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Effects of physiotherapy in traumatic anterior shoulder instability

Literature review

Metropolia University of Applied Sciences

Bachelor of Health Care

Physiotherapy

Bachelor's Thesis

10th May 2023

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Title	Effects of physiotherapy in traumatic anterior shoulder instability
Number of Pages	24 pages
Date	10th May 2023
Degree	Bachelor of health care
Degree Programme	Physiotherapy
Instructors	Sanna Garam, Senior Lecturer Heini Maisala-McDonnell, Senior Lecturer

The anterior shoulder dislocation is the most frequently occurred type of dislocation of the shoulder joint, which is most often caused by trauma but can also be idiopathic. It is estimated that 1 - 2% of the general population will suffer from glenohumeral instability, and 98% of these are anterior instabilities caused by trauma. This thesis aims to investigate the effects of physiotherapy on traumatic anterior shoulder instability and related conditions such as subluxation and dislocation.

A modified literature review is used in this thesis, including randomized control trials, cross-sectional studies, systematic reviews, and cohort studies. PubMed, ScienceDirect, PEDro, and a manual search were used to select these articles. The selected articles all meet the inclusion criteria.

In accordance with the results, most studies used exercise therapy with or without other interventions such as electrical stimulation therapy, activity-based interventions, proprioceptive and range of motion exercises, and advising sessions. Among the studies, most of them were unable to conclude regarding effectiveness because of less evidence in the respective area of study. However, in most studies, exercise therapy focused on certain muscle groups that cause shoulder instability has shown significant improvements in stability.

In conclusion, exercise therapy can be used as rehabilitation for patients with traumatic anterior shoulder instability. This is to regain the muscle strength surrounding the shoulder joint and to minimize the risk of re-occurrence or developing secondary conditions. There is not enough evidence to conclude whether physiotherapy is more or less effective than other methods of rehabilitating patients with traumatic shoulder instability, such as surgical management or other conservative management approaches.

Key Words	Instability, anterior shoulder instability, shoulder anterior dislocation, physiotherapy, physical therapy

Contents

1 Introduction

Instability of the shoulders can be caused by a number of different pathologies or even occur idiopathically. The shoulder joint is vulnerable to such conditions due to its structure. The glenohumeral joint within the shoulder joint consists of one of the greatest ranges of movement among all joints in the body. Even with this ability it is considered to be one of the most unstable joints due to its anatomy. It is very often vulnerable to instability which can result in dislocation or subluxation of the joint. There are many structures that holds the shoulder joint together. The glenoid labrum, glenohumeral ligaments, surrounding muscles and tendons hold importance in this structure. Trauma, overworking, and conditions that weaken the structures surrounding the joint. This may have a possibility of leading into recurrent instability of the shoulder which is more common in the anterior direction. (Ladd, Crews & Maertz, 2021.)

It is estimated that 1% - 2% of the general population will experience glenohumeral instability during their lifetime. The youth population is more vulnerable to developing instability due to high chance of trauma and overuse. Among these instabilities 98% were anterior instability. Therefore, it is essential to understand the possibilities of the scope of physiotherapy to treat instability of the anterior shoulder. It is also crucial to investigate the success rate of physiotherapy interventions through statistics. This literature will provide evidence for future implications to treat anterior shoulder instability with higher success rates. (Hayes et al., 2002.)

According to Brophy and Marx (2009), shoulder instability is commonly treated with non-operative means such as physiotherapy initially and with surgical means if the condition recurs. There-fore, proceeding with surgical management of anterior shoulder instability will reduce the rates of re-occurrence of the condition, especially among the younger population. For this reason, it is debatable which method is more effective in successfully rehabilitating patients suffering from primary traumatic anterior shoulder instability.

2 Background

2.1 Shoulder instability pathophysiology

A significant amount of work is done by the negative intraarticular pressure to keep the humeral head in the glenoid cavity when the upper limb is in its normal position at the shoulder joint. In the shoulder joint capsule, there is an average volume of 28–35ml which holds a small amount of 2ml of synovial fluid in an average. According to current studies, the capsule of a shoulder joint with instability can expand in size than the average amount which can cause increased volume in the capsule. This can lead to laxity of the glenohumeral ligament which can also make the ligament thinner and weaker. In this circumstance a joint with shoulder instability shows a pressure of 150mmHg in the capsule in elevated position where shoulder capsule should maintain a pressure of 300mmHg at all times. When assessing instability, the reduction of capsular pressure can be used to indicate that the shoulder joint capsule is expanded. This causes the capsular volume to rise. Instability of the shoulder can be treated in a variety of ways. With conservative management showing success in 80% of cases, it is safe to proceed with non-operative management first (Itoi, 2004).

Among all possible dislocations, anterior dislocations are the most common. Due to the primary dislocation, the labrum and other structures holding the joint may be injured, causing it to loosen from the bony area of the glenoid and rebound more inferiorly. Meantime, the capsular ligaments will stretch and enlarge the capsule. This can cause shoulder dislocations repeatedly. The primary treatment for this condition is debatable. It is unclear whether surgical or conservative management should be used initially. Acute dislocations often lead to chronic impairments in young people (Van Kampen et al., 2013.)

According to Midtgaard et al., (2021), acute anterior dislocation of the shoulder is the most common type of dislocations occurs in the shoulder, frequently caused by trauma. As a result, the shoulder joint will be more unstable, leading to frequent dislocations and recurrent instability. Particularly among active young people, this is more common. A sling or brace is usually used to immobilize the injured joint for a number of weeks, based on the intensity of the injury. Exercises will follow the rehabilitation.

2.2 Anterior shoulder instability

The shoulder joint has the highest dislocation rate among all the joints in the body, which is up to 50 percent. The higher range of motion was found to be the reason for the higher risk of instability in the joint. As the joint is weak, there are many structures encompassing the glenohumeral joint to function improperly. These structures are known as stabilizing structures and conditions that affect one or more structures which cause instability in the shoulder joint. In order to understand the underlying cause of the instability, proper assessment, including history and examination, is essential. Instability can be treated with a broad range of interventions including rehabilitative and surgical. The first stages of shoulder instability are considered to be better treated non-operatively (Moya et al., 2021.)

In comparison to other joints of the body, the shoulder joint has a much greater range of movement, but it is also one of the most unstable joints, which can lead to traumatic anterior shoulder dislocations. Injuries cause shoulder instability at a rate of 1.7%, which in seen among the general population. Over 90% of all shoulder dislocations are caused by anterior shoulder instability. Males, contact athletic individuals and people with a history of trauma have a higher instability of the shoulder. The inferior glenohumeral ligament is among the most vital anatomical formations located in the shoulder joint. It can also be the leading cause of an anteriorly subluxed head of humerus while the shoulder is positioned, elevated to 90° and turned outwards. The most common incident that can cause shoulder instability is falling with extended arms while the shoulder is raised up and turned outward. In the above-mentioned trauma, the inferior glenohumeral ligament is the key restriction to forward movement of the humeral head. Trauma to this ligament and also to the anteroinferior labrum, which is known as a Bankart lesion, can result in injury. Bankart rupture is found in 90% of anterior shoulder dislocations caused by injuries. Repeated instability will weaken ligament structures, causing further instability (Dumont, Russell and Robertson, 2011.)

3 Aim and methods

3.1 Aim

This bachelor's thesis aims to investigate the effects of physiotherapy for traumatic anterior shoulder instability that leads into anterior subluxation and anterior shoulder dislocation.

3.2 Search strategy

The preliminary search for the bachelor's thesis is done by using PubMed, ScienceDirect and PEDro databases. To initiate the search, topic related search words were articulated and used to find related research articles. A number of selective search words were used to gather related articles as the primary search. The search words were, traumatic, shoulder, glenohumeral, anterior, instability, physiotherapy, physical therapy.

While conducting the primary search in PubMed, few changes were made due to the search engine. The search was done using two separate set of search words. The first was "Anterior shoulder instability" OR "anterior glenohumeral instability" AND Traumatic AND Physiotherapy and the second was "Anterior shoulder instability" OR "anterior glenohumeral instability" AND Traumatic AND "Physical therapy". The combined results of both will be used as the final primary result in PubMed search engine. For ScienceDirect and PEDro the search words were used in the format of "Traumatic" "anterior shoulder instability" "anterior glenohumeral instability" "Physiotherapy" "Physical therapy".

The literature review will be achieved using selected articles that are published only after 2016. The literature is conducted with the use of numerous types of studies that illustrate the effects of physiotherapy interventions on anterior shoulder instability, subluxation and dislocation. The inclusion and exclusion criteria are indicated by table 1.

Table 1 - inclusion criteria and exclusion criteria

	Inclusion criteria	Exclusion criteria
Publication date	Publication after year 2016	Publication before 2016
Publication language	Publication in English	Publications not in English
Method	All categories of study methods in the articles related to the topic	All categories of study methods in the articles not related to the topic
Contents	Physical therapy techniques for traumatic anterior shoulder instability, traumatic anterior glenohumeral instability	Manual therapy techniques, drug therapy related articles, articles related to the surgical interventions

The literature will be evaluated according to the inclusion criteria and a selected number of articles will be finalized and used to gather data. The collective data will be investigated on the effects of various physiotherapy interventions which will be used to treat shoulder instability and related conditions.

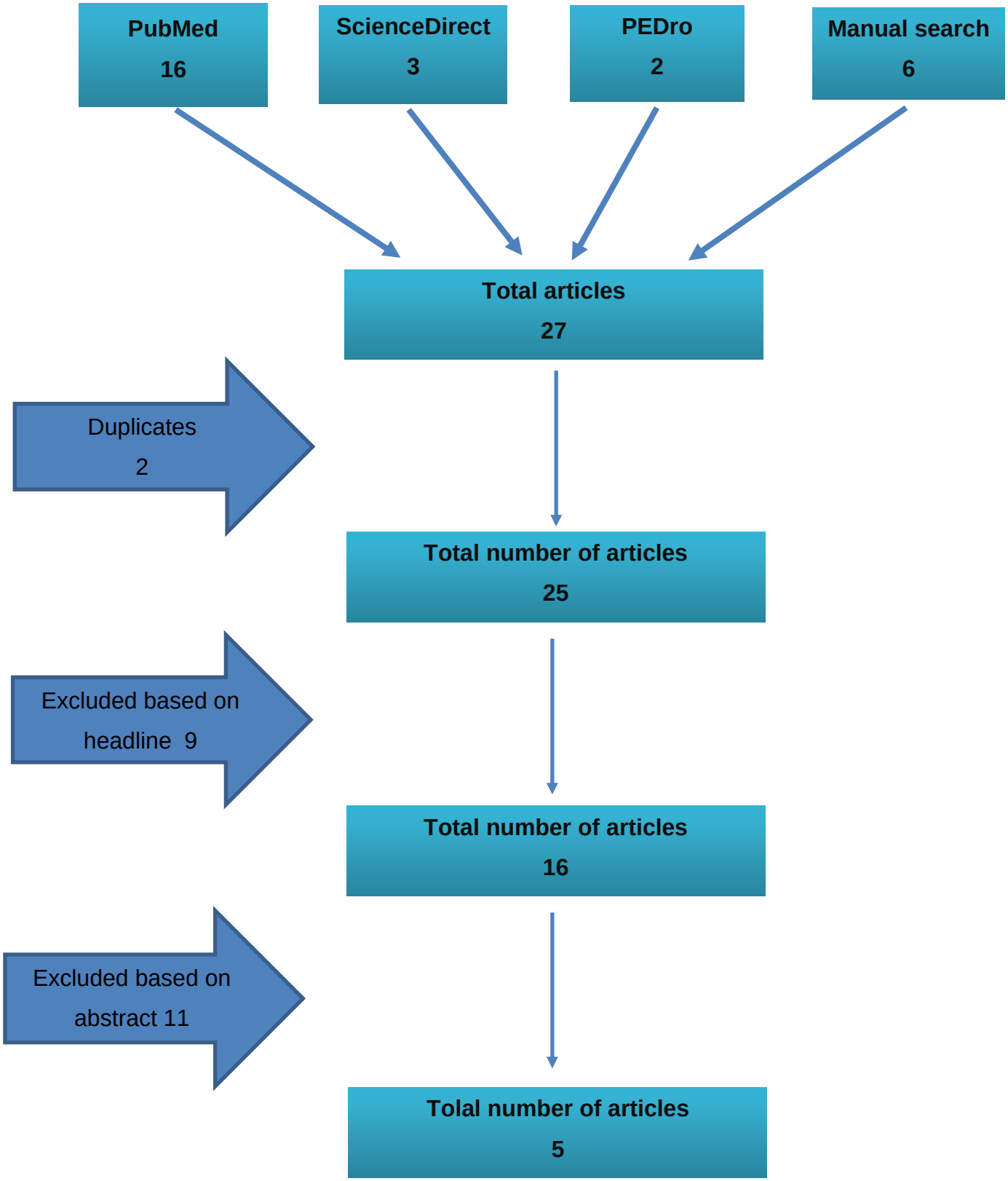

Figure 1 -: Flowchart of the search

To conduct the bachelor's thesis 5 articles were recognized through searching in databases.

4 Results

For this bachelor's thesis 5 articles were selected and finalized according to the selection criteria to assess which is displayed in the flowchart (Figure 1). These selected articles include 1 randomized control trial, 2 systematic reviews, 1 cross sectional study and 1 cohort study. All the articles are between the years 2016 to 2023. All of these studies have used physiotherapy interventions to discover the effects of physiotherapy on traumatic anterior shoulder instability. Some of the articles have compared the non-surgical management which includes physiotherapy with surgical management to discover which method is more successful.

Table 2 - table of results

Authors, Year and Place	Purpose of study	Methods	Participants	Intervention	Results and conclusion
(Eshoj et al., 2017)	analyze the effectuality and safeness of physical therapist overseeing, shoulder instability neuromuscular exercise (SINEX) compared to self-managed, home-based, standard care shoulder exercise (HOMEX) in subjects with anteriorly dislocated shoulder cause by injury.	Randomized control trial	18 – 39 years with acute traumatic primary anterior shoulder dislocation. 130 participance in total.	Shoulder instability neuromuscular exercises were implemented to one group and home bases, standard care shoulder exercises were implemented to the other. These exercises were continued as 45-minute sessions 3 times a week for 12 weeks.	Neuromuscular shoulder exercise (SINEX) followed for 12 weeks show better results compared to the standard care home exercise program (HOMEX) in enhancing patient reported activeness of the in subjects with traumatic anterior dislocation of the shoulder.
(Harada et al., 2020)	Investigate possible alteration on scapular muscular power in patients with anterior glenohumeral instability caused by injury.	Cross-sectional study	52 subjects of subjects of both male and female; 26 healthy and 26 with	Participance with glenohumeral instability showed with lower peak force of protraction and retraction throughout isometric and fast speed tests in the scapular plane;	People with anterior glenohumeral instability caused by injuries present muscular weakness of scapular protractors and retractors. Taking into account, the significance of the

			traumatic anterior glenohumeral instability.	and of isometric protraction in the longitudinal plane.	scapulothoracic muscles for the dynamic steadiness of the glenohumeral joint, reinforcing the strength of these muscles is suggested for rehabilitation of anterior glenohumeral instability cause by trauma.
(Braun and McRobert, 2019)	The advantages and disadvantages of different conservative rehabilitation methods to treat people after closed reduction of an initial anterior shoulder dislocation caused by injury.	Systematic review	6 randomized controlled trials and 1 quasi-randomized controlled trial with 704 subjects with dislocation of the shoulder.	Immobilization, rehabilitative interventions or both of rehabilitative intervention including guidance and education, active and passive mobilization, proprioception and stabilization exercises, scapular setting and trunk stability exercises.	The current proof is inadequate to inform the use of immobilization in outward in comparison with inward rotated position of the shoulder. No proof is available report on any other non-surgical interventions followed by closed reduction of anterior dislocation of the shoulder cause by trauma. However, evaluation of other interventions, including rehabilitation, is justified. There is a necessity for highly adequate, better-standard, well-reported randomized controlled trials with follow-ups that last long.

(Ma et al., 2017)	Evaluate the currently available evidence-based literature and concepts adjoining rehabilitation in patients with anterior shoulder instability injuries and surgical reconstruction.	Systematic review		Acute; pain-free submaximal isometrics, active-assisted locomotion in a restricted arc. Stabilization and proprioceptive exercises. Closed kinetic chain exercises – transferring weight opposing the wall/table within a safe radius. Rhythmic stabilization drills. Scapular exercises. Neuromuscular electrical stimulation. Intermediate; Isotonic, tube exercises along with side-lying ER and head down position rowing. Rotator cuff exercises above 90° of abduction. Closed kinetic chain exercises. hand-wall stabilization drills. Progressive push-up exercises. Additional scapula, core, and hip exercises.	Rehabilitation conducted following an anterior shoulder instability and anterior labral repair is paramount in restoration of the injured or operative shoulder function but also potentially minimizing risk of recurrent injuries in the future.

				Chronic; progressive resistance accompanied by isotonic exercises - bench press, seated row, and latissimus pull-downs. Plyometric exercises. Two-handed throwing drills - chest pass progress to one-handed throwing drills against a trampoline.	
(Teske et al., 2021)	compare index frequency, treatment option, and athlete disability followed by an occurrents of anterior or posterior shoulder instability in high school and collegiate athletes.	Prospective Cohort Study	58 athletes with a range of same age groups weights, and heights regardless of direction of instability. 30 athletes with anterior instability and	Patients were position in a sling for 6 weeks post-operatively. A standardized rehabilitation program was applied and formed with passive range of motion beginning at 3 weeks, active range of motion at 6 weeks, resistance exercise at 8 weeks, and weight-training at 10-12 weeks. Return to sport was permitted only after 6 months from date of surgery.	Results indicate athletes with anterior shoulder instability who showed with significant disability may hold a satisfactory result on return to play with either conservative or surgical intervention.

			28 with posterior instability.		

From the above articles mostly focused on investigating outcomes such a shoulder instability in anterior direction caused by trauma, anterior shoulder dislocation, and shoulder subluxation in some articles range of motion, muscle strength and control in shoulder joint and physical function were also among the outcomes that were investigated.

Traumatic anterior shoulder instability: out of 5 articles, 4 articles (Eshoj et al., 2017, Harada et al.,2020, Ma et al., 2017, Teske et al., 2021) has clearly indicated that traumatic anterior shoulder instability has been reduced. According to (Eshoj et al., 2017), the found that compare to a control group, standard care shoulder exercises (range 0-2100 with 2100 counted as the least favorable score) resulted the most benefit, this exercise program could possibly be the initial preference for patients with traumatic ASDs. Based on moderate quality evidence, the participates who engage in standard care home exercise program (HOMEX) exhibited improvements in patient-reported shoulder function in patients with traumatic ASDs. However, the improvement did not make it to the MCID required level. According to (Harada et al., 2020) People who have severe anterior glenohumeral instability have shoulder protractors and retractors muscular weakening. because of the significance of the scapulothoracic muscles in glenohumeral joint dynamic stability, strengthening these muscles would be recommended for the rehabilitation of traumatic anterior glenohumeral instability.

According to (Ma et al., 2017) rehabilitation following anterior shoulder instability and anterior labral repair is critical not only to reinstate the damaged or shoulder functions but also for possibly reducing future risk of injury recurrence. Whereas certain objective criteria like a range of movement and rotator cuff strength are thought to be critical to include throughout the rehabilitative phase following trauma and reconstruction, others like scapular rotation and strength are lacking evidence. The performance of functional trials in relation to taking percussions to avoid injuries is likewise unclear. Arriving back to sports following surgical reconstructions should be derived from a range of motion assessment, neuromuscular control recovery, strength, and functional assessment where minor evidence literature accessible.

According to (Teske et al., 2021) Athletes who suffers from anterior instability were more seemingly to make a main complaint of instability (70%), those who suffer from posterior instability reported a initial complaint of pain intervening in performance (96%). The main MOI was categorized as a contact event in both groups (77% vs.

54%, P =.06), as was the choice to continue with surgery (60% vs. 72%, P =.31). Athletes with anterior instability had a substantially higher primary impairment compared to those with posterior instability in nonoperative treatment (326.1 vs. 588.1, P =.001).

Anterior shoulder dislocation: out of 5 articles, 4 articles (Eshoj et al., 2017, Harada et al., 2020, Ma et al., 2017, Braun & McRoberts, 2019) has clearly indicated that anterior shoulder dislocation has been reduced. According to (Eshoj et al., 2017) Only a single level-II trials attenuated success in nonoperatively treating anterior shoulder dislocation caused by trauma patients (average age 19 years) by including 12 weeks of particular shoulder rehabilitation exercise. After an average of three years of follow-up, 15 of 20 patients (75%) did not redislocate their shoulder and had returned to sports after an average of three months. Thus, supervised and appropriate intensifying shoulder rehabilitation is obvious followed by anterior shoulder dislocation caused by trauma, but has yet to be shown in a high-level investigation like the current trial. Finally, regardless of therapy (operative or nonoperative), agitation of movement and reinjury, mood, social assistance, and self-motivation have all been demonstrated to have a significant impact on the choice to re-turn to sport.

According to (Harada et al., 2020) Repetitive anterior shoulder dislocations and lay the basis for conservative treatment recommendations. Furthermore, when patients look for orthopedic and/or physiotherapy care for an essential or recurring anteriorly dislocated shoulder. According to (Harada et al., 2020) in 5, 3, and 4 cases, frozen shoulder happened after the first dislocation, after the first subluxation, and with repeated dislocation, respectively. The average time between the accident and the initial appointment was 5.3 ± 3.4 months. (Range, 1-13 months). In 6, 2, and 4 cases, MRI showed Bankart lesions, bony Bankart lesions, and no obvious Bankart lesions, respectively. In 11 individuals, Hill-Sachs tumors were discovered. The MRI findings revealed no rotator cuff tear and made determining the existence of a capsular tear or humeral avulsion of the glenohumeral ligament problematic.

According to (Braun & McRobert, 2019) finding of this study following closed reduction, each investigation contrasted immobilization in external rotation (with or without an additional abduction section) as against internal rotation (the conventional technique). No other treatments or comparisons, such as rehabilitation, were evaluated in the study. All trials gave data for a one-year or longer follow-up; the most prevalent time period was two years or even extended. Due to the absence of blinding, all experiments were at risk of bias, most frequently performance and recognition biases. Two trials were at

significant risk of selection bias, and attrition bias impacted some trials for some outcomes. Uncertain whether external rotation immobilization reduces the risk of re-dislocation after 12 months or longer follow-up compared to internal rotation immobilization risk ratio (RR) 0.67, 95% confidence interval (CI) 0.38 to 1.19; 488 participants; 6 studies; very low certainty evidence). A dislocation in the internal rotation group occurred in a moderate-risk group with an indicative risk of 312 per 1000 individuals. This corresponds to 103 fewer (95% CI 194 fewer to 60 more) re-dislocations after immobilization in external rotation. As a con-sequence, this outcome includes the potential of an advantage for each intervention. Individually, the four trials (380 subjects) reporting on verified patient reported outcome measures for shoulder instability at a least of 12 months' follow-up found no indication of a clinically significant contrast between the two treatments. Ma et al., (2017) review was also included. According to their review, there is minimal data on the effectiveness of rehabilitation regimens in reducing the likelihood of recurrence following anterior shoulder dislocation.

Shoulder subluxation: out of 5 articles, only in 1 article (Harada et al., 2020) At the initial visit, the average age of the subjects was 42.5 years. Two subjects had surgery, which exposed scar-like anteroinferior capsule tissue. At a mean follow-up of 15 months, the range of movement, Rowe score, and University of California, Los Angeles score all im-proved considerably. The telephone survey indicated recurrent instability in 1 subject who was managed conservatively after an regular follow-up of 82 months; the average Oxford Shoulder Score and Oxford Instability Score were 46.4 and 43.2, respectively.

5 Discussion

This thesis was carried out with the intention of evaluating the effects of physiotherapy and physical therapy on traumatic anterior shoulder instability and conditions that occur as a result of instability such as subluxation and dislocation of the shoulder joint. This literature includes all types of physiotherapy interventions such as exercise therapy which includes strengthening, proprioceptive, neuromuscular, stabilization, range of motion and activity-based exercises as well as other interventions such as physiotherapy sessions with teaching, advising and supervising, neuromuscular electrical stimulation. Some studies state that non-surgical or conservative management which includes physiotherapy would be the first option to manage instability of the shoulder and some

studies state that it is debatable which method would be much effective between surgical and non-surgical management of anterior shoulder instability caused by injuries. (Itoi, 2004., Van Kampen et al., 2013.)

The neuromuscular shoulder exercise (SINEX) program showed stronger effects than the standard care home exercise program (HOMEX) when it comes to improving patient reported shoulder functions in individuals who suffered with anterior shoulder dislocations caused by trauma. The intervention group who followed the SINEX program reported higher effectiveness compared to the control group who followed the HOMEX program. Anyhow, the participants returning to sports after the rehabilitation was greatly affected by the fear of re-dislocation and the levels of motivation despite of the success rate of the treatments (Eshoj et al., 2017.)

According to the study conducted by Harada et al., (2020) Traumatic anterior shoulder instability can lead to secondary conditions such as frozen shoulder due to the damage and weaknesses caused by the trauma. Therefore, using conservative management, mainly physiotherapy, to improve the shoulder condition of patients with traumatic anterior or shoulder instability has shown success to a greater extent. Strengthening the scapula-thoracic muscles is recommended in the rehabilitation process for higher success rate of the treatment to traumatic anterior shoulder instability.

According to another study, the advantages and disadvantages of using physiotherapy as rehabilitation after closed reduction after an initial anterior shoulder dislocation has been evaluated. The treatments include active and passive mobilization as well as proprioception and stabilization exercises and scapular setting. Yet the study reveals that there was no sufficient evidence to conclude which treatment method was more effective among all the surgical and non-surgical methods used. Therefore, it was challenging to show which method out of surgical and non-surgical methods is the best option to use as the primary rehabilitation method (Braun and McRobert, 2019.)

A study conducted by Ma et al., (2017) has Assessed the modern existing evidence-based studies and theories containing rehabilitation for anteriorly unstable shoulder joint injuries and surgical fixation. For this various physiotherapy interventions including different types of exercises, neuromuscular electrical stimulation, drills and activities were evaluated in acute, subacute and chronic stages. This bachelor’s thesis illustrates that Rehabilitation of an anteriorly unstable shoulder joint and repair of the anterior labrum is extremely important to reduce the risk of repeating such conditions besides

from recovery. However, it has also mentioned the need for more evidence and therefore, more evidence-based studies should be conducted in the respective area to have a better understanding about the rehabilitation interventions.

The evidence illustrates that exercise therapy is widely used as a primary rehabilitation intervention following a traumatic anterior shoulder instability initially after a period of immobilization. It has been effective in improving the strength of muscles surrounded the shoulder joint which improves the stability the joint of and most importantly targeting specific muscle groups and performing certain goal-oriented exercise programs can effectively reduce the risk of repeating shoulder instability and related conditions.

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