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# THE EFFECTS OF MULLIGAN TECHNIQUE AND ULTRASOUND ON PAIN AND FUNCTIONAL ABILITY IN SHOULDER IMPINGEMENT CONDITION AT EMC SENTUL HOSPITAL

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**ABSTRACT**

*The shoulder joint is a highly mobile joint that is prone to injuries. Shoulder impingement is a painful shoulder condition caused by injuries to the structures in the subacromial space. Symptoms include pain, disruptions in daily activities, and a decrease in the range of motion of the joint. The research aims to analyze the effects of the Mulligan Technique and Ultrasound on pain and functional ability in shoulder impingement conditions at EMC Sentul Hospital. The research method used is a quasi-experimental design with pre and post-test control groups. Thirty participants were divided into two groups: an intervention group receiving the Mulligan Technique and Ultrasound (15 participants) and a control group receiving TENS and conventional exercise therapy (15 participants). Each participant underwent six sessions per week, twice a week. Before and after the treatment, each participant's pain level was measured using the Numeric Rating Scale (NRS), and functional ability was assessed using the Shoulder Pain and Disability Index (SPADI). The analysis of the data showed that both treatments in the two groups reduced pain and improved functional ability in shoulder impingement conditions. However, there was a significant difference in the group receiving the Mulligan Technique and Ultrasound, with an average pain reduction from 6.6 NRS to 1.3 NRS and an increase in functional ability from 62.6% to 11.85%. In contrast, the group receiving TENS and conventional exercise therapy showed an average pain reduction from 3.6 NRS to 6.13 NRS and an increase in functional ability from 61.3% to 40.2%. In conclusion, the study suggests that the application of the Mulligan Technique and Ultrasound is more effective in reducing pain and improving functional ability compared to TENS and conventional exercise therapy in shoulder impingement conditions.*

**KEYWORDS** *Shoulder impingement, Technical Mulligan, Mobilization with Movement, Ultrasound*



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## INTRODUCTION

Shoulder Impingement is a complaint in the shoulder joint that occurs due to injury to the structures in the subacromial space, including rotator cuff tendinosis, bursitis, and partial tear of the rotator cuff tendon. Symptoms include pain, functional impairment, and decreased range of motion (ROM) of the shoulder joint, resulting in the inability to perform daily and other functional activities (Steuri et al., 2017). Physiotherapy intervention is widely recommended as an alternative option for managing shoulder pain complaints. Physiotherapy interventions such as manipulation and manual therapy are effective in improving shoulder joint range of motion and reducing pain. Recommended manual therapy and manipulation techniques include high-velocity, low-amplitude manipulation, end-range mobilization, mid-range mobilization, and mobilization with movement (Doner et al., 2013). Mobilization with movement is one of the Mulligan techniques based on the analysis and correction of minor positional faults in the joint caused by soft tissue lesions, resulting in limited physiological movement (ROM) (Lirio Romero et al., 2015). Manual therapy combined with electrotherapeutic modalities such as Ultrasound is recommended to assist in tissue healing and regeneration, reduce pain, and increase ROM (Analan et al., 2015). Shoulder pain conditions, including musculoskeletal disorders, are frequently encountered in the Physiotherapy outpatient clinic of EMC Sentul Hospital. However, the success of therapy in this condition is still considered insufficient due to the variety of intervention choices. Most patients present with complaints of pain when raising their arms, difficulty in dressing and toileting activities, and even disruption of sleep patterns due to pain. The aim of this study is to analyze the influence of Mulligan Technique and Ultrasound on pain and functional ability in shoulder impingement conditions.

## RESEARCH METHOD

The research design is quasi-experimental with a pre-test and post-test control group design. Respondents are divided into 2 groups: the intervention group and the control group. The population in this study consists of patients who come to the physiotherapy clinic at EMC Sentul Hospital with complaints of shoulder pain. Sample selection is done randomly with simple random sampling that meets the inclusion and exclusion criteria. The sample size is 30 respondents determined based on the Federer formula. The sample is divided into 2 groups: the intervention group with 15 respondents receiving the Mulligan Technique and Ultrasound, and the control group with 15 respondents receiving TENS and conventional exercise therapy.

The research is conducted at the physiotherapy clinic of EMC Sentul Hospital from August 14, 2023, to September 30, 2023. In the initial stage, each respondent undergoes a pre-test, which includes measuring the degree of pain with NRS and measuring functional ability with SPADI (Shoulder Pain and Disability Index) in both the intervention and control groups. Treatment in each group is provided for 6 sessions with a frequency of twice a week. Then, at the end of the study, a post-test

is conducted, which involves measuring again with the same parameters. Data collection procedure: each respondent undergoes anamnesis to determine the medical history, physical examination: specific tests such as Hawkin test, Neer test, and filling out SPADI and NRS questionnaires.

After collecting data, the degree of pain and functional ability values of each respondent from both groups are analyzed using IBM SPSS version 25:

1. Descriptive and respondent characteristics: age, gender, duration of complaint, and degree of pain and functional ability with mean, median, and standard deviation.
2. Homogeneity test with Levene Test to determine if the sample from the population has homogeneous variances with a result of $p > 0.05$.
3. Hypothesis testing with paired two-sample t-test to assess the effect of pre and post-test treatment in both groups ($p < 0.05$) and Independent two-sample T-test to compare the difference in degree of pain and functional ability before and after treatment ($p < 0.05$).

## RESULT AND DISCUSSION

### Descriptive statistics and characteristics of respondents

***Descriptive respondents by gender***

Table 1. Descriptive respondents by gender

| Gender | Frequency | Percentage |
|---|---|---|
| Male | 12 | 40% |
| Female | 18 | 60% |
| **Total** | **n = 30** | **n = 100%** |

All respondents from both groups, more female respondents (60%) than men (40%).

***Descriptive respondents by age***

Table 2. Descriptive respondents by age

| Age Category | Frequency | Percentage |
|---|---|---|
| 19 – 30 year | 5 | 16,7% |
| 31 – 40 year | 5 | 16,7% |
| 41 – 50 year | 12 | 40% |
| 51 – 60 year | 8 | 26,6% |
| **Total** | **n = 30** | **n = 100%** |

From the table of age groups of respondents with the most *shoulder impingement* complaints in the age range of 41 – 50 years (40%).

***Descriptive old complaints***

Table 3. Descriptive respondents based on the length of the complaint

| Length of Complaint | Frequency | Percentage |
|---|---|---|
| < 1 month | 16 | 53,3% |
| 1 - < 3 month | 11 | 36,7% |
| y ≥ 3 month | 3 | 10% |
| **Total** | **n = 30** | **n = 100%** |

Respondents with *the most shoulder impingement* with a complaint length of less than 1 month, as many as 16 respondents (53.3%)

***Average degree of pain of respondents before treatment***

Tabel 4. Derajat nyeri rata-rata responden sebelum perlakuan

| Group | *Mean* | *Median* | Std Deviation |
|---|---|---|---|
| Intervention (n =15) | 6,6 | 7 | 1,502 |
| **Control (n=15)** | **6,13** | **6** | **1,060** |

Based on the data above, the average pain picture of respondents before treatment in the intervention group was 6.60 on the NRS scale. While in the control group, the average degree of pain of respondents was 6.13 on the NRS scale.

***The average degree of pain of respondents after treatment***

Table 5. The average degree of pain of respondents after treatment

| Group | *Mean* | *Median* | Std Deviation |
|---|---|---|---|
| Intervention (n =15) | 1,3 | 1 | 0,488 |
| **Control (n=15)** | **3,6** | **4** | **0,507** |

Based on the table above, the average degree of pain of respondents after treatment in the intervention group dropped to 1.3 on the NRS scale, while in the control group it dropped to 3.6 on the NRS scale.

***Average functional ability of respondents before treatment***

Table 6. Average Functional Ability of Respondents Before Treatment

| Group | *Mean* | *Median* | Std Deviation |
|---|---|---|---|
| Intervention (n =15) | 62,6 | 62 | 10,857 |
| **Control (n = 15 )** | **63,8** | **61,5** | **9,73** |

The table above illustrates the average condition of respondents' functional ability in the intervention group before treatment of 62.6%, while in the control group the average functional ability of respondents was 63.8% on the SPADI scale.

***Average functional ability of respondents after treatment***

Table 7. Average Functional Ability of respondents after treatment

| Group | *Mean* | *Median* | Std Deviation |
|---|---|---|---|
| Intervention (n =15) | 11,8 | 7,0 | 17,83 |
| **Control (n = 15 )** | **40,2** | **42** | **4,91** |

Based on the table above, an overview of the average functional ability of respondents after treatment from the intervention group was 11.8% on the SPADI scale. While in the control group it was 40.2% on the SPADI scale.

1. Homogeneity Test

Table 8. Levene Test

| **Variable** | ***PreTest*** ***sig*** | ***Post Test*** ***sig*** |
|---|---|---|
| **Pain** | ***0,151*** | **0,478** |
| **Functional Ability** | ***0,750*** | **0,287** |

From the Levene test it was found that the p - level test value of each group obtained a p value of > 0.05, so it can be interpreted that the sample comes from a population with homogeneous variance (similiar).

2. Hypothesis Test

Table 9. Paired two-sample t-test

| **Group** | **Pain ( *sig* )** | | **Functional Ability (*sig*)** | |
|---|---|---|---|---|
| | ***Pre test*** | ***Post test*** | ***Pre Test*** | ***Post test*** |
| **Intervention** | ***0,000*** | ***0,000*** | **0,000** | **0,000** |
| **Control** | ***0,000*** | ***0,000*** | **0,000** | **0,000** |

From the hypothesis test with the T Test of two paired samples of sig values from both groups of 0.000 each, which means *a p value of < 0.05, the treatment given has an influence on the pain and functional ability of each group*.

Table 10. Independent Two Sample T Test

| **Group** | **Speakers (Mulligan &; Ultrasound Technique)** | **Control *(*TENS & Conventional Training Therapy *)*** |
|---|---|---|
| **Pain** | **1,333** | **3,600** |
| **Functional Ability** | **11,85%** | **40,2%** |

From the results of the comparison test above, there are differences in the effect of the treatment given, that the administration of Mulligan Technique and Ultrasound is more significant in reducing pain compared to the administration of TENS and conventional exercise therapy.

## DISCUSSION

### Analyzing the degree of pain in *shoulder impingement conditions* before and after administration of Mulligan and Ultrasound Techniques

Based on the results of statistical tests using the T test of two paired samples, the results of *a sig* value of 0.000 *from both groups (p* value < 0.05) this means that the treatment in the intervention group and the control group has an influence on pain in the condition of *shoulder impingement*. Meanwhile, based on the T test of two independent samples to test the difference in the effect of treatment on pain, a sig result of 0.000 (p value < 0.05) means that there is a difference in average pain

between the control group and the intervention group, where the Mulligan Technique and Ultrasound are more meaningful and effective in reducing pain compared to the administration of TENS and conventional exercise therapy in *shoulder impingement conditions*.

Based on descriptive data, the average decrease in respondents' pain degrees in the intervention group was significant, which was 1.3 on the NRS scale from before treatment by 6.6 on the NRS scale. Pain pathology occurs due to stimulation of nociceptors (pain receptors) that deliver pain signals to the brain (Bahrudin, 2018). In the condition *of shoulder impingement*, stimulation of the nociceptor occurs due to lesions / injuries to the shoulder. These injuries/lesions occur due to incorrect positioning when lifting items, injuries due to sports, or repetitive overhead activities. The Mulligan technique *(mobilization with movement) can reduce pain, because according to* (Dharmawan et al., 2018) repetitive movements mobilization with movement (MWM) *will stimulate mecanorspetor so that it can inhibit pain stimuli in nociceptive*.

In addition, repeated MWM movements allow changing anti-inflammatory mediators so as to inhibit pain nociceptors. In addition, based on research (Lirio Romero et al., 2015), the provision *of mobilization with movement* (MWM) can restore *minor position faults of the* shoulder joint by performing specific techniques in the form of *gliding* manually, so that the maneuver can reduce pain and increase joint mobility. Mobilization in peripheral joints produces hypoalgesion and excitation simultaneously in the motor system and parasympathetic system.(Lirio Romero et al., 2015). What is meant by *Minor position* fault in shoulder *impingement* conditions is a change in the gap in the subacromial space that occurs due to mechanical trauma from the subacromial bursa located in *the antero-inferior part* of the acromion and clamping occurs when the shoulder joint moves flexion and internal rotation (Dharmawan et al., 2018). It can be assumed that the administration of the Mulligan Technique (*mobilization with movement / MWM*) for 6x, will gradually be able to restore the minor position fault that *occurs, so that if the* minor position fault has been corrected, it will be able to reduce pain and improve the patient's functional ability.

In addition, ultrasound can help reduce pain, this is in accordance with studies that say that the physiological effects of ultrasound administration are to improve local blood circulation, increase vascular permeability, increase local metabolism of tissues so as to reduce muscle pain and spasm.(Gürsel et al., 2004). In addition, the effects of ultrasound can increase the speed of conduction of sensory and motor nerves, which can increase the excitatory threshold for pain. Ultrasound in this condition is given for 8 minutes with an intensity of 1.5w/cm2. After being given ultrasound, the Mulligan technique is carried out, *with mobilization with movement*, that is, the physiotherapist performs a manual technique in *the direction of dorsolateral gliding in the patient's humeral caput*, while the patient moves *the shoulder in the direction of* flexion *(in the sagittal plane), and the physiotherapist*

*still maintains the direction of* the dorsolateral gliding movement force vector that, while following the *patient's* shoulder flexion movements.

This movement is carried out in 3 sets with 10x reps interspersed with breaks of about 30' in each set. the combination of Mulligan technique and *ultrasound* has a positive effect in reducing pain compared to TENS and conventional exercise therapy in *shoulder impingement conditions* at EMC Sentul Hospital. Where with the administration of Mulligan Technique and Ultrasound, respondents' pain dropped significantly.

**Analyzing functional ability in *shoulder impingement* conditions before and after Mulligan and Ultrasound Techniques**

Based on the results of statistical tests using the T test of two paired samples to analyze functional ability in shoulder impingement conditions in both groups, the results of sig values of 0.000 or $p - value < 0.05$ were obtained, this means that the treatment in both groups had an effect in improving functional ability in *shoulder impingement conditions* . Meanwhile, from the results of the T test analysis of two independent samples to compare the difference in the effect of each treatment on the functional ability of the two groups, a *sig value of 0.000 or* p value of *< 0.05 was obtained, this means that there is a difference in the effect of Mulligan and Ultrasound Techniques compared to the administration of TENS and conventional exercise therapy.*

Based on descriptive data, the average functional ability of respondents from the intervention group before treatment was 62.6% and after treatment was 11.85%. On average, respondents in the intervention group after receiving treatment, experienced low shoulder disability with functional ability to carry out activities that were still good and independent. While in the control group the average functional ability of respondents before treatment was 61.3% and after treatment was 40.2%, which means that the average respondents in the control group experienced moderate shoulder disability, with slightly limited functional ability, but still able to do most daily activities.

The increase in the average functional ability of respondents with the provision of the Mulligan Technique, according to (Dharmawan et al., 2018) is influenced by several aspects, namely biomechanical aspects where there is a correction of minor position faults in the shoulder joint. MWM movements that are done repeatedly will correct the position error, so that joint mobility increases. In addition, in terms of arthrokinematics, there is a proprioceptive repair of the joint and an improvement in the physiological motion of *roll glide* in the glenohumeral joint. In addition, based on the thermal effect of ultrasound, which increases the colagen extensibility of tendons, joint capsules and connective tissue scars, stretching exercises will be more effective.

From the results of data analysis tests and descriptive data, that the administration of Mulligan and Ultrasound Techniques is more effective than the administration of TENS and conventional exercise therapy in improving functional

abilities in *shoulder impingement conditions*. The Mulligan Technique will affect the mechanical changes of the joints with intraarticular repositioning so as to reduce pain and increase the range of motion of the shoulder joint. While the administration of ultrasound in addition to its physiological effects, the thermal effects of ultrasound can help the process of tissue regeneration, reduce inflammation and reduce muscle stiffness.

## CONCLUSION

Based on the analysis of the data conducted and the study of existing theories, it can be concluded that: 1. Mulligan technique combined with ultrasound is effective in reducing pain in *shoulder impingement* conditions at EMC Sentul Hospital. 2. Mulligan technique combined with ultrasound shows improved functional ability that has a positive impact on patients with *shoulder impingement* conditions at EMC Sentul Hospital, so that patients are able to carry out daily activities independently better.

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