

Differences in the Effects of Maitland Technique and Muligan Technique on Pain Changes and Functional Walking in People with Osteoarthritis Knee

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Abstract

Osteoarthritis is an articular cartilage degeneration disease, which generally causes pain when bending the knee, limited knee flexion movement, pain when walking for a long time, difficulty performing prayer movements to sit between two prostrate and unable to perform activities up and down stairs. This study is a quasi experimental study with randomized pre test-post test two group design, aiming to find out the difference in effectiveness between the combination of Ultrasound, Maitland Technique, Theraband exercise and combination of Ultrasound, Muligan Technique, Theraband exercise. Against changes in pain and functional walking in people with osteoarthritis knee, carried out at Poli Physiotherapy Hospital Makassar City, the sample is a knee osteoarthritis patient with a sample number of 14 people divided randomly into 2 groups, namely the treatment group I given ultrasound, theraband exercise and Maitland technique and treatment group II are given ultrasound, theraband exercise and muligan technique. Based on hypothesis testing using the paired sample t test obtained a value of $p = 0.000$ ($p < 0.05$) in the treatment groups 1 and 2, which means that a combination of Ultrasound, Maitland Technique, Theraband exercise and a combination of Ultrasound, Muligan Technique, Theraband exercise can produce significant pain and functional walking changes. The combination of Ultrasound, Maitland Technique, and Theraband exercise is no more effective than the combination of Ultrasound, Muligan Technique, Theraband exercise against pain changes and functional walking in people with osteoarthritis knee.

Keywords: Osteoarthritis Knee, Ultrasound, Theraband Exercise, Maitland Technique, Muligan Technique.

Introduction

Osteoarthritis is a disease characterized by *degeneration of articular cartilage, which causes fissures, fibrillation, and finally loss of thickness of articular cartilage*. Osteoarthritis is a leading chronic medical condition and is the leading cause of disability for people aged 65 years and over. Osteoarthritis begins as a result of trauma or repeated use of the joints that causes a change in the articular substance to the point of removal of the actual material through mechanical action [1].

According to the *World Health Organization* (WHO) (2017), it is estimated that 10% to 15% of adults over the age of 60 have a certain degree of OA, with a higher prevalence of women than men. According to the *AAOS (American Academy of Orthopedic Surgeons)*, the incidence of knee osteoarthritis in the United States

is estimated at 240 people per 100,000 annually. In 2009, more than eleven million outpatient visits were cases of osteoarthritis. It is estimated that in 2010, nearly ten million adults experienced symptoms of osteoarthritis knee [2].

Based on Basic Health Research Data (Riskesdas) in 2018, the results of interviews at the age of ≥ 15 years, the average prevalence of joint / rheumatic diseases was 24.7%. East Nusa Tenggara Province (NTT) is the province with the highest prevalence of OA which is about 33.1% and the lowest prevalence province is Riau which is about 9% while in East Java the prevalence rate is quite high, which is about 27% [3].

Based on the observations of researchers at Makassar City Hospital from October to December 2018, the number of *osteoarthritis*

knee patients was obtained as many as 35 people. The results of researchers' observations in the practice field there are several problems experienced by people with *osteoarthritis knee*, namely pain when bending the knee, limited knee *flexion* movement, pain when walking for a long time, difficulty doing prayer movements to sit between two prostrate and unable to do activities up and down stairs.

Some effective exercises to help reduce OA knee symptoms are, *strengthening exercises (quadriceps for OA knee)* and *Aerobic exercise*; walking, swimming and cycling. The purpose of this exercise includes improving joint function, increasing joint strength, protecting joints from damage by reducing stress on the joints, preventing disability and improving physical fitness. This exercise is certainly tailored to the patient's condition and ability [4].

Ultrasound therapy or abbreviated ASUS is one of the most common physical agents used in physiotherapy practice in countries that have ever existed. We are based on the application of high frequency waves to body tissues to obtain mechanical or thermal effects. These effects are aimed at improving soft tissue healing, reducing *inflammatory* responses, increasing blood flow, increasing metabolic activity, and reducing pain [5].

Mobilization with Movement (MWM) is a manual therapy technique that combines active movements by the patient while the physiotherapist applies a continuous glide that is perpendicular to or parallel to the joint. According to MWM techniques are clinically effective in relieving pain and improving joint mobility in knee OA; there is published literature on the effectiveness of MWM in knee OA management. In the Randomized Control Trial study, it was shown that the application of the MWM technique coupled with trunk stabilization exercises and electrotherapy modalities (thermotherapy, ultrasound and interference therapy) in subjects with knee OA resulted in better WOMAC score improvements and more significant pain reduction than in the control group that received only trunk stabilization and electrotherapy.

In the Maitland Mobilization technique, a combination of physiological passive movement and glide accessories can improve joint ROM and restore kinematics between joint surfaces. Most research on manual therapy on knee OA has used *Maitland's mobilization* technique. Randomized Control Trial research shows that Maitland's techniques which include *antero-posterior glide (AP) tibia against femur*, and *patellar glide* in all directions plus *stretching, isometric quadricep, closed-kinetic chain exercise* and *static bicycle*; can result in better pain reduction in OA knee.

Theraband exercise is part of the *strengthening exercise*, where *strengthening exercise* has been shown to be effective as an intervention in *osteoarthritis knee patients*, based on a systematic review of 17 randomised clinical trial studies with 1705 osteoarthritis knee patients, obtained results that resistance

exercise. It can reduce significant pain, reduce stiffness and improve significant physical function [6].

Based on the description of the problem above, the formulation of this problem is Is there a difference in effectiveness between the combination of *Ultrasound, Theraband exercise, Maitland Technique* and a combination of *Ultrasound, Theraband exercise, Muligan Technique* against pain changes and functional walking in people with osteoarthritis knee?, and the purpose of this study is to find out the difference in Effectiveness between combinations *Ultrasound, Theraband exercise, Maitland Technique* and a combination of *Ultrasound, Theraband exercise, Muligan Technique* against pain changes and functional walking in people with osteoarthritis knee.

Method of Study

This type of research is experimental research with *randomized pretest-post two group design*. The study consisted of 2 sample groups, namely treatment group 1 given *ultrasound intervention, Theraband Exercise and Maitland Technique* and treatment 2 given *ultrasound intervention, Theraband Exercise and Muligan Technique*. The population of this study is all people with Osteoarthritis Knee who get physiotherapy services at Makassar City Hospital. The sample in this study was *osteoarthritis knee sufferers* who fit the criteria for inclusion in sampling. The sampling technique used is *accidental sampling*.

Data collection is obtained through *pretest* and *post test* data, namely measurement of pain intensity and functional walking, with the test procedures are as follows:

1. Pain Changes

a. Patient preparation: Provide an explanation of the test procedure to be carried out.

b. Engineering:

1) Instruct the patient to perform walking or ambulation activities standing to squat, then the patient is asked to give a mark on the NRS scale line, which describes the intensity of the complained pain, between 0 (painless) to 10 (severe pain).

2) Record the measurement results.

2. Functional walking

a. Patient preparation: Provide an explanation of the test procedure to be carried out. Then the patient is positioned to sit comfortably and lean on the chair with the arm position above the support of the chair.

b. Engineering:

1) Physiotherapists give "start" ababa, the patient stands up and starts walking towards the cone or sign that has been prepared then rotates around the cone / marker and walk back to the chair and sit down.

2) The calculation of time in patients begins when the ababa "starts" until the patient sits where he originally sat.

3) The patient should not be helped during the test.

4) Record the measurement results.

Evaluation

measurement results adjusted by time up and go tables

- a. < 10 seconds: Normal
 - b. < 20 seconds: good mobilization
 - c. < 30 seconds: problematic, unable to go out of the house by yourself, needing the help of others when walking or using aids
- There were 2 sample groups, namely treatment group 1 given *ultrasound intervention, Theraband Exercise dan Maitland Technique*, Treatment Group 2 which was given *ultrasound intervention, Theraband Exercise and Muligan Technique*. As for *ultrasound procedures, Theraband Exercise, Maitland Technique and Muligan Technique*.

There is a difference in effectiveness between the combination of *Ultrasound, Theraband exercise, Maitland Technique* and the combination of *Ultrasound, Theraband exercise, Muligan Technique* against pain changes and functional walking in people with osteoarthritis knee.

Result

Based on the research of study, we find the result of this study below.

Table 1: Average pain and functional changes run based on pre-test scores, post test and difference

Data Group	Average		
	Pre test	Post test	Difference
Treatment Group 1			
Pain	6.43±0.98	3.57±1.27	2.86±0.69
Functional walking	34.91±3.95	32.33±3.83	2.58±0.91
Treatment Group 2			
Pain	5.86±0.90	3.00±1.16	2.86±0.90
Functional walking	37.09±1.69	34.03±1.19	3.07±0.73

Based on the table above obtained the average value of pain and functional walking changes in treatment group I, as follows:

1. Pain: obtained pretest of 6.43±0.98 and posttest of 3.57±1.27 with an average difference of 2.86 ± 0.69, which means a decrease in pain with an average decrease of 2.86 after *ultrasound intervention, Maitland Technique, and Theraband Exercise*.
2. Functional walking: pretest of 34.91± 3.95 and posttest of 32.33± 3.83 with an average difference of 2.58±0.91, which means that there is a change in walking speed with an average speed of 2.58 seconds after being given *ultrasound intervention, Maitland Technique, and Theraband Exercise*.

Then, obtained the average value of pain changes and functional runs in the treatment group II, as follows:

1. Pain: obtained pretest of 5.86± 0.90 and posttest of 3.00 ±1.16 with an average difference of 2.86± 0.90, which means a decrease in pain with an average decrease of 2.86 after *ultrasound, Muligan Technique and Theraband exercise interventions*.

2. Functional Walking: obtained an average pre-test value of 37.09± 1.69 and posttest of 34.03±1.19 with an average difference of 3.07± 0.73, which means a change in walking speed with an average speed of 3.07 seconds after being given the intervention

Table 2: Test different averages of pain and functional changes running before and after Treatment group 1

Data Group	Before	After	t	p
Pain Relief				
Average	6,43	3,57	10,95	0,000
Standard Deviation	0,98	1,27		
Functional Walking				
Average	34,91	32,33	7,55	0,000
Standard Deviation	3,95	3,83		

Based on the table above obtained the results of the paired sample t test, namely the value of $p < 0.05$ which means that *ultrasound interventions, Maitland Technique and Theraband exercise* can have a significant influence on pain changes and functional walking in people with *osteoarthritis knee*.

Table 3: Test of average pain and functional changes before and after in treatment group II

Data Group	Before	After	t	p
Pain Changes				
Average	5,86	3,00	8,402	0,000
Standard Deviation	0,90	1,16		
Functional Walking				
Average	37,09	34,03	11,104	0,000
Standard Deviation	1,69	1,19		

Based on the table above obtained the results of the paired sample t test, namely the value of $p < 0.05$ which means that *ultrasound interventions, Theraband exercise and Muligan Technique* can have a significant influence on pain changes and functional walking in people with osteoarthritis knee.

Table 4: Test of average difference after intervention between groups treatment I and treatment group II

Data Group	Treatment Group I	Treatment Group II	t	P
Pain Changes				
Average	3,57	3,00	0,88	0,396
Standard Deviation	1,27	1,16		
Functional Walking				
Average	32,33	34,03	-1,126	0,282
Standard Deviation	3,83	1,19		

Based on the table above obtained the results of *the independent sample t* test, namely the value of $p > 0.05$ which means that there is no significant average difference between the treatment group I (*Ultrasound, Maitland Technique and Theraband exercise*) and the treatment group II (*Ultrasound, Muligan Technique and Theraband exercise*).

Discussion

Based on hypothesis testing using the paired sample *t* test obtained a *p* value of < 0.05 which means that a combination of *Ultrasound, Maitland Technique and Theraband exercise* can provide significant pain and functional walking changes in people with *Osteoarthritis Knee*. Based on the difference are in pain measurement and functional walking, all samples experienced decreased pain and improved functional walking. *Osteoarthritis knee* can cause pain when accumulating weight, limited movement, and finally to the tendency in walking activities. The presence of asymmetrical loads on the *knee joint* surface and *laxity* of some ligaments due to changes in joint *space* can cause pedestal pain, while limitations of motion arise due to pain and inflammation factors in the joint capsule so that *tight* or contracture occurs in the joint capsule. *Ultrasound* in this study with a frequency dose of 1 MHz and a *pulse ratio of 100% (continuous ultrasound)* was applied to joint capsules as a therapeutic target. Localized *thermal* effects can increase the temperature of capsule tissue so that there is an improvement in the *extension* of the shortened capsule.

The knee joint capsule absorbs ultrasound energy so that movement and friction occur in the molecules in the tissue. The movement of these molecules can produce heat production in the *joint capsule*. The increase in temperature that occurs in the *joint capsule* will improve the *extension* of the joint capsule and inhibit the activity of the sympathetic nerve resulting in a decrease in tension in the capsule. This will facilitate the application of *Maitland Technique* and *Theraband exercise* in improving the functional ability of the knee.

Rutjes et al. (2010) analyzed five randomized, controlled studies comparing the effects of *ultrasound* and *placebo* on pain levels and function with a total of 341 *osteoarthritis knee* patients. In *ultrasound* there was a difference of 1.2 cm on the VAS scale of 10 cm compared to placebo ultrasound and also there was a significant increase in WOMAC score [8].

The problem of tight or contracture of knee joint capsules can be overcome by *Maitland Mobilization*. In *Maitland mobilization*, physiological *oscillation movements* and *accessories* are applied to the joints to regain the ROM of the joints lost due to pain or stiffness, and to restore optimal kinematics between the joint surfaces.

The Maitland Technique responds to mechanical stress in limited tissue. The effect obtained from joint mobilization is the normalization of accessories movements with skillful application

of extrinsic forces. To achieve a mechanical effect, the joint structure is moved into the *plastic region of the stress-strain curve* where *permanent deformation occurs*. In such positions, minimal force is required to mechanically affect obstacles.

According to Kaya Mutlu et al (2018), the application of *oscillation movements in the Maitland Technique* helps reduce pain perception by stimulating *repetitive mechanoreceptors* that can block the *nociceptive path way in the spinal cord and at the brain stem level*.

Maitland Technique with posterior anterior application can produce strain on the anterior knee joint capsule, while lateral-medial application provides strain on lateral joint capsule and medial knee. The strain effect on the joint capsule can restore *joint play* motion in the *knee joint* so as to provide improved knee joint mobility. In addition, the strain effect can stimulate *mechanoreceptors* in joint capsules, where the activity of *mechanoreceptors* can block *nociceptive* impulses so that joint pain can decrease [8].

The *application of Theraband exercises* can improve muscle performance, especially muscle strength in *osteoarthritis knee* patients. *Theraband* is an elastic rubber with a different percentage of elasticity, where generally used is 50% elasticity. With this elasticity, the *theraband* wrapped around the limbs can provide resistance when the patient performs active movements resulting in *consequential and eccentric isotonic* contractions. A simple statement from Kisner and Colby (2014), explaining that in order to improve muscle performance, the muscle must be given a load or resistance. The load or resistance must exceed the metabolic capacity of the muscle so that the muscle acquires new challenges at a greater level than usual. Then, if the load or resistance is still constant after the muscle adapts, then the level of *muscle performance* can be maintained but cannot be increased.

Dynamic resistance exercises with both consequential and eccentric contractions can improve muscle strength and endurance based on the principle of overload. Improvements in muscle strength and endurance in the regio knee can reduce pain and improve the functional ability of the knee. This happens because improved muscle performance can strengthen joint stability and reduce asymmetrical mechanical load on the joint so that it can reduce pedestal pain while improving knee functional ability in osteoarthritis knee patients.

Thus, the combination of *Ultrasound, Maitland Technique and Theraband exercise* can improve the functional ability to walk in osteoarthritis knee patients through the effect of improving joint capsule extensibility by *Ultrasound*, repair of joint ROM by *Maitland Technique*, and improvement of muscle performance by *Theraband exercise*. Improvements in ROM and muscle performance can result in freedom of movement in the knee and improvements in joint stability so that patients can walk functionally with very minimal pain.

Based on hypothesis testing using the paired sample t test obtained a p value of < 0.05 which means that Ultrasound, Mulligan Technique and Theraband exercise can provide significant pain and functional walking changes in people with Osteoarthritis Knee. It has been explained that ultrasound is aimed at the capsule of the knee joint that is tight. The thermal effect of Ultrasound therapy with a dose of 100% pulse ratio (continuous ultrasound) can provide an increase in local temperature in knee joint capsules and the increase in temperature can change the extensibility of capsule tissue that is tight. This situation can facilitate the application of mulligan technique on knee joints.

Mobilization in the Mulligan technique uses active mobilization of the patient combined with passive assessor movements from physiotherapists. In the concept Mulligan theory describes the concept of "minor positional faults" that occur in the surface of the joint after injury, sprain or strain, related to 'malalignment' that occurs secondarily due to poor chronic injury and arthrokinematics, resulting in symptoms such as pain and stiffness [9]. In the case of osteoarthritis knee, there is generally a slight shift of the tibia plain towards the lateral due to the large pull of muscles on the lateral side (iliotibial band and vastus lateralis) and weakness of the vastus medialis muscle, especially vastus medialis oblique. This causes motion pain and pain when collecting due to asymmetric loads on the surface of the joint.

The mulligan technique with the MWM method can correct or reposition the surface of the malalignment joint so as to improve the kinematics of the knee joint and reduce irritation of the joint so that the knee joint can freely move functionally without pain. In addition, this MWM technique can produce strain effects on knee joint capsules and stimulate muscle proprioceptors due to active motion, so this technique can improve joint ROM while reducing tight muscle pain and tone through muscle proprioceptors (muscle spindles and organ tendon goals) [9].

It was already explained that theraband exercises can improve the performance of the quadriceps femoris and hamstring muscles through resistance created by theraband with consequential and eccentric isotonic contractions. Resistance exercises with eccentric isotonic contractions can improve muscle strength and endurance as well as result in muscle work balance. This will strengthen the protection and stability of the joints so that the joints can support the body's load without pain, which eventually the patient can perform functional activities walking without symptoms. Through the therapeutic effects produced by the combination of Ultrasound, Mulligan Technique and Theraband exercises can produce several improvements, including: decreased pain, freedom of movement of the knee joint, and increased functional ability to walk through changes in walking speed without symptoms.

Based on hypothesis testing using the independent sample t test obtained a p value of > 0.05 which means that ultrasound, theraband exercise and Maitland Technique are not significantly

more effective compared to Ultrasound, Theraband exercise and Mulligan Technique against pain changes and functional walking in people with osteoarthritis knee.

The difference in interventions in both sample groups lies in the interventions of the Maitland Technique and the Mulligan Technique. The Maitland technique uses passive mobilization of accessories combined with physiological passive motion. While the Mulligan technique uses passive mobilization of accessories movement combined with physiological active movement of the patient. Although there are differences in their application, both techniques can produce the same therapeutic effect that causes strain in the joint capsule so that the effect can release the tight state that occurs in the joint capsule. Thus, both techniques can improve knee joint mobility he results of this study also showed no significant difference between the combination of Ultrasound, Maitland Technique, Theraband exercise and the combination of Ultrasound, Mulligan Technique, Theraband exercise against pain changes and functional walking in people with osteoarthritis knee joint. However, judging from the average difference, there was a slight difference in the functional ability to walk, where the Mulligan Technique group was slightly larger resulting in improvements in the functional ability to walk than the Maitland Technique group, but the small difference was insignificant.

This is in line with previous research, namely research by Ramya et al (2017) on immediate effects of Maitland mobilization versus Mulligan Mobilization with Movement in Osteoarthritis knee, where the results showed that both techniques are equally effective in producing pain changes and functional walking [10-33].

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Conflict of Interest

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