young athlete. Although the growth plate is more prone to injury in the skeletally immature athlete, several injury patterns described show that tendons, ligaments, and bones are also injured.

The delivery position of the shoulder plays a key role in the injury of these muscles. If the angle of delivery (biomechanics) is correct and posture is stable, one can easily avoid this injury at an early age. According to Sciascia & Karolich (2013) that most postural concerns can be addressed through the implementation of known stretching techniques and joint mobilizations similar results was observed before execution of rehab plan the result showed significant improvement resulted, which has been the absolute focus of this rehab plan.

Rotator cuff tendonitis was the most frequent diagnosis (Blevins, 1997). It has been observed that the beginners in the sport of baseball at the university or district level lack the knowledge

of throwing mechanism and in the rehab plan it was addressed quite briefly on how to get the technique of right and how to overcome the injury of the rotator cuff muscles.

Kibler et al. (2003) says that the completion of rehabilitation of rotator cuff tendinopathy requires fulfillment of specific criteria regarding healing, range-of-motion, strength, and kinetic chain restoration. Frequently the patient will then return to the same activity or sport that created the injurious stresses, however, thereby placing himself at some increased risk for repeat injury because the exact nature of the stresses operating in rotator cuff tendinopathy is not completely known, the best strategies for prevention are based on empirical protocols that attempt to understand the inherent demands of the sport or activity, and then devise a maintenance exercise program to maximize the body's ability to withstand those demands. The rehabilitation plan included flexibility, strength, power, anaerobic, and aerobic demands can then be matched with specific exercise programs. Moreover, include trunk/hip strengthening and continued rotational flexibility exercises for baseball pitchers and tennis players, scapular stabilization exercises in workers who continually use their arms extended in front or overhead, and isolated mild rotator-cuff strength exercises in older patients. The present study was also based on developing a suitable rehab plan for the athletes as described in the recent studies. The effectiveness of rehabilitation in the treatment of rotator cuff tendinitis due to primary impingement is well documented in the literature. Most athletes with primary impingement without full thickness rotator cuff tears respond well to non-operative treatment directed toward strengthening the rotator cuff, decreasing inflammation and regaining range of motion. Rehabilitation will also be effective in the majority of athletes with cuff pathology due to primary tensile overload, instability and contact injury (Blevins, 1997). These observations also clarify that a proper rehab plan plays a key role in the recovery of the athlete as it was a major objective of the study.

Millet et al. (2006), states that the keys to the prevention of overuse injuries include educating coaches, parents, and children alike of the potential hazards associated with

premature sport specialization and by emphasizing the recreational value of sports. In addition, as rotator cuff injuries and impingement are patterns of injuries that occur secondary to repetitive loading and chronic overuse, guidelines on pitching technique, pitch counts, and frequency of pitching in baseball, as well as early recognition of these injuries will help prevent their progression. This research shows that at the club or the university level, the level of awareness among the athletes is pretty low and it has been seen that they overwork and overload themselves to get more benefit from the sport but by overdoing they fall a prey to these injuries which can be lifelong disasters for their carriers. By following a proper diagnosis and treatment plan one can recover swiftly from this issue and can return back to the sport. The use of rubber bands even after the recovery must be encouraged as these provide strength and mobility to the working muscles. Therefore, a proper rehab plan and proper diagnosis is necessary at this level to stop this issue which is the major factor in affecting the performance of the athletes.

Conclusion

The result should significant and optimistic results as the test conducted resulted in no pain with Post-test execution. The reason of rotator cuff pathology in athletes is probably multifactorial, but may be classified into categories which aid the clinician in determining a treatment plan. History and physical examination are key elements in the evaluation and decision-making process of the athlete with rotator cuff pathology. Rehabilitation is the best way to rotator cuff suffering athletes except for those with symptomatic full thickness rotator cuff tears for whom surgical repair is indicated. The rotator cuff injury is seen as the most common injury especially in the sports that involve throwing like baseball and cricket. A number of injuries are due to lack of proper technique or overtraining of the particular muscle group due to lack of knowledge in the athletes of the national or university level in Pakistan. The research aimed on the early diagnosis of the injury and was followed by a proper rehab

plan for each athlete who resulted in the complete recovery of the athletes and all of the set of objectives were met. Moreover, the researcher was able to create awareness among this athlete as they are the new faces and can help their juniors to prevent this injury.Hence, the rotator cuff injury can be prevented at initial levels if it is diagnosed properly and a suitable rehab plan can boost up the recovery process. The proper technical guidelines and awareness can also enhance the performance of the muscle and can prevent the reoccurrence of the injury in the athletes.

Future Recommendations

The rotator cuff injury is a natural occurring phenomenon in the sports that involve throwing mechanisms. The future researches can be done on the rehabilitation in the other sports by following this rehab plan with additional and more modified exercises according to the sports. The diagnosis process can be done with the help of magnetic resonance imaging (MRI) if one has adequate resources and budget for more accurate diagnosis. The research can be useful if it is done on the general population facing the shoulder issue and same rehab plan with less intense exercises can be applied. The rehab plan can be a stepping stone for the professional level athletes who aim to make a quick recovery following a rotator cuff injury.

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