

Effect of Exercise Therapy in Reducing Pain, Joint Range of Motion, and Functional Disability in Patients with Frozen Shoulder at Causa Primary Adhesive Capsulitis: A Systematic Review

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ABSTRACT

Background: Adhesive capsulitis is a condition of inflammation, adhesions and shortening of the joint capsule resulting in significant limitations in joint movement from active and passive movements, thus disrupting human mobility and activities. The severity of adhesive capsulitis varies from mild to severe pain. The prevalence of adhesive capsulitis is 2%-5% of the entire population and occurs more often in women than men. Adhesive Capsulitis treatment has many options, namely conservative and surgical. Exercise therapy has many benefits for the body, providing exercise therapy for adhesive capsulitis can improve disability, prevent increasing severity and optimize health status and motor function. This study aims to review the effectiveness of exercise therapy in reducing pain, increasing joint range of motion and functional ability in patients with primary adhesive capsulitis.

Subjects and Method: A literature search was carried out using PubMed, Google Scholar, and PEDro databases during 2013-2023. Population= patients with frozen shoulder at causa primary adhesive capsulitis. Intervention= exercise. Comparison= no exercise. Outcome= pain, joint range of motion, and functional disability. PRISMA was used as a writing rule and methodological quality was checked with the PEDro scale. The data were synthesized quantitatively.

Results: Seventeen studies describing exercise therapy in adhesive capsulitis were included in this study. Studies showed that exercise therapy reduced pain and increased range of motion and functional ability in patient with frozen shoulder.

Conclusion: Exercise therapy are able to reduce pain and increase range of motion and functional ability in patient with frozen shoulder.

Keywords: frozen shoulder, adhesive capsulitis, exercise therapy, range of motion, functional disability

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BACKGROUND

Movement is one of the basic human needs to support daily life, the upper limbs, especially the shoulder joint, have an important role in carrying out movement because the shoulder joint is the joint that has the widest range of motion and allows movement in all planes of motion. Injuries to the shoulder joint can affect stability and affect mobilization of the shoulder joint, so that mobility and activities involving the shoulder joint and hand will be disrupted. One of the disorders of the shoulder joint is frozen shoulder or adhesive capsulitis.

Frozen Shoulder *et causa* adhesive capsulitis is a condition of inflammation, adhesions and shortening of the joint capsule. It is a common musculoskeletal disorder characterized by progressive and painful restriction of the shoulder joint in a capsular pattern (Iqbal et al., 2020a; Widyaningrum et al., 2023). The main problem with adhesive capsulitis is pain, the pain is described as a dull ache that is not well localized, and can spread to the biceps muscle. Reaching above the head or behind the back can stimulate sensations of pain and stiffness (Nugraha et al., 2023; Ramirez, 2019). Apart from pain, limited movement ability is one of the problems with adhesive capsulitis. limited movement ability to reach above the head which hinders work and daily activities such as dressing and hair care (Mohammed et al., 2020).

The prevalence of frozen shoulder in women reaches 59-70%. Other data shows that in women it occurs 3.38 and in men 2.36 per 1000 people per year or 2.4 people per 1000 people for both sexes, especially middle age. The age of onset is 50 years old. There is a family history of disease in 9.5% (Bintang et al., 2021; Cohen & Ejnisman, 2015). Adhesive capsulitis is seen most frequently in patients with Diabetes Melli-

tus (27%), previous Myocardial Infarction (5%), Immobilization (5%), Stroke (4%) and sedentary workers (4%) (Rawat et al., 2017a).

Adhesive Capsulitis is classified into 3 stages. Stage 1, namely the painful stage, lasts from 3-9 months and is characterized by acute synovitis in the glenohumeral joint, stage II or stiffness or transition stage, namely the stage where there is pain and limited movement, lasts from 4-12 months. The final stage is stage III, namely the Thawing phase or thawing, namely the limitation without pain and lasts from 12-24 months (Elhafez & Elhafez, 2016).

Adhesive capsulitis treatment has many options, namely conservative and surgical. Conservative treatment includes Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), Intra-articular injections, exercise programs and Physiotherapy modalities (Balci et al., 2016). NSAIDs are the first-line treatment option in the painful initial clotting stage to relieve pain, but NSAIDs cannot be affected in the natural course of Adhesive Capsulitis and it cannot be confirmed that NSAIDs can be effective in the specific condition of Adhesive capsulitis (Cho et al., 2019). Although NSAIDs cannot be affected in the natural course of Adhesive Capsulitis but NSAIDs can be used to relieve symptoms in combination with other treatment modalities such as Physiotherapy. Providing physiotherapy in the early phase can prevent further damage or severity, with the main priority being the optimization of pain management. Several physiotherapy interventions have been used to overcome pain, limited mobility and to improve the function of adhesive capsulitis patients both in the long and short term. Consists of various modalities of physical therapy (PT) and exercise therapy. Management plan for an

exercise program with the goal of regaining and maintaining movement.

SUBJECTS AND METHOD

The research design used in this article is a Systematic Review. Articles used in this review had to meet several criteria. The criteria that must be met are 1). Research articles using the Randomized Control Trial, 2). Research articles published in English, 3). In full text, 4) Data is collected through online strategies. This study followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) rules. The criteria for respondents were respondents who were over 18 years old, had characteristics of primary or idiopathic Adhesive Capjualitis, and the

treatment was exercise therapy. The outcomes measured are pain, functional limitations and joint range of motion.

Data is searched using search engines related to health, health sciences, including the Physiotherapy Evidence Database (PEDro), Pubmed, Google Scholar. Using key words for searching, the keywords are: Adhesive Caplalus, exercise therapy, treatment, physical therapy, and physiotherapy. The search was carried out with the help of Google and was carried out manually to identify existing references. The literature search covered the period between 2013 and 2023. Published studies focused on the effectiveness of various exercises to reduce pain, joint range of motion and functional activity.

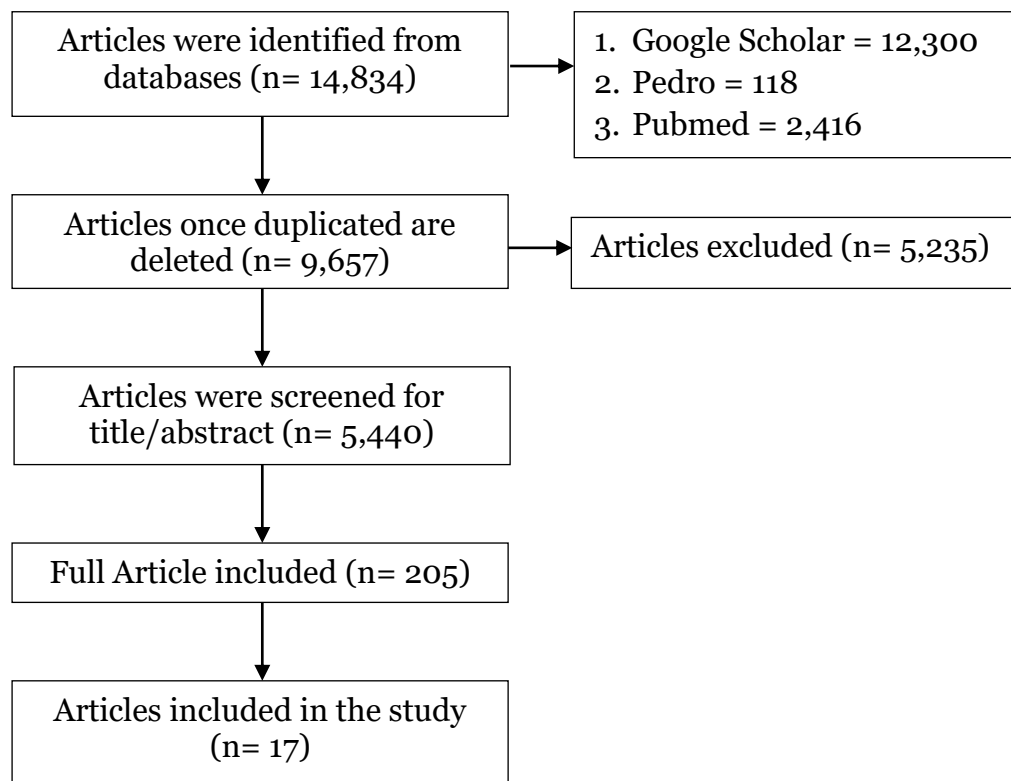


Figure 1. Review Flow Chart

Each author has their own role in writing this. The first author was the main author and carried out the tasks of reviewing, extracting and processing the

data. The second author has the task of directing the assignment, conducting reviews and extracting data. The author also clarified all data items and all assess-

ment tools so as to maintain consistency in data mining. For each trial, data were extracted regarding participants (age range, eligibility criteria), nature of the intervention, and data relating to outcomes.

RESULTS

The initial online search of 3 databases was 12,586 potential studies, selecting 17 articles that met the study inclusion and exclusion criteria. All selected paper articles use RCT studies with a 2013-2023 framework. The targets of the research investigation were respondents aged over 18 years

with the main research results being pain, limited range of motion and limited functional activities. Details regarding the research can be seen in table 1. Table 1 contains the flow of selecting papers that have the potential to be reviewed until papers are selected that meet the inclusion and exclusion requirements.

Evaluation of the quality of the articles reviewed using PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) and Pedro. Table 1 Quality evaluation using PRISMA

Table 1. PRISMA Study Scale regarding exercise therapy compared with other interventions

Author	Participants	Intervention	Comparison	Outcome
Balci et al., (2016)	Fifty-three respondents (40 women, 13 men)	PNF	Classic Workout	VAS, Goniometer, Simple Shoulder Test (SST), and LSST
Elhafez & Elhafez et al (2016)	45 respondents (27 women and 18 men) aged 40-60 years	Postisometric facilitation (MET)	US, laser, traditional physical therapy	NRS, Goniometer
Wang et al., (2023)	44 Participants over the age of 40 years	Maitland mobilization, stretching exercises, range of motion exercises, isometric and isotonic exercises	NME	VAS, goniometer
Robinson et al., (2017)	41 patients	Exercise therapy, manual therapy, passive stretching, accessory mobilization, passive physiological mobilization of joints, accessory mobilization of the cervical and thoracic spine	Slide hall, active exercises, internal and external rotation, passive stretching, isometric strengthening and hot compresses	VAS, ROM, and Indeks EQ-5D
Çelik and Mutlu, 2016	30 patients	Joint Mobilization and stretching	Usual care	The disabilities of the arm, shoulder and hand, the constant, VAS, goniometer
Rahbar et al., (2019)	51 patients aged 18-60 years	Acromioclavicular joint mobilization, active ROM exercises and towel stretching exercises	Hot pack, Ultrasound, TENS	VAS, SPADI, Goniometer
Thu et al.,	64 patients	Exercise therapy,	Autologous PRP	VAS, Goniometer

Author	Participants	Intervention	Comparison	Outcome
2020	aged 20-65 years	stretching exercises, active and passive ROM exercises, pulley exercises	injection using ultrasound, SWD	ROM, Disabilities of the Arm, Shoulder and Hand (DASH)
Iqbal et al., (2020)	60 patients aged 30-55 years	SMET glenohumeral joint mobilization, passive stretching exercises and resistance exercises	Hot pack	NPRS, SROM, DASH, SPADI
Mohammed et al., (2020)	66 patients aged 40-60 years	Dynamic Scapular Exercises	Hot compresses, active ROM exercises, scapula mobilization	Goniometer, SPADI, ROM, BMI
Rawat et al., (2017)	42 patients AC	Rotator cuff (RC) muscle strengthening, joint mobilization, rotator cuff	TENS, pendular exercises, isometric and isotonic exercises	VAS, ROM
Yeole et al., (2017)	30 patients aged 40-70 years (16 men and 14 women)	Joint mobilization and guided practice	Mulligan manual training	Goniometer, NPRS, SPADI
(Wang et al., 2021)	64 patients aged 35-65 years	Codman pendular internal and external rotation exercises and bar and towel stretching exercises	Hydrodilation Injection	VAS, SPADI, ROM
Gutiérrez Espinoza et al., (2015)	57 patients aged 50-58 years	Posterior mobilization, cycle ergometer	Ultrasound, independent training, Codman training, Swiss ball training and isometric training	VAS, functional test Constant-Murley score
Shanmugam et al., (2021)	76 peserta usia 30-60 tahun	Peregangan otot, strengthening, latihan thera-band	IMES, Akupuntur	VAS, DASH
Kraal et al., (2017)	82 patients aged 18-70 years	Maitland mobilization, Thera band training	Injection MUA	NRS ROM, SPADI Oxford Shoulder Score (OSS), WORQ-UP questionnaire, EQ-SD
Hammad et al., (2019)	30 pasien	Kaltenborn Mobilization	Termotherapy	VAS, ROM, SPADI
Rana et al., (2021)	40 patients (8 males and 32 females) range of age was 52,80 to 53,60 years old	Maitland Mobilization with Exercise	Muligan mobilization and exercise	VAS, SPADI, ROM

The data taken in table 1 is descriptive data. Next, to evaluate an article, the data needs to be assessed using the PEDro scale

(table 2). The PEDro scale consists of 11 questions, where the first question is related to external validity and the other ten

questions are internal validity. Filling in the PEDro scale is done by giving a YES answer if it meets the criteria, and a NO answer if it does not meet the criteria. A YES answer can be given using a √ sign if it meets the criteria and an × for a NO answer if it does not meet the criteria. The maximum rating

on the PEDro scale is 10 points. The PEDro scale can be grouped as follows: 1) 9-10 perfect, 2) 6-8 good, 3) 4-5 sufficient, 4) <4 poor. Then after the 10th assessment, the points are added up to see the PEDro category in the article.

Table 2. Quality assessment of selected articles using the PEDro scale

Author (year)	Item assessment											Total score
	1	2	3	4	5	6	7	8	9	10	11	
Balci et al., 2016	√	√	x	√	x	x	x	x	x	√	√	5/11
Elhafez and Elhafez (2016)	√	√	√	√	x	x	√	x	x	√	√	7/11
Wang et al., 2023	√	√	√	√	√	√	√	√	√	√	√	11/11
Robinson et al., 2017	√	√	√	√	x	x	x	x	x	√	√	6/11
Çelik and Mutlu, 2016	√	√	√	√	x	x	x	√	x	√	√	7/11
Rahbar et al., 2019	√	√	√	√	x	√	√	√	√	√	√	10/11
Thu et al., 2020	√	√	√	√	x	x	√	x	x	x	x	5/11
Iqbal et al., 2020	√	√	√	√	x	x	x	√	√	√	√	8/11
Mohammed et al., 2020	√	√	x	√	x	x	√	√	√	√	√	8/11
Rawat et al., 2017	√	√	√	√	x	x	√	√	√	√	√	9/11
Yeole et al., 2017	√	√	√	√	√	√	√	x	x	√	√	9/11
Wang et al., 2021	√	√	√	x	x	x	x	x	√	√	√	7/11
Espinoza et al., 2015	√	√	√	√	x	x	√	√	√	√	√	9/11
Shanmugam et al., 2021	x	√	√	√	x	x	√	√	√	√	√	8/11
Kraal et al., 2017	√	√	√	√	x	√	x	√	x	√	√	8/11
Hammad et al., 2019	x	√	√	x	x	x	x	x	x	√	√	4/11
Rana et al., 2021	x	√	√	√	x	x	x	x	x	x	√	4/11

Based on the assessment of the methodological quality of clinical studies using the PEDro scale on 17 literature articles, it can be concluded that the score ranges from 4-10/10 with 2 articles being perfect, 11 articles being good, and 4 articles being adequate. The higher the score obtained, the superior the methodological quality of the literature. PEDro results are not used to validate a research conclusion, but the PEDro scale test can be used as a guide to differentiate high-quality clinical trials from low-quality clinical trials.

DISCUSSION

This study uses a systematic review method to identify and assess several exercise and

exercise therapy interventions that can reduce pain, increase range of motion and significantly improve functional ability for Adhesive Capjualitis. Existing data shows that the therapeutic exercises and exercises carried out by researchers, namely NME, active ROM exercises, joint mobilization, stretching, posterior glenohumeral mobile- zation, dynamic scapular recognition exer- cises, Spencer muscle energy technique exercises are proven to reduce pain, in- crease range of motion and increase ability. The functional function of Adhesiva Caplaluis sufferers is significantly reduced. Existing data shows that conventional exercises are more often chosen to treat adhesive capelus than pharmacological and

other exercises. So we have to choose exercises carefully for sufferers according to the condition and phase of Adhesive Capjualitis.

The quality of the methodology is based on PEDro's assessment, each score is in the range of 4-10/10 with 2 articles being perfect, 11 articles being good, and 4 articles being adequate. Seven investigators studied mobilization to reduce pain, improve ROM and increase functional activity in Adhesive Capjualitis. Rana et al., (2021) found that Maitland mobilization and Mulligan mobilization showed an increase in range of motion and a significant decrease in SPADI scores, but Mulligan mobilization showed more significantly than Maitland mobilization. According to Hammad et al., (2019) combining Kaltenborn mobilization with thermotherapy can reduce disability to a greater extent than just applying Kaltenborn mobilization. Scapular mobilization in the form of anterior glide, posterior glide, caudal glide was chosen by Rawat et al., (2017) in their research program, in their research Rawat et al (2017) also added TENS and rotator cuff strengthening exercises in the form of isotonic, isometric, shoulder slig and "Exercise" quad set" can result in decreased pain, increased ROM and function. Rahbar et al., (2019) also researched that the addition of Acromioclavicular Joint mobilization to physical therapy and active ROM exercises can reduce pain, SPADI, disability, but there was no significant difference in the group without additional Acromioclavicular Joint mobilization. Gutiérrez Espinoza et al., (2015) also compared the provision of posterior glenohumeral mobilization after administering an ergometer for 15 minutes with conventional physiotherapy treatment in the form of (USG, independent exercises, Codman exercises, Swiss ball exercises and isometric exercises), the posterior gleno-

humeral mobilization group showed an increase which is significant in reducing pain and improving function. Yeole et al., (2017) researched on respondents aged 40-70 years that the application of Mobilization Techniques with Movement (WMW) and supervised exercise could reduce NPRS pain scores and SPADI scores could increase. Çelik & Kaya Mutlu et al., (2016) added joint mobilization to stretching exercises for adhesive capjualitis in 30 patients. Joint mobilization combined with stretching exercises is better than stretching exercises alone in terms of external rotation and range of motion.

Proprioceptive Neuromuscular Facilitation (PNF) techniques and classical exercises were compared with Physiotherapy Modalities carried out by Balci et al., (2015), research was conducted on 53 subjects with the results of the study being that there was a significant difference in the VAS results in the PNF and control groups. LSST results before and after intervention showed no significant differences, and there was a significant improvement in shoulder ROM in all groups.

Elhafez & Elhafez (2016) divided the research into 3 groups. Group A was given traditional physical therapy treatment, ultrasound, laser, supervised exercise program and home exercise program. Group B received the same physical therapy program, and group C received the same modified physical therapy program as group B and were given additional Post Isometric Facilitation Techniques for the shoulder. The results of the research conducted by Elhafez were: showing a significant reduction in pain and increase in ROM in all groups. The greatest increase was in group C.

Iqbal et al., (2020) compared the Spencer muscle energy technique with passive stretching. Iqbal et al (2020)

applied it to 60 patients with an overall average age of 45.84 ± 5.88 years. In his research, the results showed a significant increase in the Spincer Muscle Energy Technique group compared to passive stretching.

Research that produced significant results on scapular flexion and rotation was conducted by Mohammed et al., (2020). In their research, Mohammed et al (2020), compared Dynamic Scapular recognition exercises with placebo exercises in the form of movement exercises for the upper limbs. However, this study also showed that there was an insignificant difference in shoulder external rotation movement and SPADI scores.

One of the latest exercises researched by Wang et al., (2023) is neuromuscular training with motor tools. In their research, Wang et al., (2023) compared the experimental group and the control group to determine the positive effects of neuromuscular training on pain and range of motion. The experimental group was given neuromuscular training with regular therapy, while the control group was given strengthening exercises with regular physical therapy. The experimental group and control group were given warm-up exercises in the form of hall walls, Maitland mobilization techniques, stretching exercises, range of motion exercises and isotonic isometric strengthening exercises before being given intervention for 40 minutes. The experimental group and control group carried out the intervention for 20 minutes. NME performed with motor tools combined with physical therapy in the form of joint mobilization, stretching and A ROM in FS is more effective in eliminating pain and increasing AROM compared to regular physical therapy with strengthening exercises.

The application of exercise therapy on electrical stimulation (IMES) and dry needling (DN) was carried out by Shanmugam et al., (2021). In their research, Shanmugam et al divided into two research groups. The first group was given IMES and the second group was given DN. Each group was given intervention twice a week for three consecutive weeks. Apart from that, both groups were given 15-20 minutes of therapeutic exercise five days a week during the second and third weeks. Post-intervention VAS, DASH, shoulder abduction and external rotation ROM increased significantly. The IMES group experienced a greater increase than the DN group.

The implementation of supervised exercise therapy and exercise therapy carried out at home in post-hydrodilatation patients did not show a significant improvement in research by Robinson et al., (2017)

Other exercises are exercises combined with non-exercises such as anesthesia, hydrodilatation, Triamcinolone Acetonide which have also been proven to be effective in Adhesive Capjualitis.

Overall, the application of exercise therapy in Adhesive Capjualitis has a good effect on treatment, compared with pharmacology and conservative therapy.

Exercise therapy has an effect on reducing pain. By providing exercise therapy, nutrition will effectively enter the shoulder due to smooth blood circulation. Apart from that, the application of exercise therapy also stimulates pain by activating proprioception, peripheral mechanoreceptors and inhibitory nociceptors thereby reducing pain in the shoulder. Exercise therapy also plays a role in preventing and improving body function and correcting disabilities caused by Adhesive Caplpluis.

There are limitations to the research, namely: 1). Researchers did not consider shoulder MRI, 2). Researchers did not

consider the participant's Adhesiva Caplalus phase, 3). The training protocol is only carried out in the short term, 4). Researchers did not measure any changes at each intervention session.

AUTHOR CONTRIBUTION

Each author has their own role, the first author as the main author, extracting and processing data. The second author is in charge of directing the assignment, reviewing, reviewing, and directing the assignment.

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CONFLICT OF INTEREST

There is no conflict of interest.

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