Abdullah Nilamdeen Yasara Nayana Edirimanne

Therapeutic exercises for rotator cuff injuries among cricket players

Literature Review

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Author	Abdullah Nilamdeen Yasara Nayana Edirimanne
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Cricket has always been seen as a reasonably injury-free sport, due to its 'low' risk of injury risk. With a year-long tournament schedule and a particularly short off-season, cricket has grown quicker and more demanding in terms of performance and conditioning. Rotator cuff tears are the most common issue faced by cricket players. The two leading causes of rotator cuff in-juries are trauma and degeneration. Typically, accidents are the cause of acute tears. After a shoulder rupture, other injuries, such as a clavicle fracture or displacement, may also happen. Together, physiotherapists and players may recognize potential cricket injuries at an early stage, while ensuring players' safety, and working to reduce, eliminate, and prevent rotator cuff injuries.

The purpose of this modified literature review was to investigate the benefits of therapeutic exercises on rotator cuff injuries among cricket players.

In this bachelor's thesis, previously published literature was examined. Searches were done on Pub Med, CINAHL, Medline, and ScienceDirect. Five articles that met several inclusion criteria were selected for the thesis. All of them were empirical studies; quantitative and qualitative concerning rotator cuff injuries and other problems of the shoulder due to sports.

If a rotator cuff injury is not treated effectively, the severity of the tear, muscle atrophy, and joint instability may all deteriorate within 5 to 10 years. There is also an indication that healed rotator cuff repairs had better patient-reported and functional outcomes than unhealed rotator cuff repairs for whom therapeutic activities were not performed.

This literature review concluded that therapeutic exercises help heal rotator cuff injuries by increasing the range of motion and strengthening surrounding muscles after surgery. Immediate treatment of rotator cuff injuries is vital. The rotator cuff tendon will retract if treatment is delayed which makes the repair of rotator cuff injury more complex and less effective. When therapeutic exercises are conducted during the treatment period, when the injury is still fresh, rotator cuff rehabilitation is extremely effective.

Key Words	Rotator cuff injury, physical therapy, physiotherapy rotator cuff tear, therapeutic exercise, training, cricket, cricket player, cricketer

Contents

1 Introduction

Cricket is a sport performed in a variety of countries that were former British colonies and it is played and appreciated by athletes with different ability levels such as school level, national level and international level. The most common injury among cricket players is the rotator cuff injury. Due to the duration of a match and the natural stride variances of the players, cricket is both a sport that demands a high degree of ability to perform and a tough physical test. However, it is known to be a safe sport with a low prevalence of injury. (Orchard, James, Alcott, Carter & Farhart 2002.) Players neglecting fitness and rest goals during the season or off-season have the potential to strain and injure these muscles. Despite the fact that cricket is a non-contact sport, there are several ways for players to get injured. (Stretch, Ryan & Nicole 2009.)

Batting, bowling and fielding activities such as catching and throwing and wicket-keeping are various aspects that contestants in this sport perform during practice and at competition levels. Bowlers and fielders who must often toss the ball during games and practices are especially prone to overexposure pains. (Nag, Murugappan, Chandran, Mohan & Das 2009.)

Injuries may have a substantial effect on the career of players, since they may restrict them from participating in physically demanding sports (Orchard, James, Alcott, Carter & Farhart 2002). The shoulders are at an increased risk of being injured due to repeated range of motion. Glenohumeral joint injuries and distractive forces may cause tearing or tension in the joints. Subsequent healing may result in a reduced capacity for internal rotation. (Olivier, Lala & Gillion 2020.) Rotator cuff injuries are common among cricketers (Prabhakar & Pandey 2015). According to Stretch (2003), rotator cuff injuries account for half of all shoulder ailments. Rotator cuff injuries were the third most prevalent shoulder injury in college sports (Finch et al. 2002). According to Dhillon (2012), cricket players who have had rotator cuff injuries in cricket have a low chance to be selected by their preferred clubs than those who reported pain in the rotator cuffs. Rotator cuff injury may happen in various ways among professional athletes and players of other levels, primarily by sudden trauma, such as a fall upon an outstretched arm, acute overuse and recurrent microtrauma. Trauma to the rotator cuff may result in minor sprains, tendinopathies, and even complete tears. A rotator cuff injury may be partial or full thickness, depending on the severity of the damage. The notion that rotator cuff injuries in bowlers are due to a reduction of tensile strength

during the deceleration portion of thethrowing action seems plausible. (Hanson & Gregory 2008.) On the articular side, athletes are more prone to tear their rotator cuff than the bursa side (Copeland 2000). The majority of tears or ruptures are located posterosuperior, around the supraspinatus and infraspinatus tendon insertions on the humerus (Nag, Murugappan, Chandran, Mohan & Das 2009). Cricket players are susceptible to rotator cuff injuries, which may result in extensive training, preparation, and competition downtime (Stretch 2003). Thus, this thesis aims to look at the benefits of therapeutic exercises for rotator cuff injuries among cricket players.

2 Literature Review

2.1 Biomechanics of the throwing movement

The rotator cuff is responsible for stability and range of motion of the glenohumeral joint, maintaining its health and wellness which is essential for an upper limb in order for it to perform its intended functions. This network of muscles and tendons consists of four distinct muscles and tendons: supraspinatus in the upper back, scapularis in front, and teres minor and infraspinatus in the back. (Parsons, Apreleva, Fu & Woo 2002.) There is a prevalent misperception that the four rotator cuff tendons are independent of each other. It was shown that the four tendons connect synchronously for about a quarter-inch of their insertion into the humerus. The enlarged head of the biceps tendon, the coracohumeral ligament, the centre glenohumeral ligament, and the supra glenohumeral ligament, all of which are positioned in the triangle created by the supraspinatus and the subscapularis, serve to stabilize the glenohumeral joint.
It is a common misconception that the four tendons of the rotator cuff belong to four individual entities. On the contrary, it was demonstrated that the four tendons connect together at the same point for about a quarter of an inch along their entrance through the humerus. In examining micro-anatomically, all the tendons of supraspinatus and infraspinatus are organized into five layers. The first layer is made up of the fibers of coracohumeral ligament, the second and third layers are made of big tendons, the fourth layer is made up of loosened connective tissue and a subcapsular bursa, and the fifth layer is the shoulder joint capsule, which is at the end of the structure. The rotator cable, which is a continuation of the coracohumeral ligament, travels down the underside of the supraspinatus and infraspinatus tendons on the shoulder. (Ainsworth & Lewis 2007.)

The shoulder contains anatomical components that provide static and dynamic security, strength and support that may be modified or adapted to the throwing mechanics that

contribute significantly to the improvement in throwing performance. In the case of a serious injury, the cohesion of the glenohumeral joint may be compromised, and the center of the humeral head may shift. This change in mobility may be the result of alterations in muscles, tendons, capsular and ligamentous adaptations. This may cause the humeral head to go too far forward, resulting in rotator cuff weakness and eventual rupture. As the shoulder recovers following a rotator cuff injury, muscles and tendons, including all of the rotator cuff muscles, compensate for any loss in the function of anatomical components that provide static cohesion. Ligaments, capsule joint, and labrum contribute to static stability and keep the shoulder vacuum-clutched and in place. (Michael & Curtis 2005.)

The bottom of the coracoacromial arch is in contact with the glenoid, and the articular surface of the humerus is the convexity of the proximal humerus formed by the tuberosities and the superficial surface of the rotator cuff tendons. The humeral head moves anteriorly and superiorly when the rotator cuff begins to degenerate, the posteroinferior capsule contracts, and the coracoacromial bottom surface is not congruent. The rotator cuff of the humerus provides for a certain amount of rotation of the scapula in reference to the humerus. The muscles of the rotator cuff attach to a tendon that wraps continually around the joint and provides support for the head of the humerus. These muscles provide rotational pressures to the tendon. The numerous muscles that make up the rotator cuff will apply force in a number of different directions and to varying degrees, depending on the position of the joint in relation to themselves. (Torrens, López, Puente & Cáceres 2007.)

The supraspinatus either abducts the humerus or rotates it externally, depending on the placement of the arm at the beginning of the movement. A higher glenohumeral angle stimulates the deltoid muscle during shoulder elevation, while a smaller glenohumeral angle activates the supraspinatus. Abduction is facilitated by the subscapularis and infraspinatus muscles regardless of whether the humerus is turned externally or internally. At each joint, the greatest amount of force and torque that can be generated by each muscle is unique. The muscles that make up the rotator cuff are at their weakest at the beginning and end of the movement range when the muscles are either at their most constricted or their most extended positions. Coordination of the rotator cuff muscles is necessary for effective movement. Since the shoulder lacks a stable point of rotation, it needs a wide number of muscles to maintain its stability. The net torque generated by the shoulder muscles must be positive, and any negative

effects must be neutralized. It is necessary for the muscle and apical rotator cuff to act against the abducting latissimus dorsi in order to perform a simple inward rotation. It is not possible for pure adduction to take place unless the dorsal deltoidal muscle and the rear rotator cuff muscle work against the internal rotation moment of the same muscle. (Akhtar, Richards & Monga 2021.)

During forward elevation without rotation, the infraspinatus and posterior deltoid work to counterbalance the cross-body and internal rotation torque exerted by the anterior deltoid. Tension forces on the tendons of the rotator cuff may vary considerably. During resisted abduction, as the humerus travels in a plane perpendicular to the cuff muscle, a concentric tension strain is formed. After being cuffed in place, the acromion is better equipped to tolerate these stresses, since the coracoacromial arch will not impinge on it at low degrees of flexion. For instance, the rotator has the ability to combat gravity where tension strains are formed as a result of an eccentric humeral movement in proportion to the contraction of the muscles that surround the rotator cuff. This causes the rotator cuff to be subjected to a strained state. Continuous stress is placed on the tendons of the rotator cuff which results in the involuntary rotation of the articular surface with respect to the scapula. The fact that the cuff is elastic ensures that it will remain intact despite the force that is being applied to it. Additionally, compressive stresses are placed on the tendons that make up the rotator cuff. The rotator cuff is pressed as the arm is lifted onto the humerus due to the humeral head and the coracoid process located between each other. (Akhtar, Richards & Monga 2021.)

The biomechanics and integrity of the glenohumeral joint are negatively affected when the rotator cuff is torn. A tear in the subscapularis tendon may cause damage to the anterior rotator cuff, leading to a loss of active internal rotation and a gain in passive outward rotation. Internal rotation of the shoulder may be enhanced and external rotation is decreased if the infraspinatus or teres minor muscles of the posterior rotator cuff are torn. Ruptures in the muscle associated with supraspinatus severely restrict shoulder abduction because of the muscle's pivotal role in preparing the shoulder for motion. If the rotator cuff injury progresses because the transverse force coupling breaks down, complete abduction of the shoulder is not feasible. This is the result of injury to the fulcrum that permits the glenohumeral joint to move freely and effortlessly. If an infraspinatus rupture proceeds, the mechanics of the head of the humerus alter. It causes the humeral head to shift superiorly, laterally, and posteriorly during complete internal rotation. This is due to a mismatch in the glenohumeral force pair, which results

in the application of less compression force on the humeral head. This is perfectly reasonable in light with past biomechanical research which showed that a ruptured rotator cuff significantly reduces the magnitude of joint reaction forces at the glenohumeral joint. Due to the off-center compression stress, the joint response forces shift, which contributes to the instability and migration of the humeral head. If the rotator cuff is ripped, the glenohumeral joint may become unstable, and the concavity may become less compressed, which may lead to degeneration of the joint. This can happen if the rotatorcuff is torn. (Akhtar, Richards & Monga 2021.)

Based on the discrepancies in muscle strength between the activator and oppositional muscle groups, cricket players are at an increased risk of developing a variety of shoulder conditions, such as impingement and those caused by an inability to maintain outer rotator stability. Since the outer rotators are eccentrically engaged during the acceleration phase of a bowling attack to reduce arm control, a lack of strength in this shoulder region may result in an impingement. (Hackney 1996.)

2.2 Classification of rotator cuff tears

The classification of rotator cuff tears is necessary for appropriate treatment and rehabilitation. It may be based on the size of the lesion, number of tendons involved, and signal abnormality of the tendon. The first step is to make a distinction and evaluate and distinguish an acute contusion from an underlying chronic process. (Weiss, Wang, Hendel, Buzzerio & Rodeo 2018.)

It is crucial to accurately classify rotator cuff injuries so that treatment results may be compared across studies. This can be done with a diagnostic arthroscopy. The sign for diagnosing a lesion is a positive peel-back sign. At the same time, other arthroscopic findings indicate unstable biceps superior labrum complex. Angled arthroscopic probe is used to test the stability of the bicep attachments to the glenoid. Along with these benefits, signs of instability can be detected easily. Peel-back test is performed by removing the arm from traction and by performing arthroscopy of the superior labrum. In performing this manoeuvre, the extent of the drop of the superior labrum medially can guide the classification of the lesion. (Burkhart, Morgan & Kibler 2003.)

Originally believed to be a sensitive predictor for full-thickness rotator cuff injuries, the acromiohumeral interval, often known as the AHI, largely determines the classification of severe rotator cuff injuries. Previous research indicated that the bottom limits of a

typical AHI range from 6 to 7 mm. In the Hamada grading system, this became the dividing line between a Grade 1 major rotator cuff tear and a Grade 2 massive tear. Grade 1 showed that the AHI had been preserved or exceeded 6 millimeters. Five millimeters or less was the AHI for Grade 2. The development of a concave deformity on the acromial undersurface, also known as acromial acetabularization, was another distinguishing characteristic between grades 2 and 3. This acetabularization may occur in either of two separate subtypes: the first is known as an excavation deformity of the acromion and the second is caused by excessive spurring along the coracoacromial ligament. In the fourth-grade tear, glenohumeral joint constriction was added to the characteristics in addition to the features distinguished third grade tears. The last grade, Grade 5, was differentiated by a condition known as cuff tear arthropathy, abbreviated CTA. This condition causes the humeral head to collapse. (Tyler, Gary & John 2017.)

The pattern of cause and risk of injury is determined by the nature of cricket and the techniques used. At the same time, some injuries were sustained by particular techniques in the sport. The severity of the injury is affected by the extent to which the demand for certain points in the musculoskeletal system is utilized with incorrect techniques, preparation, or overuse. The extent of overuse is a major contributing factor that leads to fractures in the spine or other parts of the body. First-time injuries must be rehabilitated to avoid recurrence. Thus, the primary step is to adopt to the correct techniques and maintain a balanced position. This must accompany the right equipment and correct techniques. (Stretch 2003.)

A variety of clinical manifestations may accompany rotator cuff injuries. A thorough medical history may assist the physician in identifying the likelihood of rotator cuff problems. Details on how the arm was hurt and where it was resting at the moment of the accident should be included in this discussion of the context in which the injury occurred. The patient’s range of motion must be taken into consideration in obtaining a comprehensive understanding of their capacities. Clinical evaluation of the patient is through a physical examination and evaluation of the affected and unaffected shoulders. Along with this, a thorough neurovascular exam may be required. The load and shift test are a physical exam to test anterior and posterior instability. The patient is asked to be supine and the arm abducted and the elbow flexed. The humerus is translated anteriorly and posteriorly and loaded axially. Grade 0 translations are considered normal. Translation to the glenoid rim is grade 1+, spontaneous reduction is

grade 2+ and locked dislocation is grade 3+ over the glenoid rim. Likewise, Kim test is used for posteroinferior labrum lesions. The patient is asked to be seated and the arm is abducted to 90 degrees and elevated forward, in the sagittal plane of 45 degrees. Then, an axial load is applied. If this causes pain, the test is positive. Sulcus sign is also used to evaluate for inferior instability. The arm is abducted caudally with the patient asked to stay seated. Measurements are taken as 1+ for less than 1cm, 2+ for 1 to 2 cm and 3+ for more than 2 cm depending on the translation of the humeral head relative to the acromion. Moreover, radiography can be effective in evaluating any instabilities. This includes anteroposterior X-rays, MRI scans and CT scans. (Gibbs, Lynch, Nuber, Nuber & 2015.)

2.3 Therapeutic exercises for rotator cuff injury

Conservative treatment, comprising exercise treatment and physical therapy, is an efficient non-surgical treatment for atraumatic full thickness rotator cuff tears. It is linked to significant improvement. During the first 12 weeks, only one visit is required. However, this was not effective for all patients. Failure may be seen for them within the third month. (Kuhn et al, 2013). Non-surgical therapy for rotator cuff injuries focuses on reducing symptoms, accelerating rehabilitation, and restoring full function so that patients may resume their normal activities without interruption. There is insufficient evidence to suggest exercise for the therapeutic benefit for shoulder injuries and conditions affecting the rotator cuff. According to an article published by Pedowitz and Marsh (2012), non-surgical monitoring provides a coherent platform for exercises aimed at rotator cuff disorders and is a significant alternative to surgery. (Pedowitz & Marsh 2012.)

Nonsurgical treatment alternatives for rotator cuff tears such as repairments, surgical risks, or lack of functional improvement is linked to various therapeutic regimens and evaluation. For instance, rotator cuff strengthening exercises and its evaluation with the scoring method introduced by Constant and Murley (1987) allowed to derive evidence that guides practice in dealing with rotator cuff tears. (Goldberg, Nowinski & Matsen 2001.)

A study performed by Kukkonen et al. (2014) revealed that degeneration affects the ability of tendons to heal, so torn tendons may not heal at all despite surgical repairs. Moreover, the likelihood of repetitive post-operative tears is high. Thus, acromioplasty and conservative treatment is an effective alternative to surgical tendon repair. The study aimed to conduct trial exams to compare and contrast the effects of physiotherapy, acromioplasty and physiotherapy and rotator cuff repair, acromioplasty and

physiotherapy to treat rotator cuff tears. It was conducted among patients aged above 55 years. The results portrayed that the exercise protocol recommended by a physical therapist was standardized and included exercises that improved glenohumeral motion and active retraction of the scapular followed by the initiation of static and dynamic exercises and later resistance and strength were facilitated for the patient. All of this took approximately six months and involved outpatient reference to more physical therapy at an outpatient health facility. In the second case, acromioplasty was done arthroscopically by smoothing the inferior surface of the acromion from a posteroanterior direction through subacromial debridement and an arthroscopic acromioplasty. At times, a biceps tenotomy was done and the recovery period involved reference to the physiotherapist for guidance to exercise that enhance the capacity of glenohumeral motion and retraction of the scapula. In the third scenario, the surgical component was the same and this was followed by immobilization of the arm with a sling for a few weeks and rehabilitation as of the first scenario. This trial examination demonstrates the role of physical therapy; physical therapy alone is effective. (Kukkonen, Joukainen & Lehtinen 2014.)

Careful management of rotator cuff injuries must contain a thorough plan for rehabilitation. Conservative management of rotator cuff injuries should focus on reducing pain, inflammation, swelling and restoring the normal range of motion. This is done with ice, electrical stimulation, laser or other local physical modalities and manual therapies. Manual therapies include joint mobilization and passive range of motion can help to restore normal joint kinematics and improving glenohumeral joint range of motion. Mobilization techniques are performed to reduce pain and reduce muscle guarding to enhance the range of motion. Exercises to reduce joint stiffness and improve range of motion through rehabilitation and exercises. (Weiss, Wang, Hendel, Buzzerio & Rodeo 2018.)

Therapeutic exercises are typically the foundation of a conservative treatment plan for rotator cuff tears. The main objectives of therapy are pain reduction and function enhancement and to rectify the physical deficits that are known to cause pain and dysfunction. This is accomplished by resistance training. Shoulder impingement syndrome and rotator cuff tears are produced by distinct sources, although their clinical manifestations are strikingly similar. Clinically, symptomatic rotator cuff tears are characterized by pain with abduction or painful arc syndrome, as well as physical impairments such as weakness and dysfunction of the rotator cuff and scapular muscles, tightness of the posterior capsule and other soft tissues, and postural

abnormalities. A full patient assessment that includes examination and palpation, measurement of range of motion and strength, and provocative shoulder testing for possible impingement syndrome and glenohumeral instability is essential in order to properly design a suitable training regimen. Shoulder discomfort may be caused by a problem in another region of the body. Thus, it is vital to rule out neck and elbow problems as well. The fundamental objectives of therapy are to restore a complete, pain-free range of motion, as well as flexibility, muscular balance, and control and stability of the scapulothoracic and glenohumeral muscles. The patient must be made aware of potentially aggravating postures and movements, such as reaching above, and given instructions on how to prevent or reduce the recurrence of their symptoms. (Peter et al. 2016.)

By strengthening the rotator cuff muscles, it is possible to avoid tendon impingement and compression on the coracoacromial arch. The humeral head must be positioned and stabilized adequately inside the glenoid fossa. In healthy shoulders, translation of the humeral head relative to the glenoid fossa occurs, and the coordinated action of the rotator cuff muscles ensures that it remains within appropriate limits. When the rotator cuff is torn, it is feasible for the destabilizing force produced by the deltoid muscle to work unopposed on the humeral head during arm elevation. This causes abnormal superior translation of the humeral head onto the glenoid fossa. In addition, since a torn supraspinatus cannot generate abduction torque at the glenohumeral joint, the deltoid may have to exert more effort to raise the arm in order to compensate for the torn supraspinatus. To effectively cure rotator cuff injuries, strengthening exercises should target the uninjured rotator cuff muscles. These workouts should begin with low-intensity exercises and grow in difficulty as the patient's tolerance allows. Due to its role in sustaining active external rotation when the supraspinatus and infraspinatus are impaired, the rehabilitation approach for major rotator cuff injuries must include teres minor muscle training. (Peter et al. 2016.)

Regiments like strength-building exercises, endurance-building exercises, stabilization exercises, and sport-specific training must be included towards later stages of rehabilitation. Training within a scheduled time frame must be focused on back to the sport at the end stage and therefore must contain exercises that cater particularly to the demands of the specific sport and the position of the individual in the team. The player must be evolved behind into ample weight exercise training with thorough affiliation between the medical, restoration, and courage and servicing faculty. Endurance

exercise must handle both upper bodies snatching workouts and upper- body mashing workouts in expansion to the strength of the body. Moreover, analgesic therapies are beneficial for cognitive-emotional process like catastrophizing. Thus, they are cognitive behavioral therapies and mostly are linked to effects that may not be linked to physical rehabilitation. (Peter et al. 2016.)

Workouts related to upper extremity plyometrics can be commenced and had been demonstrated to become helpful for enhancing proprioception, kinaesthesia, and improving the efficiency of the capacity of rotator cuff muscles. Plyometric exercises require voluntary muscle activation to pretension muscles during eccentric loading along with reflexive activity leads to muscle spindles and increased production of the force of the muscle. These exercises facilitate joint proprioception and kinesthesia. To achieve optimal power transfer, the amortisation phase, which is separate from the time it takes to move from the elliptic phase to the tangential phase has to be kept to a minimum. Plyometric workouts for theupper extremity typically encompass throws which could be evolved from drills in two-hand to one-hand, whilst being executed in a mixture of circumstances. (Swanik et al. 2002.)

3 Aims and methods

3.1 Aim

The aim of this thesis is to investigate the benefits of therapeutic exercises for rotator cuff injuries among cricket players.

3.2 Search Strategy

The approach for searching using many key searches with keywords and phrases was used to identify suitable articles for the modified literature review. Electronic databases in the process of data collection such as Pub Med, CINAHL, Medline, ScienceDirect and manual searches were used. Inclusion and exclusion criteria were defined for this literature review (Refer Table 1).

Search words: “Rotator cuff injury”, “physical therapy”, “physiotherapy”, “rotator cuff tear”, “rehabilitation”, “therapeutic exercise”, “training, cricket”, “cricket player”, “cricketer”, “over-use”, “overhead injuries”, “shoulder joint”, “throwing”.

Table 1: Inclusion and Exclusion Criteria

	Inclusion Criteria	Exclusion Criteria
Date of Publication	Articles published following the year 2000	Articles published before the year 2000
Language of Publication	English	Languages other than English
Method	Publications included are specific to the topic and similar studies on other sports were also strictly relevant to the topic.	Publications excluded were non-specific to the topic and similar studies on other sports that were irrelevant to the topic
Contents	Therapeutic exercises, rehabilitation, cricketplayers, benefits of therapeutic exercises, rotator cuff injuries/ tears	Articles not related to therapeutic exercises and articles related to other sports

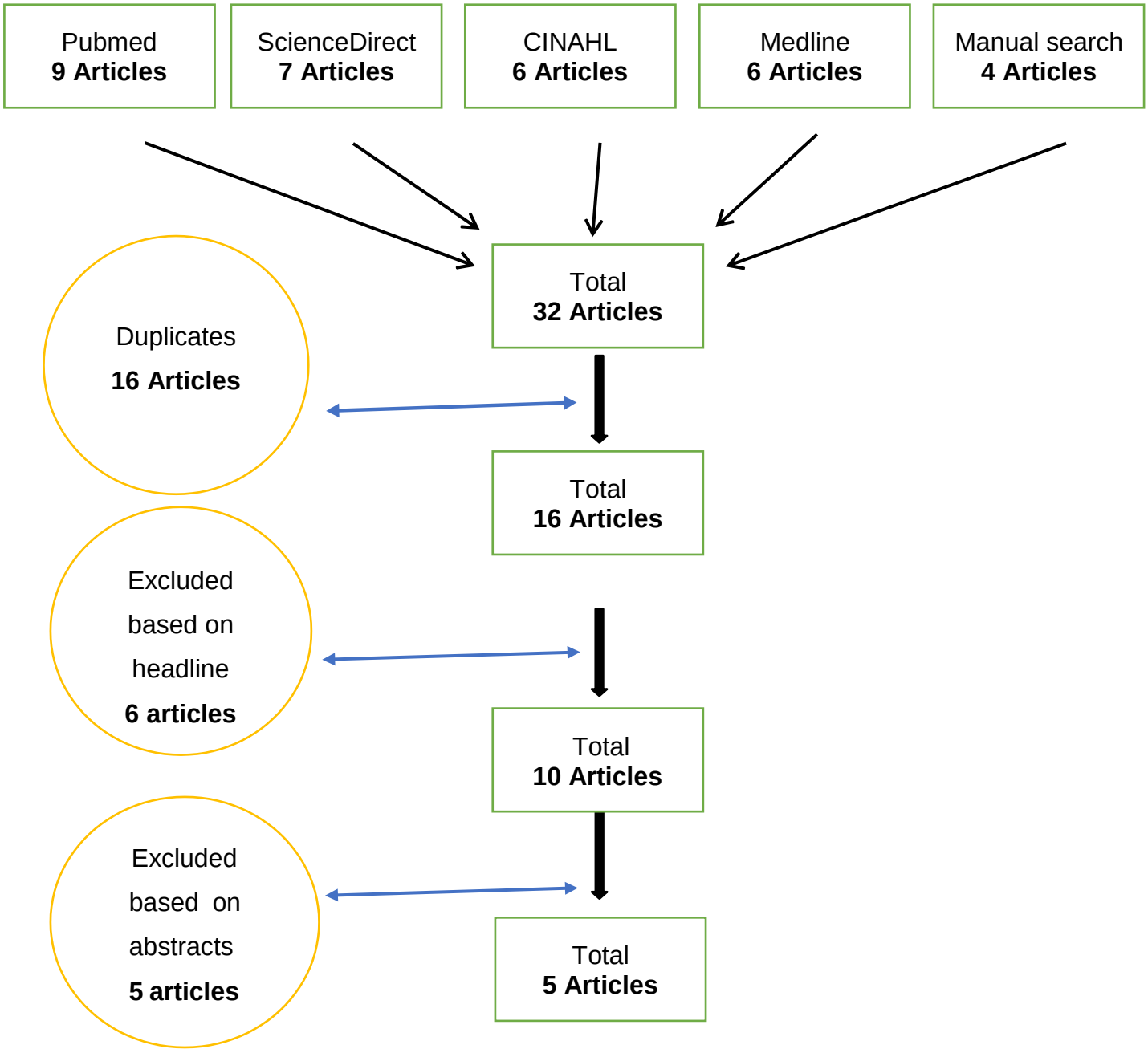

Figure 1: The flowchart of bachelor's thesis

Thirty-two articles were extracted from PubMed, ScienceDirect, CINAHL, Medline and manual searches. After duplicates have been removed, the count reduced to sixteen articles. Once the abstracts of the remaining sixteen publications were reviewed and filtered, six publications were revealed to be irrelevant and thus removed becauseof their headlines. They did not suit the topic, which left just ten articles. At the end, five publications were removed based on the abstract (Figure 1).

4 Results

Eventually, five articles were chosen for the literature review. The results derived relied mostly on publications from the PubMed database, with one article from Research Gate.

Table 2. Results and conclusions of the final five articles.

Authors and Year	**Purpose of the Study**	**Methods**	**Participants**	**Results and Conclusion**
(Weiss et al. 2018)	Assessed the conservative management of rotator cuff injuries. These injuries should include a comprehensive rehabilitation program with therapeutic exercises being one of the main focuses whereby there are collaborative management strategies. They can range from rehabilitation to operative intervention with pre-operative and post-operative rehabilitation	Literature Review	Elite athletes diagnosed with rotator cuff injuries	Physiotherapy assistance in the form of therapeutic exercises aids in restoring active range of motion, reducing pain and inflammation, returning the shoulder to its pre-injury level of function, and normalizing range of motion with normal shoulder kinematics in the early phase of rehabilitation. It has been shown that joint mechanoreceptors are activated during motions involved in a closed kinetic chain, leading to the co-contraction of the rotator cuff and the scapular stabilizer. If the therapeutic exercise-based rehabilitation programme is gradual, functional, and sport-specific, the athlete will gain significantly. This will

	using therapeutic exercises and are guided by the size of the tear, time of the season, sport, performance limitations, and presence of concomitant pathology guided by the size of the tear, time of the season, sport, performance limitations, and presence of concomitant pathology.			facilitate the athlete's preparation for his or her comeback to competition.

(Sepp et al. 2016)	Identified the right assessment of a throwing athlete's shoulder. This involves not only a thorough knowledge of the kinematics and skeletal adaptations that occur while throwing, but also the initiation of a therapeutic exercise-based rehabilitation programme for the best potential result.	Review	Athletes who play a sport with a throwing motion	Therapeutic exercise, with a focus on tissue-specific stretching and strengthening of functioning rotator cuff muscles should be the initial treatment for throwing athletes with a rotator cuff tear. Due to the substantial positive effect that such exercises have been shown to have on the treatment of shoulder injuries and rotator cuff injuries in throwing athletes, allowing damaged tissue to heal, reducing pain and inflammation, and restoring range-of-motion limitations to pre-injury levels are all aspects of rehabilitation.

(Peter et al. 2016)	Evaluated the efficacy of conservative treatment, such as therapeutic exercises, as an initial management approach for patients with full-thickness rotator cuff tears, and to evaluate the efficacy of exercise rehabilitation by physiotherapists for managing partial and full-thickness rotator cuff tears by addressing weakness and functional deficits.	Literature Review	Patients who have had an injury to their rotator cuff, irrespective of whether or not they are now suffering any discomfort.	For conservative treatment of rotator cuff injuries, a therapeutic exercise based programme has been demonstrated to be effective, in patients with symptomatic full-thickness rotator cuff tears. These stages included a broad range of motion, and advanced strengthening, as well as enhanced proprioception. exercise therapy when included as part of a treatment program. The goals of reducing initial distress and swelling, increasing shoulder movement, and working on stability, strength, power, and neuromuscular control. In addition, shoulder mobility was intended to increase.

(Ainsworth & Lewis 2007)	Evaluated the indication for the efficacy of therapeutic exercise for the treatment of rotator cuff injuries of the total thickness.	Systematic Review	Patients were adults with full-thickness, severe, or inoperable rotator cuff tears. At least one treatment group was required to get exercise therapy for the treatment of this disorder.	For the treatment of full rotator cuff tears, it has been shown that therapeutic exercise is either effective on its own or as part of a non- surgical therapy option that is given as an alternative to surgical procedures. The results also indicate that it is reasonable to prescribe therapeutic exercise to patients who have been scanned and diagnosed with a rotator cuff tear as an effective type of conservative therapy, regardless of the cause of their shoulder pain. This is because the findings show that therapeutic exercise is more successful than other types of conservative therapy.

(Kuhn et al. 2013)	Assessed the efficiency of therapeutic exercises as a non-surgical intervention for treating numerous traumatic perforations located across the whole of the rotator cuff.	Cohort Study	Participants currently having significant atraumatic rotator cuff injury's with full thickness tears.	Findings from this study on the efficacy of therapeutic exercise indicate in many cases that the rotator cuff tears that are caused by non-traumatic injuries may be repaired without the need for surgical intervention. The creation of an exercise programme for rotator cuff injuries was precipitated by research into the efficacy of physiotherapy for this ailment. Patients have reported tremendous results with a training regimen comprising of three sessions of strengthening exercises per week, together with daily stretches and range-of-motion activities. After nonoperative treatment with physiotherapy for atraumatic full-thickness rotator cuff injuries, validated patient-reported outcome ratings showed significant recovery.

From the total number of articles utilized to obtain the results, all the articles describe the use of therapeutic exercises as a conservative treatment.

Therapeutic exercise as a conservative treatment and its efficacy: Conservative management of a torn rotator cuff in the form of therapeutic exercises may be a suitable primary treatment for rotator cuff injuries, since it has been shown to alleviate all major symptoms, including inflammation and pain. Nearly two-thirds of patients responded well to therapeutic exercises as opposed to surgical intervention, indicating that conservative therapy may be a viable alternative to surgical surgery. (Peter et al. 2016.) According to Weiss et al. (2018) therapeutic exercises are a non-invasive and conservative treatment option for rotator cuff injuries. It has the potential to be highly beneficial in restoring the athlete to the state before they had the injury, in which they were pain-free.

Since the kinetic chain plays such a significant part in the throwing motion, it is vital to develop a training regimen that not only develops each link in the chain but also ensures that there is a seamless transition between each one. The athlete must gain the information essential to train with equal emphasis on the agonist and antagonist muscles of the upper body, lower body, and trunk. As a nonsurgical approach to treating their injuries, it has been recommended that athletes who participate in overhead throwing follow a gradual rehabilitation plan. (Sepp, Dirk & Peter 2016.)

Rotator cuff injuries should be addressed with therapeutic exercises such as rotator cuff-specific strengthening exercises, active and passive range of motion and muscle strengthening activities, proprioception, and home exercise treatment programmes. These elements should all be included in the rehabilitation strategy for the patient. Nearly eighty percent of patients who undertake non-surgical intervention in the form of therapeutic exercises for rotator cuff injuries report acceptable or outstanding symptom improvement. (Ainsworth & Lewis 2007.)

In the majority of instances, rotator cuff disorders may be properly rehabilitated with the use of rehabilitative exercises without the need for surgical intervention. The recovery process consists of several phases. Successful rehabilitation involves identifying the injury's underlying causes. Using a phased approach to rehabilitation enables a more favorable outcome by giving a more practical, multi-centered approach. With the ultimate objective of restoring shoulder strength to pre-injury levels, the complexity of the exercises and the volume of the pressures put on the shoulder joint increase steadily from one stage to the next. (Kuhn et al. 2013.)

The static and dynamic aspects of rotator cuff injuries: Stability of the shoulder is the result of a complicated interaction between static and dynamic shoulder restrictions, which is one of the most important causes of rotator cuff tears. Several clinical complications, including rotator cuff tears and shoulder dislocation, are conceivable in the event that these limits are compromised. (Michael & Curtis 2005.)

Static exercises, a subset of therapeutic exercises in the form of isometric movements, enable athletes to restore their normal shoulder movement range, strength of the shoulder, and functional mobility. When inflammation inhibits shoulder mobility, such as in the early phases of rotator cuff injury, this form of exercise can be very useful. (Gerald & Martin 2000.)

Dynamic exercises, which are a vital component of therapeutic exercises, improve the glenohumeral joint's movement range, agility, and acceleration. The glenohumeral joint moves through its complete movement range when the shoulder muscles are contracting actively. (Frederick et al. 2015.)

In general, dynamic and static exercises act in tandem to increase both muscle strength and joint mobility. In the initial stages of rotator cuff recuperation with therapeutic exercise, static movements are appropriate. The movement range and joint flexibility is still insufficient at this stage. Both the muscle and the joint are strengthened without requiring the patient to do any unnecessary actions. When the patient makes progress in expanding their range of motion and flexibility, dynamic exercises assume a larger degree of importance since they are the most effective at healing the components surrounding the glenohumeral joint and specifically help in rebuilding muscle. When a patient has attained their maximal degree of recuperation, they may resume weight-bearing exercises, which stretch and strengthen their muscles and joints. (Peter, Erik, Katharine, Kine & Joshua 2016.)

5 Discussion

A rotator cuff injury is a traumatic condition that may have a substantial influence on the quality of life of a cricket player. Injuries to the rotator cuff that result in symptoms have a substantial social and an economic burden. Therapeutic exercise has emerged as a typical strategy for treating and managing rotator cuff injuries, both partial and full thickness, by addressing the weakness and functional limitations often identified among patients with sore shoulders. (Dhillon, Garg, Sony, Dhillon & Prabhakar 2012.) In individual patients, it is important to investigate the possibility of treating tendinopathy of the rotator cuff, in complete tears, and possibly even minor comprehensive tears without resorting to surgery and in additionally should be evaluated for the potential of non-operative treatment, which may involve an extensive exercise rehabilitation programme. Acute tears in younger athletes are more likely to benefit from surgical intervention, but full-thickness tears in individuals 30 and older with muscle atrophy and fattyinfiltration may benefit more from an activity-based rehabilitation programme. Despite the fact that the majority of patients benefit from conservative treatment, some may not respond favourably or quickly to it. When deciding on a conservative treatment strategy,it is vital to be aware that the reaction of the patient and the risk of symptom recurrenceinfluence the chance of a favourable outcome from exercise rehabilitation. (Ranson, Kerslake, Burnett, Batt & Abdi 2005.)

Bowlers and fielders are susceptible to shoulder injuries because of the repeated action of throwing over the shoulder (Dhillon, Garg, Sony, Dhillon & Prabhakar 2012). There are several methods for preventing overuse and impact injuries, in addition to other common types of injuries.Pre and post-game stretching, as well as fitness and technical training programs before the season starts which includes rest period and during the season, are essential injury prevention strategies. Cricket players may reduce their risk of shoulder injury by doing scapular stabilization and rotator cuff strengthening exercises after each throw, switching to a throwing technique that exerts less stress on the shoulder joint, and practicing this new technique before to a game.A combination of rotator cuff muscle imbalance and greater shoulder joint mobility may raise the risk of rotator cuff injury in cricket players. (Shaji & Chachra 2010.) A well-designed strength and flexibility training programme for players helps reduce shoulder injuries which are prevalent among cricket players in a significant manner. This evaluation is performed with the goal of assisting the athlete in a speedier recovery. The physiotherapist will regularly assess the patient's shoulder resilience which is the ability of the shoulder to recover rapidly and successfully

from stress, functional mobility, and the ratio of agonist to antagonist muscle strength in order to facilitate the athlete's recovery from shoulder trauma. If a player's shoulder condition has fully healed, he or she may resume gameplay. (Lee & Candice 2016.)

In conclusion, in the rehabilitation of a rotator cuff injury, cricket players can benefit from a combination of therapeutic exercises that assists in strengthening the muscles surrounding the shoulder and restoring appropriate shoulder movements by striving to strengthen the surrounding shoulder muscles in combination with pain reduction, range of motion restoration, postural training and shoulder reconditioning.

6 References

Ainsworth, R. & Lewis, J.S. 2007. Exercise therapy for the conservative management of full thickness tears of the rotator cuff: a systematic review 41.200-210. < https://www.researchgate.net/publication/6540666_Exercise_therapy_for_the_conservative_management_of_full_thickness_tears_of_the_rotator_cuff_A_systematic_re- view >. Accessed on June 11th 2022.

Akhtar, A. & Richards, J. & Monga, P. 2021.The biomechanics of the rotator cuff in health and disease 8.150–6. < https://www.sciencedirect.com/science/article/abs/pii/S097656622100241 1>. Accessed on June 8th 2022.

Burkhart, S.S. & Morgan, C.D. & Kibler, WB. 2003. The disabled throwing shoulder: spectrum of pathology part II: evaluation and treatment of SLAP lesions in throwers 19(5):531–539 < https://nhg-kba.nl/pluginfile.php/404/mod_data/content/147/The%20Disabled%20Throwing%20Shoulder.pdf > Accessed on June 22nd 2022

Collin, P. & Matsumura, N. & Lädermann, A. & Denard, PJ. & Walch, G. 2014. Relationship between massive chronic rotator cuff tear pattern and loss of active shoulder range of motion 23 1195–1202. <https://pubmed.ncbi.nlm.nih.gov/24433628/>. Accessed on June 15th 2022.

Constant, C.R & Murley, A.H 1987. A clinical method of functional assessment of the shoulder. Clinical Orthopedic 214 160-164. <https://pubmed.ncbi.nlm.nih.gov/3791738/> Accessed 30th November 2022.

Dhillon, M.S. & Garg, B. & Soni, R.K. & Dhillon, H. & Prabhakar, S. 2012. Nature and incidence of upper limb injuries in professional cricket players a prospective observation. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3520788/>. Accessed on 27th May 2022.

Edwards, R. & Dworkin, R. & Sullivan, M. & Turk, D. & Wasan, A. 2016. The Role of Psychosocial Processes in the Development and Maintenance of Chronic Pain. The Journal of Pain 17 (9) T70-T92. <https://pubmed.ncbi.nlm.nih.gov/27586832/> Accessed 30th November 2022.

Ellman, H. (2014). Diagnosis and treatment of incomplete rotator cuff tears. 254 64–74. <http://www.achot.cz/dwnld/achot_2014_4_256_266.pdf>. Accessed on June 10th 2022.

Engstrom, C.M. & Walker, D.G. & Pars, 2007. Interarticularis stress lesions in the lumbar spine of cricket fast bowlers 39. 28–33. <https://pubmed.ncbi.nlm.nih.gov/17218880/ >. Accessed on June 15th 2022.

Frederik, O. & Lambers, H. & Jos, J.A.M.R. & Rinco, C.T.K & Pepijn, J.M.E. & Robin, E.W. & Esther, RI. & Inge, A.S. & Ronald, L. D.2015. Comparing surgical repair with conservative treatment for degenerative rotator cuff tears: a randomized controlled trial 25.1274–1281. <https://share.internxt.com/d/sh/file/41f1c987dbe8acc82878/c50e4e2ede2178dd5a1b1fe48a15908d7201356d5789e831712a7b1e66c4213a >. Accessed on June 6th 2022.

Gerald, R. & Martin, K. 2000. Management of Rotator Cuff and Impingement Injuries in the Athlete. 35(3): 300–315. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1323393/>. Accessed on June 14th, 2022.

Gibbs, D.B. & Lynch, T.S. & Nuber, E.D. & Nuber, G.W. 2015. Common shoulder injuries in American football athletes 14.413–4190. <https://pub-med.ncbi.nlm.nih.gov/26359844/>. Accessed on June 20th, 2022.

Goldberg, B.A. & Nowinski, R.J. & Matsen, F.A. 2001. Outcome of non-operative management of full-thickness rotator cuff tears 382.99–107. < https://journals.lww.com/cli-northop/Fulltext/2001/01000/Outcome_of_Nonoperative_Management_of.15.aspx>. Accessed on June 23rd, 2022.

Hackney, R.G. (1996). Advances in the understanding of throwing injuries of the shoulder 30. 282–288. <https://pubmed.ncbi.nlm.nih.gov/9015587/>. Accessed on June 18th, 2022.

Kuhn, J.E. & Dunn, W.R. & Sanders, R. 2013. Effectiveness of physical therapy in treating a traumatic full-thickness rotator cuff tears: a multicenter prospective cohort study 22(10).1371–1379. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3748251/> Accessed on June 23rd, 2022.

Kukkonen, J. & Joukainen, A. & Lehtinen, J. 2014. Treatment of non-traumatic rotator cuff tears: A randomized controlled trial with one-year clinical results 96.75–81. <https://pubmed.ncbi.nlm.nih.gov/24395315/>. Accessed on June 28th, 2022.

Michael, M.R. & Alan, S.C. 2013. Microinstability of the shoulder in the overhead athlete 8(5): 601–616. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3811734/>. Accessed on June 8th, 2022.

Nag, H. & Murugappan, K.S. &Chandran, P.S.M. & Mohan, M.R. & Das, R.B. 2009 Little leaguers' elbow in a pubertal cricket player, 19: 97–99 <https://reposi-tory.nie.edu.sg/bitstream/10497/18020/1/CSMR-14-6-455.pdf > Accessed on June 12th 2022

Nicolozakes, C.P. & Coats-Thomas. & M.S, Ludvig, D. & Seitz, A.L. & Perreault, E.J. 2021. Translations of the humeral head elicit reflexes in rotator cuff muscles that are larger than those in the primary shoulder movers .15:796472. <https://pub-med.ncbi.nlm.nih.gov/35185484/>. Accessed on June 12th, 2022.

Olivier, B. & Lala, B. & Gillion N. 2020. The cricketer's shoulder and injury: Asymmetries in range of movement and muscle length. South African Journal of Physiotherapy, 76 (1), 754. <https://pubmed.ncbi.nlm.nih.gov/32285016/> Accessed 30th November 2022.

Orchard, J. & James, T. & Alcott, E. & Carter, S. & Farhart, P. 2001.Injuries in Australian cricket at first class level 1995/1996 to 2000/2001 36.270–274. < https://pub- med.ncbi.nlm.nih.gov/12145117/ >. Accessed on 27th May, 2022.

Parsons, I.M. & Apreleva, M. & Fu, FH. & Woo, SLY. 2002 The effect of rotator cuff tears on reaction forces at the glenohumeral joint 20(3):439–46 <https://onlineli- brary.wiley.com/doi/epdf/10.1016/S0736-0266%2801%2900137-1> Accessed on June 6th 2022.

Patte, D. (1996). Classification of rotator cuff lesions 254.81–86. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5367545/ >. Accessed on June 15th, 2022.

Pedowitz, R. A & Marsh J 2012. Motor Skills Training in Orthopaedic Surgery: A Paradigm Shift Toward a Simulation-based Educational Curriculum. Journal of th American Academy of Orthopaedic Surgeons, 20 (7) 407-409. <https://pubmed.ncbi.nlm.nih.gov/22751159/> Accessed 30th November 2022.

Peter, E. & Jay, E. & Brendan, J. & Gev, Bhabra. & Tim, Ackland. & Allan, Wang. 2016. Exercise rehabilitation in the non-operative management of rotator cuff tears: a review of the literature 11(1): 102–112. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4827371/ >. Accessed on June 12th, 2022.

Peter, J. M. & Erik, JG. & Katharine, J. W.,Kine, K., Joshua, A.2016 Alterations in glenohumeral kinematics in patients with rotator cuff tears measured with biplane fluoroscopy 446-451. < https://drmillett.com/wp-content/uploads/2017/04/alterations-glenohumeral-kinematics-patients-rotator-cuff-tears-measured-biplane-fluoroscopy.pdf>. Accessed on June 18th, 2022.

Pote, L. & Candice, J. C.2016. Strength and Conditioning Practices of University and High School Level Cricket Coaches: A South African Context 8.150–6. < https://www.sciencedirect.com/science/arti- cle/abs/pii/S097656622100241 1>. Accessed on June 25th, 2022.

Prabhakar, S. & Pandey, R. 2015. Shoulder Injuries in Cricketers. Journal of Postgraduate Medicine, Education and Research, 49 (4) 194-196. <https://www.jpmer.com/doi/JPMER/pdf/10.5005/jp-journals-10028-1174> Accessed 30th November 2022.

Ranson, C.A. & Kerslake, R.W. & Burnett, A.F. & Batt, M.E, & Abdi S. 2005. Magnetic resonance imaging of the lumbar spine in asymptomatic professional fast bowlers in cricket 87.1111–1116. <https://pubmed.ncbi.nlm.nih.gov/16049249/>. Accessed on June 15th, 2022.

Sepp, B. & Dirk. K. & Peter, M. 2009.Shoulder Injuries in the Throwing Athlete 91(4):966-78. <https://sci-hub.ru/10.2106/JBJS.H.01341> Accessed on 29th May, 2022.

Shaji, M.S.J. & Rohit, C. 2010. Comparative analysis of stretching vs mobilization on posterior shoulder tightness in cricketers 4.75–79. < https://ijpot.com/scripts/IJPOT%20JAN-MARCH%202010.pdf#page=79>. Accessed on June 17h, 2022.

Stretch R.A. (2003). Cricket injuries: a longitudinal study of the nature of injuries to South African cricketers 37. 250–253. < https://bjsm.bmj.com/content/37/3/250.long >. Accessed on 27th May, 2022.

Stretch, R.A. & Ryan, PR. & Nicole. & Allan. 2009. Injury patterns of South African provincial cricket players over two seasons original research article 21.4. < https://journals.co.za/doi/abs/10.10520/EJC67045 >. Accessed on 27th May, 2022.

Swanik, K.A. & Lephart, SM. & Swanik, C. & Lephart, S.P. & Stone, D.A. & FH F.2002. The effects of shoulder plyometric training on proprioception and selected muscle performance characteristics 11(6).579–586. <https://studylib.net/doc/10810655/the-effects-of- shoulder-plyometric-training-on-propriocep...>. Accessed on June 30th, 2022.

Torrens C. & López J.M. & Puente I & Cáceres E. 2007. The influence of the acromial coverage index in rotator cuff tears. Journal of shoulder and elbow surgery. 347-351. < http://public-files.prbb.org/publicacions/cfd9ff00-58a1-012a-a767-000c293b26d5.pdf >. Accessed on June 11th, 2022.

Tyler, J.B. & Gary F.U. & John, G.H. 2017. Classifications in brief: hamada classification of massive rotator cuff tears 475.2819–2823. < https://link.springer.com/article/10.1007/s11999-017-5340-7>. Accessed on June 11th, 2022.

Weiss, L.J. & Wang, D. & Hendel, M. & Buzzerio, P. & Rodeo, SA. 2018.Management of Rotator Cuff Injuries in the Elite Athlete. Current Reviews in Musculoskeletal Medicine. 102–112. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5825345/>. Accessed on June 6th, 2022