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

ABSTRACT

The purpose of this experimental study is to diagnosis and rehabilitate the rotator cuff muscles (RC) in domestic, Intervarsity & National athletes of various throwing sports selected from five major cities of Punjab (Lahore, Multan, Gujranwala, Faisalabad & Sialkot) having confirmed Acute and Chronic injury) with confirmed injury along with some suggested treatments for fasten recovery. The subjects were selected from all the cities having same number of sample size (N=25). A total of N=125 subjects were selected and passed through different test to identify or get the baseline data information. A survey questionnaire was also spread among athletes 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 control injured group (N=25) were also selected for further comparison. The rehabilitation plan (Isometric, isotonic and theraband exercises) was executed for 8 months and statistical analysis performed through Statistical Package for Social Science (SPSS-26) along with paired sample t-test utilized to analyze the results. The reliability calculated through Cronbach Alpha and its value was 0.82. The statistical results showed significant values and showed optimistic response of rehabilitation through Isometric, isotonic and theraband exercises. The post test assessment through tests also indicated satisfactory results. The research concluded that rehabilitation through Isometric, isotonic and theraband exercises produces positive results, as conditioning rehab plan was effective and satisfactory and all the athletes returned to their sport after the completion of the rehabilitation and recovery program. The study also checked the recurrence by followed the subjects for 2 months and resulted that no one is injured during this period.

Keywords:Isotonic; Isometric and therab; rehabilitation.

1. INTRODUCTION

Now-a-days rotator cuff is one of the commonest injuries among of all throwing sports activities which produces soreness and get off from your performance along with chronic effects as well. It is also a frequent cause of pain and dysfunction in professional and elite athletes [1]. There are strong evidences that numerous researchers worked on prevalence and rehabilitation program which not only recover the injured rotator cuff but helped out in diagnosis and treatment procedures as well [2,3]. Another group of thoughts that shoulder muscles should be isolate as much as it can so that the assessment and diagnosis might be easier for the selection (Jobe&Moynes, 1992). Old method of treatments e.g (ultrasound, anti-inflammatory, needling and corticosteroid intramuscular injections) not effected in long terms as adopted a comprehensive rehab program is necessary to return to its performance condition (Jobe&Moynes, 1982:)[1,4]. The rotator cuff injury has been diagnostically confirmed and physical activity becomes altered therapeutic exercise which might be beneficial for attempting to restore the lost function as long as all contributing factors have been considered [5]. It can also be observed through 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 [6]. Throwing sports, notably baseball, volleyball, & cricket have increased the occurrence of such injuries in elite athletes, sometime overuse muscles resulted in impairments and chronic rotator cuff injuries are possible. Abduction coupled with external

rotation is thought to press on the rotator cuff, especially supraspinatus, effected articular-sided fraying and eventually rotator cuff tears [1]. Moreover, overhead throwing athletes complained such kind hurting and dysfunction of rotator cuff impingement [1]. 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 Shaffer and Huttman[7]. Connor et al, [8] cited in his study about 25% of athletes has a problem of throwing with pain, and 40% of the athletes have rotator cuff injuries as compared with non-throwing arm. To cure this injury the concept of rehabilitation utilized efficiently, effectively and economically which required comprehensive rehab plan along with extra care, healing process, restore range-of-motion, isometric and isotonic strength, and sports specific loom which arranged both athlete and the injured tissue psychological, physiological and kinsiophobia at higher rate of performance [9-11].

1.1 Significance of Study

Rehabilitation with exercises is not only recovered the performance of athletes but also cut down the recurrence rate of reinjures. An appropriate way to identify, manage and rehabilitation of rotator cuff injury with proficient rehabilitation exercises plan on athletes through suitable technique by using isometric, isotonic and theraband exercises which help the athletes to recover quickly, effectively and efficiently from the rotator cuff injury along with check of recurrence for 2 months.

1.1.1 Objectives of the study

- Importance of rehabilitation for athletes, coaches, trainers and professionals suffering from rotator cuff injury.
- To regain strength & also strengthen the weak muscles through rehabilitation exercises.
- To check recurrence after 8 weeks (2 months).

1.1.2 Research Question

- The implemented isometric, isotonic and theraband exercises rehab plan is helpful & effective for the athlete.
- Does rehabilitation recover from injury & helpful in cut down the recurrence rate?

1.1.3 Research Hypothesis

- Rehabilitation through isometric, isotonic &theraband plays a vital role in the recovery of athletes suffering from a rotator cuff injury (RC).

1.2 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 [12]. 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 [6,12]. 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 [6,7]. 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 [6,12].

1.3 Treatment

In recent past, numerous technique of treatment utilized which not only recovered efficiently but also cut down the future occurrence rate. Some famous methods of management depend upon level of disability, relevant action to injury, duration of the recovery timing, R.I.C.E principle, hydrotherapy, rehabilitation exercises, kinesiophobia (fear of movement) and associated diagnoses all have a role in treatment along with categorization of incomplete Cuff injuries. Additionally, the medicines prescribed by the specialist also played a vital role for recovery and regaining strength. Moreover, the history of the treatment, management strategies along with grades are helpful not only in designing the rehabiliatation plan but also beneficial in recovery of the shoulder injuries [7,13,10,11].

1.4 Non Operative

Due to the high level of rotator cuff injury in sports throwing events or games, Shaffer and Huttman[7] cited that mostly the management of rotator cuff injury is non-operative. The old conservative methods or supervised techniques are not guaranteed for successful execution recovery and replay as well. A well-planned physiotherapist program, trying non-steroidal anti-inflammatory medicines (NSAM), and getting rest soon along with stopping playing are basic protocols for efficient recovery. Dynamic and static Stretching with arm mobilization is used to treat posterior capsular contractures [14,15,13,10]. To create strength in the 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 function improved. A gradual short distance throw or movement activity planned with a game and postural specific spotlight aids in the restoration of good mechanics, food supplementation along with the use of subacromial corticosteroid injections occasionally [16]. The length of non-operative treatment depends on the causes, grade of injury, and the athlete's circumstances. While three months is an acceptable time frame for a complete program, some rehab plans take a long time to recover, particularly for athletes who have a full rupture. A comprehensive literature, non-treatment therapy of partial tears is regarded as reasonably beneficial for a large number of over head throwers [7].

2. 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 different 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. A form of questionnaires was also spread to all the athletes to get the feedback. All the players were either novice with acute or chronic symptoms RC injury, as they not properly treated results in chronic. The athletes were followed for 2 months to check recurrence. 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.1.

2.1 Flow Chart

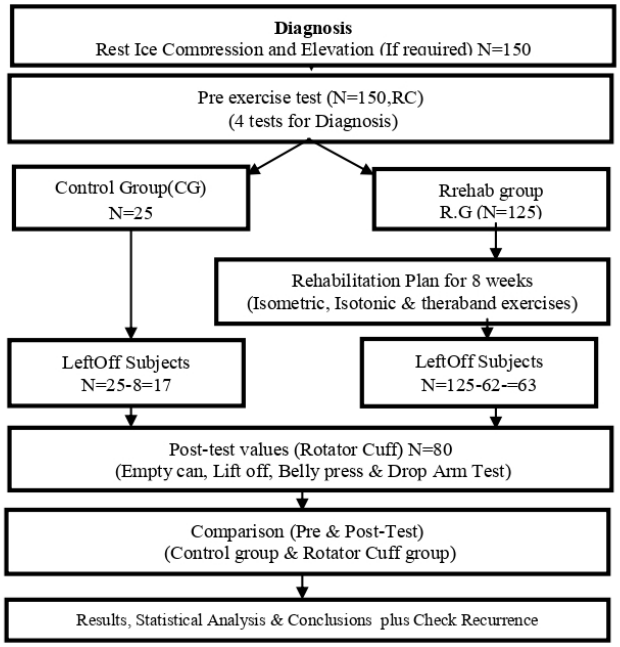

Fig. 1.Shows the flow chart of RC

2.2Subjects Selection

2.2.1 Diagnosis

The subjects selected through a physical assessment on the movements of the shoulder (rotator cuff muscles movements) of athletes. A number of tests were performed to detect the severity of pain and immobilization of the rotator cuff muscles at pre-test observed procedure. The tests used by the researcher have high validity and reliability, its value is 0.82 through Cronbach's Alpha and it has been use in numerous researches in the past. A number of test utilized by the different researcher (empty can, Drop Arm, Lift off & Belly press Test), out of them few test were performed in this study to check the injured shoulder (RC).

2.2.2 Treatment of rotator cuff (RC) injuries

Before started the rehabilitation plan, the subjects should be well aware of pain free movement of rotator cuff muscles movement. If swelling and pain observed in the movement of rotator cuff muscle so it should passed through R.I.C.E protocols and the rehabilitation process started as it free from pain and immobilization of rotator cuff muscles. The injured athletes of the rotator cuff muscle have been given a proper heed along with organized protocols of rehabilitation plan executed and it was look that safety and prevention from further deterioration of the affected area [17]. The athletes were given proper rehabilitation plan of isometric and isotonic strength exercise, range of motion exercises (flexibility exercises), mobilizing exercises along with theraband exercises (resistance) as per required by researcher, trainer, coaches and doctors [18,19](Rosa & Robert 2022;)[20]. The following Table 1 shows the physical assessment [12] of the test.

2.2.3 Rehabilitation training plan

Rehabilitation with exercises now a day's become a necessary part to come back to its original performance condition. A rehabilitation plan of sports injuries required extra care, highly structured exercise and sports specifically approach along with specificity, over loading, progression and rest and restoration principle which prepared both athlete and the injured tissue as per requirement of mental and physiological demands at peak performance [13,10,16,21,22]. The target rehabilitation weekly plan is mentioned in the Table 2 along with two unload weeks and Table 3 with exercises respectively .

2.2.4 Target shoulder muscles

There are four major muscles that supported shoulder joints and the rehabilitation plan focused on these four muscles named as: (a)Teres (minor & major) (b) Supraspinatus (c) Infraspinatus (d) Subscapularis.

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 (checked at 0°)	-----	3	----------
7.External rotation (checked 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
Similar Test			
10.Neer's sign	-----	----	----------
11.Hawkin's sign	-----	----	----------
12.Speed's test	-----	----	----------

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

Table 3. Rehab exercises (Isometric, Isotonic andtheraband)

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 Exerciseswith/without movement	Standing rows with and without therabandAbduction 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. Principle of overloading, progression, specificity & rest and restoration is implemented throughout the study

Table 4. Nonsurgical rehabilitation protocols for RTC athletes

Phase	Goals	Rehabilitation strategies
Acute	Decrease pain and inflammation Protection of RC No pain with 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	Regular RC strength Regular flexibility Right Kinetic Chain	Advanced periscapular muscle strengthening Stretching (posterior capsule, pectoral muscles) RC strengthening exercises: Isometrics to CKCE

	abnormalities	to OKCE to OKCME
Functional	Sufficient KC function Redo Sports	Multi angle functional exercise Plyometric exercises Eccentric exercises Return to practice (sports-specific exercises and drills)
Return to sports	Return to sports	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

Table 5. Shows the analysis results

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

2.2.5 Duration (8 weeks plan)

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 [2,10]. The non-surgical rehabilitation treatment is showed in Table 4.

3. RESULTS

The rehabilitation plan executed for two months along with 35 sessions (maximum) of rehabilitation conditioning plan in which the results showed statistically significant as observed by paired sample t-test analyzed through SPSS-26. The rehabilitation of 8 weeks showed massive improvement of rotator cuff injury. The result of pre-tests indicated loss of function, mild to severe pain and joint mobility issues in the all muscles of the shoulder (RC). The isometric, isotonic, tharaband exercises, stretching drills and throwing mechanics, it was seen that in control group there were no improvement but in the post-tests it was observed an improvement in the overall functioning of the muscles, range of motion as well as reduced pain and discomfort in the post tests. Out of 125, 62 subjects left the study due to their personal reasons. The 8 weeks rehabilitation conditioning plan resulted that the exercises have a great importance for the players having rotator cuff injuries. The following Table 5 shows the results as assessed through paired sample t-test by Statistical Package for Social Science (SPSS).

3.1 Pre and Post Test Evaluation

The study used number of test utilized in pre-test protocols out of them 4 were showed optimistically results to check the severity of the pain and immobilization of rotator cuff muscles. The empty can test, drop arm test, lift off test and belly press test showed positive results and the number of injured subjects were 15, 18 16 and 14 respectively. Their physical assessment was mild to severe. The subjects also showed pain and dysfunction in their movements as assessed.

The post test execution should positive results as athletes showed no pain, dysfunction and soreness, in fact they used their arm or shoulder muscles with better strength, mobilization, better range of motion, and return to their respective sports. Similarly, the results of the post-tests showed development in strength through isometric and isotonic exercises easy mode to hard mode of the rubber bands as the athletes showed progression and improvement in the performance as well. The recurrence has been check after completion of the rehab program as followed for 2 months. It was observed that no one in injured during 8 weeks follow up consistently.

4.DISCUSSION

The rehabilitation of rotator cuff muscles needs to recover the gap of performance along with efficient healing, improved range of motion and in follow of kinetic motion chain reinstall after abolition. The results were resembled with Kibler et al. [9] as they were worked on scientific basis

of rotator cuff rehabilitation program. Similarly, Browning & Desai [23] overuse in the young athletes may have placed these patients at risk for their injuries with decreased stability and strength as the overuse rotator cuff muscles were injured in young athletes recovered through speculated rehab protocols mentioned by 8 weeks rehab program of Weiss et al. [1]. Moreover, Millet et al. [5] and Weiss et al. [1], 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. The delivery position (biomechanics) of the shoulder plays a key role in the injury of these muscles. If the angle of delivery is correct and posture is well balanced, athlete might be easily avoiding this injury at an early age [24,25]. Sciascia&Karolich [14] addressed through the implementation of appropriate stretching techniques, range of joint mobilizations, postural control movement's and execution of specialized rehab plan showed significant improvement, which has been the absolute focus of this rehab plan, consisted of isometric and isotonic strength, along with theraband and isolated exercise programs. The present rehabilitation 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 similar management reported by Rodriguez-Santiago et al., [17] . Rehabilitation will also be effective in the majority of athletes with cuff pathology due to primary tensile overload, instability and contact injury as similar results observed by Blevins, [6].

5. CONCLUSION

The result concluded through experimental study that rehabilitation is the best way to rotator cuff suffering athletes except for those with symptomatic full thickness rotator cuff rupture for whom surgical repair is necessary. The study indicated education & awareness among the athletes is pretty low which has again in the state of risk injury and if they included overloading, progression, specificity and rest and restoration principles in rehabilitation they will not only achieve their goals but also cut down the recurrence rate remarkably.

6. FUTURE RECOMMENDATIONS

The research is helpful for general population facing the shoulder issue and same rehab protocols with less intense exercises can be applied. The future recommendation of diagnosis process can be done with the help of magnetic resonance imaging (MRI) if one has ample resources and funds for more accurate results. Hence, the rotator cuff injury can be prevented at initial levels if it is diagnosed properly and a suitable rehab plan fastens the recovery process.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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