

## Case Report

# The effect of physical therapy and modalities on frozen shoulder patients at Baptist Hospital Batu: a retrospective study

Nadia Ovianti<sup>1</sup>, Nurdiana Adwi Nugrahani<sup>2</sup>

<sup>1</sup>General Practitioner, Baptist Hospital Batu, East Java, Indonesia

<sup>2</sup>Department of Physical Medicine and Rehabilitation, Baptist Hospital Batu, East Java, Indonesia

Corresponding Author:

Nadia Ovianti, Baptist Hospital Batu, East Java, Indonesia

Email: [nadia.ivight@gmail.com](mailto:nadia.ivight@gmail.com)

### Article info:

Received: 4<sup>th</sup> August 2022;

Received in revised: 5<sup>th</sup> October 2022;

Accepted: 11<sup>th</sup> October 2022;

Published: 28<sup>th</sup> August 2023

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Cite this as: Ovianti N, Nugrahani NA. The effect of physical therapy and modalities on frozen shoulder patients at Baptist Hospital Batu: a retrospective study. SPMRJ. 2023;5(2):91-104.

### Abstract

**Introduction:** Frozen shoulder was one of top 10 diseases with frequent visits at Baptist Hospital's rehabilitation clinic in 2020. Treatment for this condition includes physical therapy and modalities. This study aims to compare the range of motion and pain scale before and after treatments on frozen shoulder patients in Baptist Hospital Batu.

**Material and Methods:** This is a retrospective study using the data from medical records of patients known to have frozen shoulder who came to outpatient physical rehabilitation clinic at Baptist Hospital, Batu, for at least a month period of treatment. The parameters used are range of motions after interventions, pain scale using VAS, sex, and age.

**Result:** Twenty-two patients were diagnosed with frozen shoulder, 16 patients were included in further analyses, 9 of 16 were women, and the most common age presentation was between 50-60 years. There were improvements in 12 patients being recorded for their shoulder flexion and abduction. The flexion ROM increased from 115 to 156 degrees, while abduction ROM increased from 95 to 144 degrees, on average. About 9 out of 13 patients had decreasing pain scale according to VAS, declining from 5.5 to 4.7.

**Conclusion:** The combination of physical exercises as well as SWD / ultrasound with TENS (transcutaneous electrical nerve stimulation) has a positive impact on the improvement of frozen shoulder. There was an increase in the range of motion of the joint flexion and abduction, and a decrease in pain scores in the majority of the patients after treatment.

**Keywords:** Frozen shoulder, range of motion, pain scale, sex, age

## INTRODUCTION

Frozen shoulder, also called adhesive capsulitis, is defined as “a condition characterized by significant restriction of both active and passive shoulder motion without a certain etiology and no known intrinsic shoulder disorder.” Frozen shoulder’s pathologic process starts with excessive scar tissue formation or adhesions across the glenohumeral joint, causing pain, stiffness, and dysfunction. Painful stiffness of the shoulder can adversely affect activities of daily living and decreases quality of life.<sup>1,2</sup>

Frozen shoulder or adhesive capsulitis occurs in 3%–5% of the general population every year. A study in the UK estimated an annual prevalence of 1.4 per 1000 patients from two general practices (total population 17, 000). Frozen shoulder was one of top 10 diseases with frequent visits at Baptist Hospital’s rehabilitation clinic in 2020. The nondominant extremity is often involved in idiopathic frozen shoulder, although about 40-50% cases have bilateral involvement. Frozen shoulder can be self-limiting or usually resolving in 1-3 years, but around 20-50% of patients will remain symptomatic.<sup>2,3,4</sup>

Frozen shoulder can be classified as primary or secondary. Primary idiopathic frozen shoulder is often associated with other diseases and conditions, such as intracranial lesions (stroke, bleeding, and brain tumors), clinical depression, shoulder-hand syndrome, Parkinson's disease, iatrogenic disorders (prolonged immobilization), thyroid diseases, insulin-dependent diabetes mellitus and hypothyroidism. Secondary adhesive capsulitis can occur after shoulder injuries or immobilization (e.g. subacromial impingement, rotator cuff tendon tear, biceps tenosynovitis and calcific tendonitis). These patients develop frozen shoulder due

to reduced movement from pain after shoulder pathology.<sup>1,5</sup>

Frozen shoulder develops in three stages: the freezing (painful), frozen (adhesive) and thawing phases. In the freezing stage (2-9 months) there is a gradual onset of diffuse, severe shoulder pain that typically worsens at night. In the frozen stage (4-12 months), the pain will begin to subside, but the patients will present with a characteristic progressive loss of glenohumeral range of motions such as flexion, abduction, internal rotation and external rotation. During the thawing stage, the patient experiences a gradual return of range of motion that takes about 5–26 months to complete. Frozen shoulder can persist longer with pain as the most common presenting complaint, even though it is often a self-limiting disease.<sup>1</sup>

Risk factors for adhesive capsulitis include female sex, age over 40 years, HLA-B27 positivity, preceding trauma, and prolonged immobilization of the glenohumeral joint. Most frozen shoulder patients are women, with around 70% in estimation. Although they have lower incidence, men do not respond to treatments as well as women. Consistent with demographic studies, most patients with adhesive capsulitis (84.4%) fall within the age range of 40 years to 59 years.<sup>2</sup>

The treatment choices for this condition involve the use of non-steroidal anti-inflammatories, physiotherapy, injection of corticosteroid, hydrodilatation, arthroscopic release, and manipulation under anesthesia. Recently, studies have also suggested that hyaluronan (HA) injection can help with recovery of frozen shoulder.<sup>3</sup> Non-surgical treatment for pain due to frozen shoulder includes physical therapy and supervised home exercises, although there is no hard evidence yet. Some heating modalities have been suggested for the

treatment of frozen shoulder to enhance the effect of exercises by reducing pain and relaxing the muscles. For patients who are refractory to adequate conservative therapy, consideration of surgical treatment can be made.<sup>6</sup>

In addition to exercise, physical and electrotherapy modalities are often applied on frozen shoulder rehabilitation in clinics, such as hotpack, ultrasound and TENS (transcutaneous electrical nerve stimulation).<sup>7</sup> The treatment protocols and number of sessions required for positive therapeutic effect in adhesive capsulitis have not been adequately studied.<sup>8</sup> This study aims to compare the range of motion and pain scale before and after applying combination of exercise and modalities on frozen shoulder patients in outpatient rehabilitation clinic at Baptist Hospital Batu.

## MATERIAL AND METHODS

This is a retrospective study using the data from medical records of patients known to have frozen shoulder or adhesive

capsulitis with ICD 10 code M75.0, who came at Baptist Hospital, Batu. The data were collected from January to December 2020 and only included patients who have been treated for a month (four weeks). The parameters used are range of motions after interventions, pain scale using VAS, sex, age, and duration of rehabilitation. Range of motions used were flexion and abduction. The interventions used were combination of exercise (range of motions and stretching) and modalities such as SWD, ultrasound and TENS. The parameters were recorded before (at first visit) and after the interventions.

Inclusion criteria consist of a diagnosis of frozen shoulder collected from patient's medical record, patients with prior treatment using physical therapy combined with modalities such as ultrasound/ short-wave diathermy and TENS, who came to outpatient rehabilitation clinic for at least one month and were evaluated twice (before and after), and had range of motions and pain scales data reported at their medical record.

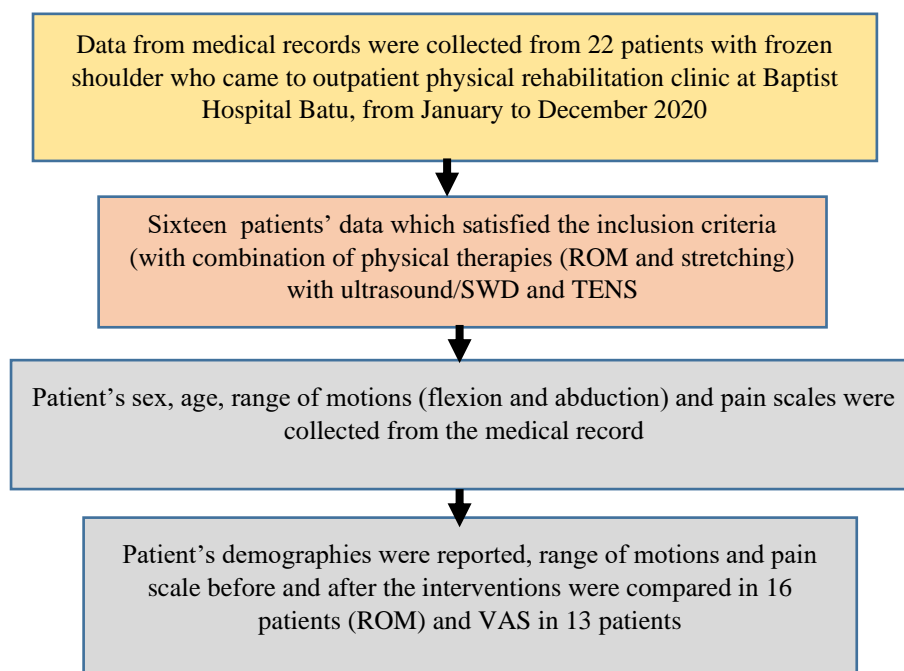


Figure 1. Study flow chart

The normality test used was Shapiro-Wilk. Paired t-test was performed for normally distributed data, and Wilcoxon test for not normally distributed data, with the significance level of  $p \leq 0.05$ .

## RESULT

### Subject Characteristic

From 22 patients with diagnosis of frozen shoulder, about 16 patients satisfied the inclusion criteria. The majority of patients are women, about 9 out of 16. The rest of them are men.

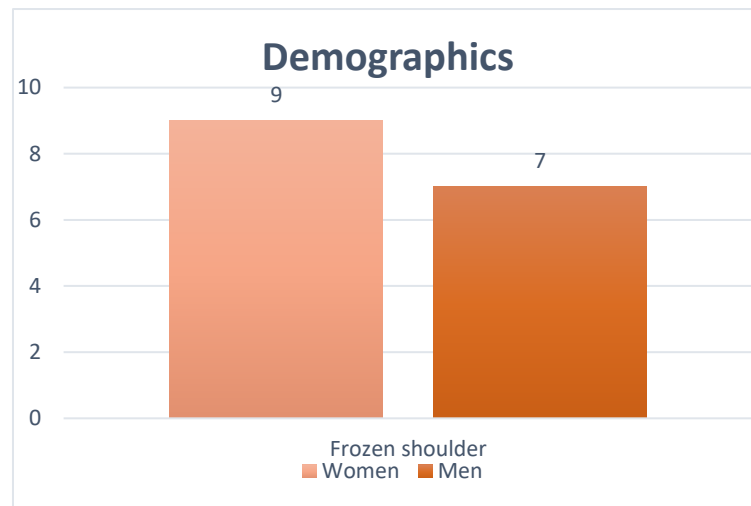


Figure 2. Demographics

For the patient's age distribution, about 6% are from the age range of 30-40 years old, 0% or none from 40-50 years old, 44% from 50-60 years old, 37% from 60-70 years old, and about 13% are patients over 70 years old.

### Range of motions before and after interventions

There were improvements in 12 patients being recorded for their shoulder flexion, while four others didn't show any improvements. The flexion ROM increased from 115 to 156 degrees after interventions, on average. There were more flexion ROM improvements in women than men. These results are significant with  $p=0.002$  ( $p < 0.05$ ).

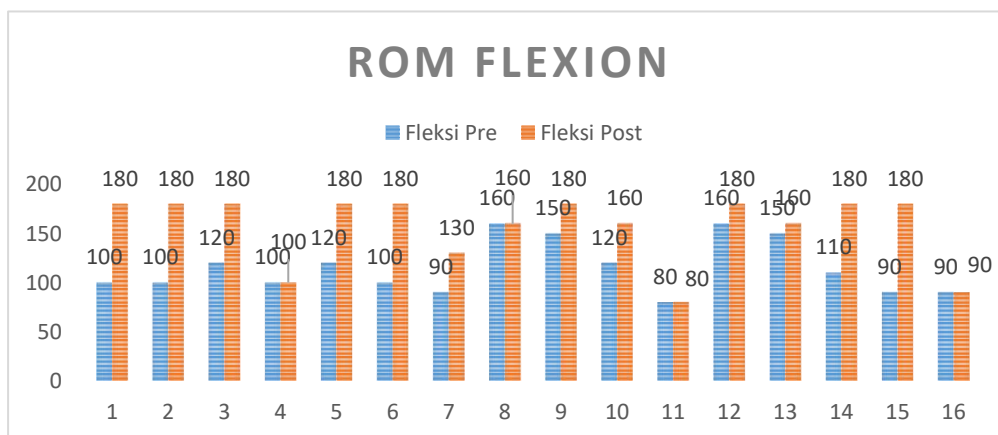


Figure 3. Flexion ROM Pre- and Post-Intervention

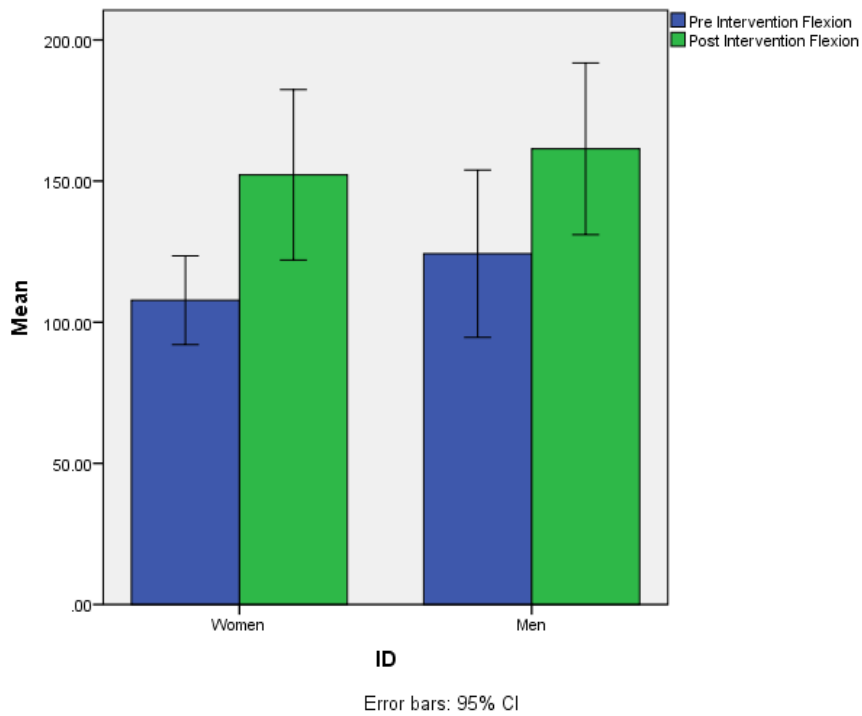


Figure 4. Mean Comparison of Flexion ROM Pre and Post-Intervention

The result of shoulder abduction ROM, before and after interventions, shows there were improvements in 12 patients, while four others didn't show any. The abduction ROM increased from 95 to 144

degrees after interventions, on average. There were more improvements in post-intervention abduction ROM in women than men. These results are significant with  $p=0.002$  ( $p<0.05$ ).

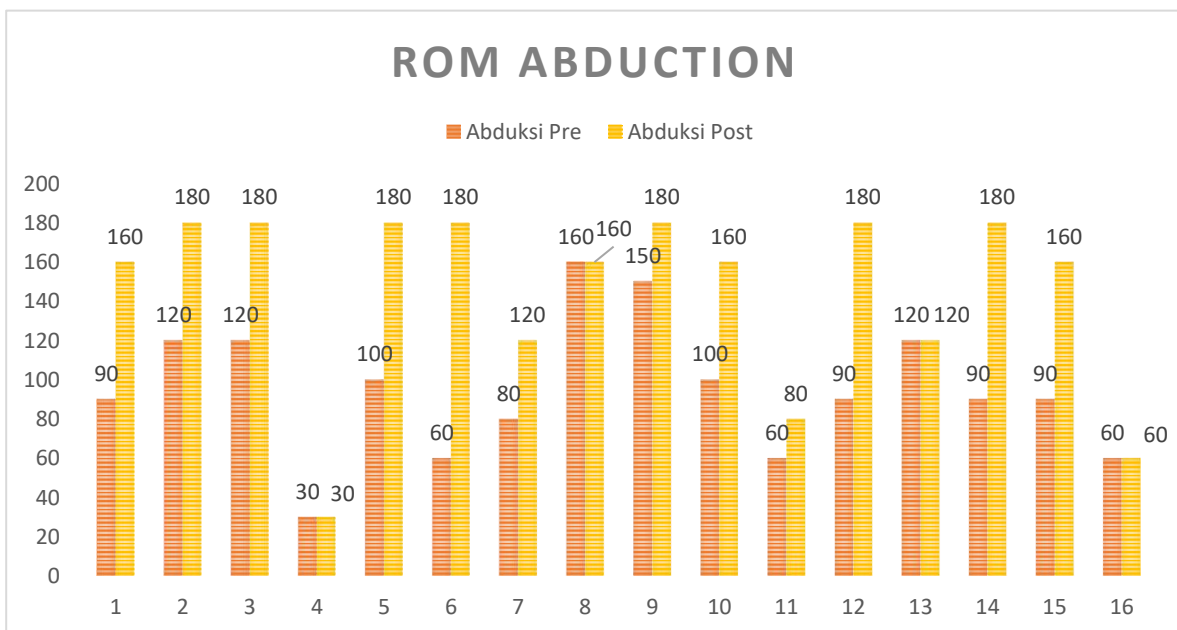


Figure 5. Abduction ROM Pre and Post-Intervention

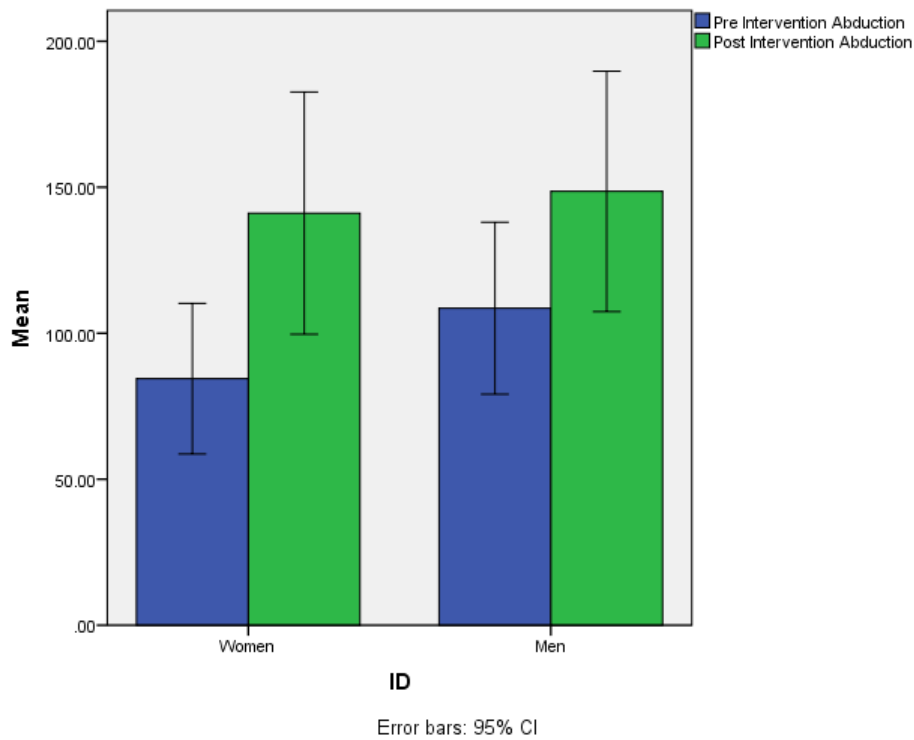


Figure 6. Mean Comparison of Abduction ROM Pre and Post-Intervention

### Visual Analog Scale Before and After Interventions

From 13 patients who were evaluated for their pain scale, about nine patients had decreasing pain scale according to VAS, while four others had the same score as

before. The average VAS is declining from 5.5 to 4.7. There were more improvements in VAS in men compared to women. This result is significant with  $p=0.013$  ( $p<0.05$ ).

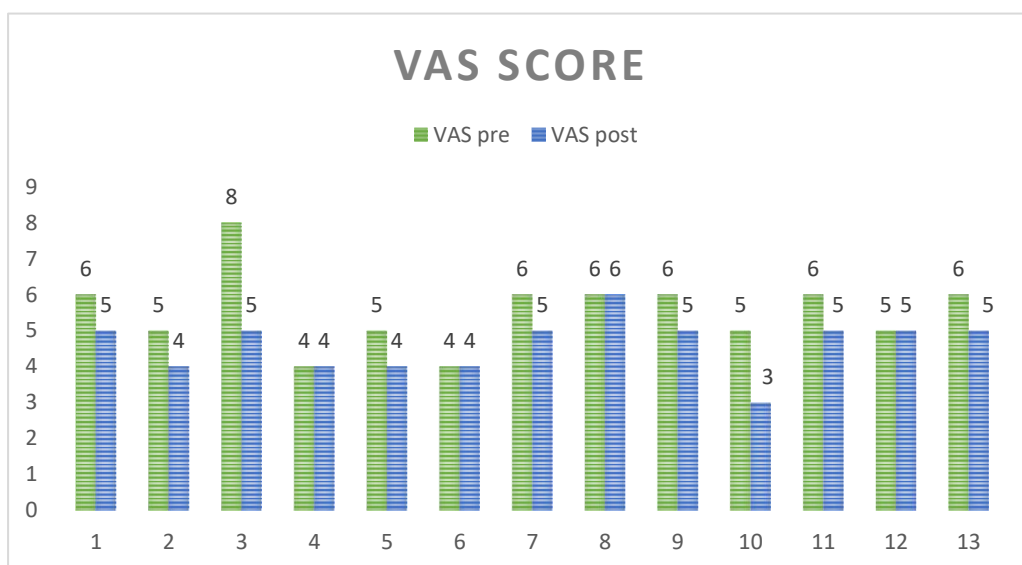


Figure 7. VAS Score Pre and Post-Intervention

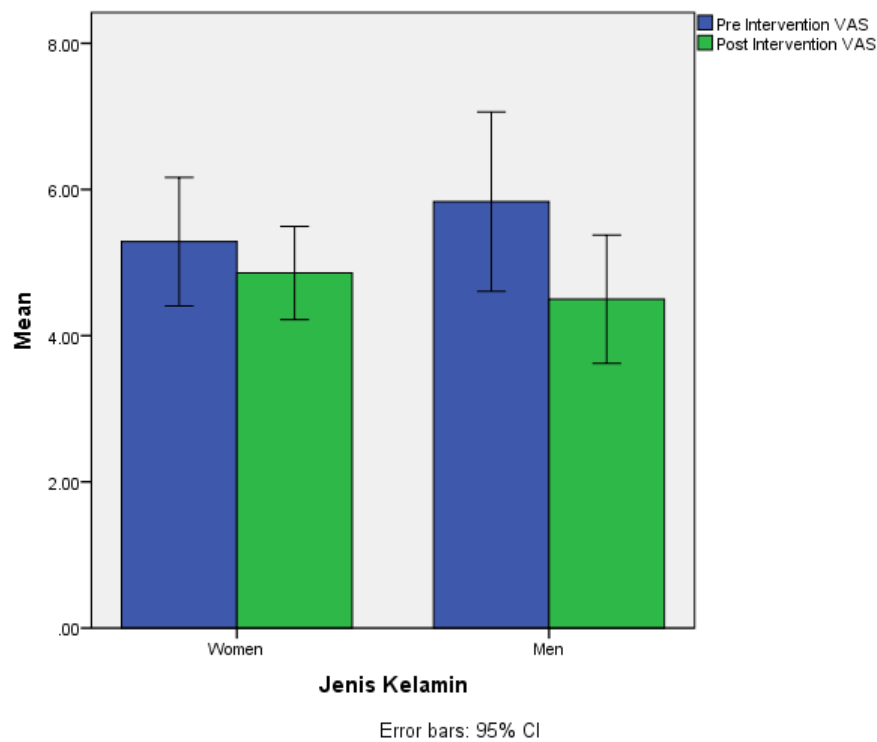


Figure 8. Mean Comparison of VAS Score Pre and Post-Intervention

### Patients' Post-Intervention Clinical Condition

There were improvements in shoulder flexion and abduction range of motion in 12 patients, while four patients didn't have any improvements, but their range of motion didn't get worse either. There were more improvements in post-intervention flexion and abduction ROM in women than men. From 13 patients who were evaluated for their pain scale, nine patients' pain has decreased, while four others didn't have any increase in pain. There were more improvements in VAS in men compared to women. There were no complaints of side effects or complications regarding the procedure of the interventions.

### DISCUSSION

First-line therapy for patients with early stages of adhesive capsulitis is physical therapy in combination with other modalities such as ultrasonic therapy, TENS, short-

wave therapy, low-level laser therapy and hydrotherapy. The use of physical therapy alone for treatment of frozen shoulder is not supported by evidence.<sup>2</sup>

There were several different physical therapy regimens used, including a combination of exercises, stretching, glenohumeral joint manipulation, ultrasound, superficial heat, short-wave diathermy, laser therapy, wall-climbing exercises, Codman's exercises, continuous passive movement, gymnastics using dumbbells, massage, and manual therapy.<sup>2</sup>

In this study, the regimens used were range of motion exercises and stretching combined with ultrasound and TENS modalities. Among 16 patients who met the inclusion criteria, nine were women while the remaining seven were male. This result is similar with other research which states that the risk factor for adhesive capsulitis is



female gender and is more common in women.<sup>2,10</sup>

The age distribution obtained was 6% from 30-40 years of age, 0% or none at 40-50 years of age, 44% of 50-60 years of age, 37% of 60-70 years of age and 13% of patients > 70 years. The highest percentage was found at the age of 50-60 years followed by 60-70 years, while in the age range of 40-50 years there were no patients who came with a diagnosis of frozen shoulder.

Demographic studies show that most patients with adhesive capsulitis (84.4%) are in the age range of 40 years to 59 years.<sup>2</sup> Another study states that the most common age range is 50-70 years.<sup>11</sup> In this study, it was found that the age range with most frozen shoulder patients was 50-70 years.

The range of motion measured in this study were flexion and abduction. There was an increase in the range of motion of flexion that was obtained in the patient after combination of physical therapy and modalities. A total of 12 patients experienced an increase in flexion range of motion, while four others had the same flexion range of motion as before. There was an increase in the range of motion of the flexion from a mean of 115 to 156 which was significant with  $p = 0.002$ .

There is an increase in the range of motion of the joint abduction seen in the patient following a combination of physical therapy and modalities. A total of 12 patients experienced an increase in joint range of motion, while four others had the same joint range of motion as before therapy. There was a significant increase in the range of motion of the joint abduction from a mean of 95 to 144 degrees with  $p = 0.002$ . There were more improvements in post intervention flexion and abduction ROM in women than men.

VAS (visual analog scale) is an evaluation of the severity of a disease by a patient that can significantly aid in clinical rehabilitation.<sup>12</sup> Of the 13 patients with pain score evaluations using VAS, there was a decrease in pain scores in nine patients and the remaining four with the same pain score before therapy, with mean VAS decreasing from 5.5 to 4.7. This decrease is significant with  $p = 0.013$ . There were more improvements in VAS in men compared to women.

Several studies support the results obtained in this study. There was an increase in the area of motion, especially in abduction and external rotation compared to flexion after 12-18 meetings of physical therapy. Another study conducted sessions with passive stretching alone for 22 months, with the results of increased joint area and decreased pain. Whereas in research with manipulation and physical therapy measured after one month, it was found that the range of active and passive joint motion was increased. In the studies that have been carried out, most of them have reported improvement although some have not responded to interventions and their conditions have not improved.<sup>11</sup>

Modalities can be used in patients with frozen shoulder to positively affect tissue in the joints and relieve pain. Modalities can also relax the muscle, thereby enhancing the effects of exercise and manual therapy. However, modalities such as massage, ultrasound, iontophoresis and phonophoresis have not been shown to be of benefit in patients with frozen shoulder. Transcutaneous electrical stimulation was better than heat therapy combined with exercise and manipulation, to significantly increase joint range of motion.<sup>13,14</sup>

A combination of physical therapy and modalities can be used to reduce pain and increase the joint range of motion, as



demonstrated by previous studies. Heat therapy with hot packs can be given before or during joint exercise. Application of stretching and moist heat has been shown to increase muscle lengthening. This neuromuscular-mediated muscle relaxation is achieved by decreasing muscle density. Transcutaneous electrical stimulation in combination with continuous light-weight stretching increases movement and reduces pain in patients with frozen shoulder.<sup>13</sup>

Another study using short-wave diathermy showed an increase in the index score of the shoulder than heat therapy using a hot pack. The deep heating effect of SWD increases the local tissue temperature, resulting in dilation of blood vessels and decreases pain. It also enhances the inflammatory process through the removal of metabolites and waste products, with increases in nutrition, oxygen supply, and eventually reduced pain and swelling.<sup>15</sup>

Research by Rawat (2017) with a combination of conventional and strengthening therapy with TENS, showed significant changes in pain scores and joint range of motion after four weeks.<sup>16</sup> Akbas et al. (2015) also used physical therapy, along with hot packs or heat therapy and ultrasound, which caused a significant reduction in pain scores and increased flexion and abduction mobility.<sup>17</sup>

The respective modalities used are all beneficial both to increase the effectiveness of training and to directly reduce pain and increase the joint range of motions. Previous studies also support the combination of physical therapy and therapeutic modalities for patients with frozen shoulder. The results in this study show similarities to previous studies where there were improvements in the joint range of motion and the pain score after treatment.

## CONCLUSION

The combination of physical therapies such as range of motion exercise and stretching, as well as SWD / ultrasound with TENS has a positive impact on the improvement of frozen shoulder. There was an increase in the range of motion of the joint flexion and abduction, and a decrease in pain scores in the majority of the patients after treatment. There were a few patients with joint range of motion and pain scores that persisted after treatment. The patient population in this study is too small to generate general conclusions, so further research is needed to prove this result.

The limitation in this study is the small population, and does not include the range of motion of other shoulder joints such as internal and external rotation. Suggestions for future research are the use of data on shoulder internal and external rotational range of motion, the use of data on the duration of frozen shoulder symptoms, monitoring of joint range of motion and pain scores longer than one month and further study about the difference in improvements between women and men.

## ACKNOWLEDGMENT

We thank the Department of Physical Medicine and Rehabilitation and Baptist Hospital Batu for allowing us to collect data, also the Ethical Department of Brawijaya University for the ethical clearance.

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**Abbreviation List**

VAS: Visual Analog Scale

ROM: Range of Motion

SWD: Short Wave Diathermy

TENS: Transcutaneous Electrical Nerve Stimulation

UK: United Kingdom

HLA-B27: Human Leukocyte Antigen B27

HA: Hyaluronan

ICD 10: International Classification of Diseases 10<sup>th</sup> revisions

**Supplementary Data**

*Table 1. Age Distribution*

Age range	Number of patient(s)	Percentage (out of 100%)
30-40	1	6%
40-50	0	0%
50-60	7	44%
60-70	6	37%
>70	2	13%

*Table 2. Flexion ROM Pre and Post-Intervention*

	Flexion ROM Pre-Intervention	Flexion ROM Post-Intervention
Patient 1	100	180
Patient 2	100	180
Patient 3	120	180
Patient 4	100	100
Patient 5	120	180
Patient 6	100	180
Patient 7	90	130
Patient 8	160	160
Patient 9	150	180
Patient 10	120	160
Patient 11	80	80
Patient 12	160	180
Patient 13	150	160
Patient 14	110	180
Patient 15	90	180
Patient 16	90	90

*Table 3. Abduction ROM Pre and Post-Intervention*

	Abduction ROM Pre-Intervention	Abduction ROM Post-Intervention
Patient 1	90	160
Patient 2	120	180
Patient 3	120	180
Patient 4	30	30
Patient 5	100	180
Patient 6	60	180
Patient 7	80	120
Patient 8	160	160
Patient 9	150	180
Patient 10	100	160
Patient 11	60	80
Patient 12	90	180
Patient 13	120	120
Patient 14	90	180
Patient 15	90	160
Patient 16	60	60

Table 4. Visual Analog Scale Pre and Post-Intervention

	VAS Pre-Intervention	VAS Post-Intervention
Patient 1	6	5
Patient 2	5	4
Patient 3	8	5
Patient 4	4	4
Patient 5	5	4
Patient 6	4	4
Patient 7	6	5
Patient 8	6	6
Patient 9	6	5
Patient 10	5	3
Patient 11	6	5
Patient 12	5	5
Patient 13	6	5