
THE EFFECTIVENESS OF ADDING CORE STABILITY EXERCISE TO MICROWAVE DIATHERMY, ULTRASOUND AND MASSAGE INTERVENTION IN IMPROVING FUNCTIONAL ABILITY IN PATIENTS WITH OSTEOARTHRITIS GENU

Made Widnyana^{1*}, I Putu Yudi Pramana Putra¹, I Made Niko Winaya¹,
Anak Agung Gede Eka Septian Utama¹, I Dewa Gede Alit Kamayoga¹

¹Physiotherapy Department Medical Faculty Universitas Udayana, 80234, Denpasar, Indonesia

Email: widnyanamade@unud.ac.id

ABSTRACT

Osteoarthritis (OA) genu is a degenerative musculoskeletal system disorder in the knee joint which is characterized by slow and progressive loss of joint cartilage. OA genu causes disability and decreased functional abilities. This research aims to determine the effectiveness of adding core stability exercise to microwave diathermy, ultrasound and massage interventions in improving functional abilities in patients with OA genu. The research method used was a randomized controlled trial design. There are two groups selected randomly with the block permutation technique. The treatment group consisted of 18 samples receiving core stability exercise, microwave diathermy, ultrasound and massage. The control group, totaling 18 samples, received microwave diathermy, ultrasound and massage. Functional ability was measured by the WOMAC questionnaire (Western Ontario and McMaster Universities Osteoarthritis Index). The research was conducted at a private physiotherapy clinic in Denpasar. The results of the study after the Paired T-Test was carried out in each group with a p value <0.05, this indicated that there was a significant difference between the results of the pre-test and post-test in each group. The different test between groups was carried out by the Independent Sample T-Test, obtaining a p value <0.05, this indicates that there is a significant difference between the treatment group and the control group. The conclusion of this study is that the addition of core stability exercise to microwave diathermy, ultrasound and massage interventions further enhances functional activity in OA genu patients. The implications of theoretical and practical research as additional knowledge and guidelines in providing effective interventions for OA genu conditions.

Keywords: Osteoarthritis genu; functional ability; microwave diathermy; ultrasound; massage.

INTRODUCTION

Osteoarthritis (OA) genu is a degenerative musculoskeletal system disorder in the knee joint which is characterized by slow and progressive loss of joint cartilage. In genu OA there are also changes in the subchondral bone and osteophyte formation. The synovial membrane is periodically irritated which causes inflammation in the joints. Genetic OA can occur in people of all ethnicities, is more common in women and in patients over 65 years, oa genu is the most common cause of disability. In Indonesia the incidence of OA genu is quite high, 5% are over 40 years old, 30% between 40-60 years old and 65% are over 61 years old. Meanwhile in Bali, based on visiting data at the Rheumatology and Orthopedics Polyclinic at Sanglah Hospital, Denpasar in 2014-2016, 90 sample data obtained experienced OA. Based on these data, 66 (73.3%) patients were patients with OA genu, 17 (18.9%) had hip OA, and 7 (7.8%) had spinal OA^{1,2}.

Physiotherapy management of OA genu consists of physiotherapy modalities, manual therapy and exercise therapy. The concept of conventional exercise therapy is usually directly applied to the knee region. In this study, researchers will apply exercises with a new concept, namely stability and proximal strengthening with Core Stability Exercise (CSE). The objective of this research was to determine the effectiveness of adding core stability exercise to microwave diathermy, ultrasound and massage interventions

in improving functional abilities in patients with OA genu. The research will be carried out using an experimental method with a randomized controlled trial design. The method used to achieve short-term research objectives is to carry out research on time and according to the procedures described in the proposal, so that accurate research results will be obtained. While the method that will be used to achieve long-term research goals, namely increasing functional abilities in patients with OA genu is by applying the results of research on an ongoing basis through the replensihment of CSE to microwave diathermy, ultrasound and massage interventions so that they can provide benefits for researchers, subjects, institutions and Indonesian nation and state.

METHODS

a. Methodology

Study design

The study was conceived as a randomized controlled trial design. Before patients were recruited, the study was approved by Medical Faculty of Udayana University/Sanglah Hospital Denpasar with ethical clearance number 1766/UN14.2.2.VII.14/LT/2022. An elucidation of the procedures and advantages of the research was conducted on all respondents before the study began. The research was done and declared in appropriate with the CONSORT 2010 explanation.

Subjects recruitment

Subject in this study were populations with OA genu in I Made Niko Winaya's physiotherapy clinic. Eligibility criteria in this study were age 40-70 years, BMI 18.5 – 27.0, don't take any pilss/medicine, past the acute period, cooperative and good communication. Subjects who have hystory of lower extremity fracture, ligament injury, meniscus injury, maliganncy and other pathological condition that can affected result of the research were excluded from this study.

Sampling technique

In this study, sampling techniques were conducted by purposive sampling method. Blinding technique used is single blind, where the sample does not know whether the sample is a control group or treatment group. The subject were entered to a treatment or a control group by using a permutation block randomized echnique. The number of blocks must be an even number, for example 4. The treatment group is given the symbol 1, while the control group is given the symbol 2. After entering the formula, six permutations are obtained: 1212, 1221, 1122, 2121, 2112 and 2211. Then one permutation is chosen at random, selected 1212. So in practice, the first patient as a sample of the treatment group, the second patient as a sample of the control group. And so on, it was repeated from the beginning until it got 36 patients.

b. Material and procedure

Material

OA genu were assesed by joint play movement test. Weight measurements were carried out using digital weighing scale with a decimal number one decimal point in kilograms. Height measurement were carried out using stature meter. Functional ability score carried out using WOMAC questionnaire. The disability test result devided into four categories, light, moderate, severe and worst disability.

Procedures

The application of core stability exercises to patients begins with an explanation of the goals and benefits of the subject. The physiotherapist then demonstrates the abdominal brace and front bridge movements on the subject. Each movement is done 15-30 times with 3-5 repetitions and 2-3 sets. In massage intervention, the physiotherapist describes the procedure, the purpose / benefits and risks of massage. The patient is then positioned in supine and prone lying lying. Massage is done with baby

oil media for 15 minutes on the quadriceps, hamstring, gastrocnemius, soleus and tibialis anterior. In MWD intervention, physiotherapists explain about the procedures, objectives / benefits and risks of using MWD. The patient is then positioned supine lying. Free the area to be given MWD modalities from clothing. MWD is applied for 10-15 minutes on the knee with a distance of 7 - 10 cm. In US intervention, physiotherapists explain about the procedures, objectives / benefits and risks of using US. The patient is then positioned in supine lying. Free the area to be given US modalities from clothing. US is applied for 5-10 minutes on the knee with circular movement of the transducers. Intervention in the sample was given three times a week for four weeks. The total sample in both groups received 12 interventions. Intervention in the sample was given three times a week for four weeks. The total sample in both groups received 12 interventions.

c. Assessment

Disability score was measured twice, first time treatment (pre-test) and the last time treatment, after (post-test). Functional ability scores were measured by WOMAC questionnaires. This questionnaire is designed to provide information to physiotherapists how OA genu affects the ability of samples in daily activities. The sample answers each question by marking a box describing your condition today. There are four classifications of disabilities, namely: light (0-24), moderate (24-48), severe (48-72) and worst (72-96).

d. Data analysis

The software used to process the data is SPSS version 16.0. (1) Descriptive Statistics to analyze age, gender and BMI, (2) Paired Sample T-Test and Independent Sample T-Test were use for hypothesis testing.

1. Normality test

The results of the normality test (Shapiro Wilk Test) on functional ability before and after the intervention showed a p value > 0.05, this means that the data is normally distributed.

2. Homogeneity test

The results of the homogeneity test (Lavene Test) on functional ability before and after the intervention showed a p value > 0.05, this means that the data is homogeneously distributed.

3. Hypohotesis test

- a. Hypohotesis 1 test used paired t-test to determine the mean difference in the effect of kinesiotaping, microwave diathermy and massage in group 1.
- b. Hypohotesis 2 test used paired t test to determine the mean difference of the effect of microwave diathermy and massage in group 2.
- c. Hypohotesis 3 test used the independent t test to determine the difference resut of group 1 compare with group 2, to test the significance different of the two groups.

RESULTS

Table 1. Respondents characteristics based on age, gender and BMI

Subject Characteristic	Treatment Group (n=18)			Control Group (n=18)		
	n	%	Average±SD	N	%	Average±SD
Age (years)	18	-	57.56±7.06	18	-	58.06±7.79
Male	7	38.89	-	8	44.44	-
Female	11	61.11	-	10	55.56	-
BMI (Kg/m ²)	18	-	23.95±2.13	18	-	23.86±1.56

Table 1 shows the characteristic data of the study subjects consisting of age, gender and BMI. Based on the characteristic of subjects by years showed in intervention group the average age of the sample was

57.56±7.06. In control group the average sample life was 58.06±7.79. Characteristics of subjects by gender in both groups showed that the most subjects in both groups were 15 male (41.67%) compared to 21 female (58.33%). The characteristics of the subject according to BMI indicate that the average value of BMI in treatment group is 23.95±2.13, while in control group is 23.86±1.56.

Table 2. Distribution and Variance of Research Subjects through Normality Test and Homogeneity Test

WOMAC score	Saphiro Wilk Test (<i>p-value</i>)		Levene Test (<i>p-value</i>)
	Treatment	Control	
Pre	0.137	0.080	0.914
Post	0.154	0.237	0.989
Difference	0.128	0.321	0.140

Table 2 shows the results of the normality test (Saphiro wilk test) and homogeneity test (Levene test) for data on disability score reduction before and after the intervention in group 1 and group 2 obtained $p > 0.05$ so that the data before and after the intervention in treatment group and control group is normally distributed and homogeneous so that the next statistical test uses a parametric statistical test.

Table 3. Hypothesis Test with Paired Sample T-Test in Treatment Group and Control Group

Group	Pre (Average±SD)	Post (Average±SD)	<i>p-value</i>
Treatment	50.89±10.11	33.61±9.36	0,000
Control	52.83±10.10	41.17±9.85	0,000

Table 3 shows a decrease in WOMAC scores between before and after intervention in the treatment group and control group. Changes in WOMAC scores were analyzed with a paired sample t-test with the same value of $p = 0.000$. The results stated that either the treatment group or the control group were equally significant in increasing functional ability in OA genu.

Table 4. Hypothesis Test with Independent Sample T-Test between Treatment Group and Control Group

Group	Pre (Average±SD)	Post (Average±SD)	<i>p-value</i>
Treatment	50.89±10.11	33.61±9.36	0.000
Control	52.83±10.10	41.17±9.85	

Based on the results of the independent samplet-test analysis, showed that disability scores after intervention in the treatment group and control group obtained a $p < 0.05$ score which means there is a significant difference between the treatment group and the control group in increasing functional ability in OA genu patients. From descriptive data, the percentage decrease in WOMAC scores in the treatment group was greater than the percentage decrease in WOMAC scores in the control group. It can be concluded that the addition of core stability exercise to microwave diathermy, ultrasound and massage interventions further increase functional ability in OA genu patients.

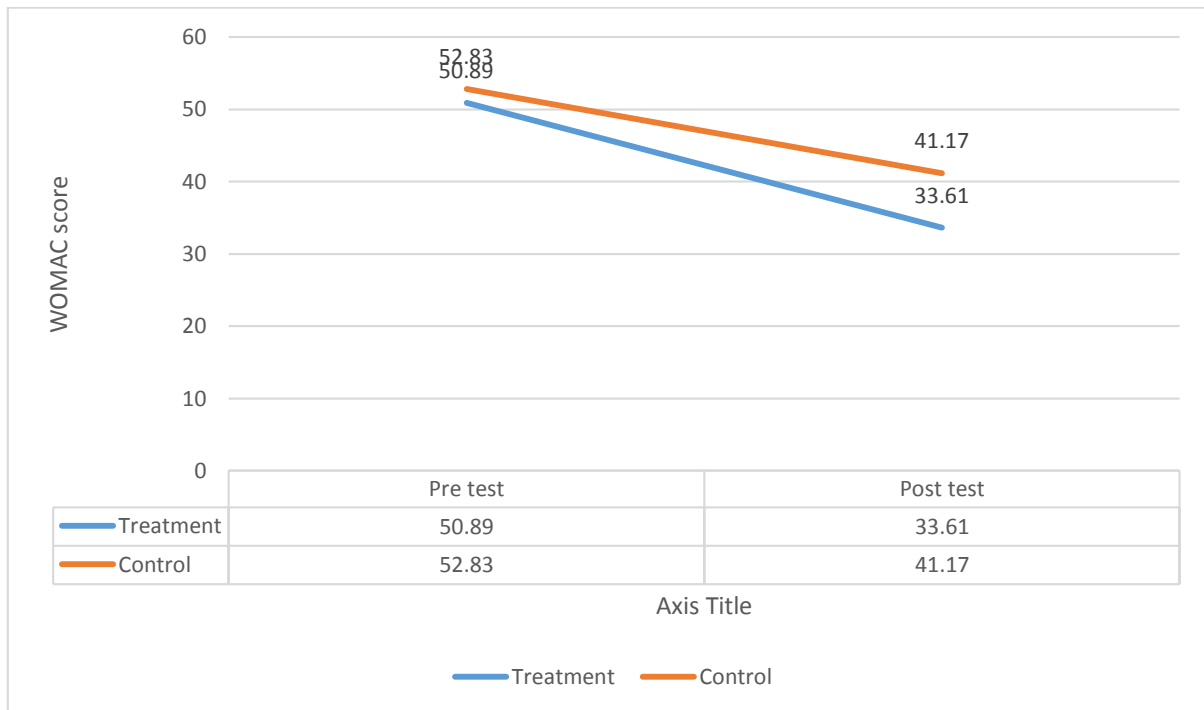


Figure 1. WOMAC score before and after intervention

DISCUSSION

Based on the characteristic of subjects by years showed in intervention group the average age of the sample was 57.56 ± 7.06 . In control group the average sample age was 58.06 ± 7.79 . Muraki, et al. explained the relationship between age and degeneration of the system and function of movement in the body, particularly in genu area which supports the highest weight happen at the years of 50 years and over³. The distribution of subjects by gender in both groups showed that the most subjects in both groups were 15 male (41.67%) compared to 21 female (58.33%). Changes in the balance of the hormones progesterone and estrogen at the age of menopause in women affect the bone balance system where there is a decrease in activity that plays a role in synthesizing calcium, phosphate and bone matrix components. This decrease in osteoblast secretion from the ovaries results in the incidence of OA genu being more common in female than in male⁴. The characteristics of the subject according to IMT indicate that the average value of BMI in treatment group is 23.95 ± 2.13 , while in control group is 23.86 ± 1.56 . Muraki *et al.* yang menyatakan secara statistik IMT berhubungan dengan OA genu. Individu yang memiliki IMT *overweight* dan obesitas lebih berisiko mengalami OA genu³.

Based on the Paired Sample T-Test, decreased WOMAC scores between pre and post treatment in the intervention group and the control group were analyzed by paired sample t-test. In the treatment group with a value of $p = 0.000$ ($p < 0.05$). These results stated that in the treatment group with the intervention of MWD, US, Massage and core stability exercise significantly increased functional ability in patients with OA genu. In the control group with a value of $p = 0.000$ ($p < 0.05$). These results also stated that the control group with MWD, US and massage interventions significantly increased functional abilities in patients with OA genu. Based on the results of the independent samplet-test analysis, it shows that the WOMAC score after intervention in the treatment group and the control group obtained a $p = 0.000$ ($p < 0.05$), which means

that there is a significant difference between the treatment group and the control group in increasing functional activity in OA patients genu. From the descriptive data, the percentage of WOMAC score reduction in the treatment group was greater than the percentage of WOMAC score reduction in the control group. In conclusion, the addition of core stability exercise to microwave diathermy, ultrasound and massage interventions further increases functional activity in genu OA sample.

This research are the same as Dabholkar's research. A research of 19 sample with OA genu, was given core stability exercise, then evaluated through a biofeedback pressure device. Core stability exercise significantly related eith functional activity in OA genu⁵. Subramanian and Suganti's research also aligns with this research. A case study study with an 87 year old OA subject. Subjects were given specific core stability exercises two times a wek for six months. The result was a significant decrease in Body Mass Index with p value <0.05 and decrease in WOMAC score with p value <0.05⁶. Zarei and Rahnama's research is also consistent with the results of this study. A total of 25 women with OA genu did three session core stability exercise for eight weeks. Significant increased in static and dynamic balance⁷. Khisty's research also aligns with this research. A total of 30 patients with unilateral medial OA genu. Subjects underwent core stability exercise with static abdominal, pelvic bridging and abdominal crunches. It was significantly increased in the KOOS and VAS scores after the intervention was given⁸.

OA genu is characterized by muscle weakness and atrophy of the joint stabilizer muscle. CSE able to increase trunk, hip, pelvic and knee coordination and stabilization by stimulating lumbopelvic-hip complex muscle and knee muscle. Exercise therapy that intend to restoring muscle power have been shown to have the potential to protect joints from pathological stressors⁹. Dynamic muscle work will increased through this exercise. Trunk will supported with coordinated and simultaneous contractions of these muscles, so that reduced in intradiscal pressure and workload of the lumbar and lower extremity muscles. It can also prevent injury to soft tissue. Reducing in muscle tension will improve muscle pump which increased blood circulation to the muscle that covered our back. It will increase blood supply and oxygen to the muscle tissue, so that reduced pain by muscle spasme too. To activating the spinal stabilizer muscles (core muscle), the muscles around them that are spasming will become relax, thereby also obtaining excellent spinal stability and a neutral spinal position. Better spinal stability will make a person easily in carrying out functional activities. In addition, less or minimal intradiscal pressure will make it more comfortable for the patient to carry out daily activities. Among other things, patients will find it more comfortable to do their functional daily activities⁹.

Core stability is the skill to supervise the position and movement of the body to the lower part of the body, which is used to perform optimal movements by transferring body weight and footing during the walking process. Core muscle activation is used to produce spinal rotation. Enhanced core stability also results in an increased level of lower extremity or leg activation to develop the ability to support or move the lower extremity. This helps maintain good posture for movement and forms the basis of all arm and leg movements⁰.

CONCLUSION

Based on the study, the age of patients experiencing OA genu is ranging in age from 40-70 years. In terms of gender, female experience more OA genu than female. In terms of BMI, overweight samples were more susceptible to experience OA genu. Statistical test results in the control group showed that microwave diathermy, ultrasound and massage interventions significantly increased functional activity in OA genu patients. Statistical test results in the treatment group showed that interventions in core stability exercise, microwave diathermy, ultrasound and massage significantly increased functional ability in OA genu patients. Statistical test results showed that interventions in core stability exercise, microiwave diathermy, ultrasound and massage increased functional ability more than microwave diathermy, ultrasound and massage interventions in OA genu patients.

Further research is needed to control the physical activity of the sample, smoking habits and nutrition

of the sample. In addition, it is necessary to conduct advanced research to determine the medium- and long-term effects of core stability exercise on OA genu patients rehabilitation programs.

CONFLICT OF INTEREST

The authors declare no conflict of interest

ACKNOWLEDGEMENT

Authors would like to thank LPPM Unud, UPPM FK and PSSFPF FK Unud.

REFERENCES

1. Cucchiari M, de Girolamo L, Filardo G, Oliveira JM, Orth P, Pape D. Basic science of osteoarthritis. *Journal of experimental orthopaedics*. 2016. 3(1):18.
2. Putra IPGCG, Wiguna IGLNAA, Niryana IW. Profil penderita osteoarthritis di rumah sakit umum pusat sanglah Denpasar periode Januari 2014 - Desember 2016. *Jurnal Medika Udayana*. 2019. 8(10).
3. Muraki S, Tanaka S, Yoshimura N. 2013. Epidemiology of Knee Osteoarthritis. *OA Sports Medicine* 26;1 (3) : 21.
4. Zhang Y. 2010. *Epidemiology of Osteoarthritis. Clin Geriatr Med* :26(3):355-369
5. Dabholkar, T. A., & Dabholkar, A. (2016). Correlation of the core stability measures with the hip strength and functional activity level in knee osteoarthritis. *IJTRR*, 5(January). <https://doi.org/10.5455/ijtr.000000180>
6. Subramanian, S. S., & Suganthi, S. (2017). Impact of Core Exercises and Alignment Correction Exercises of Bilateral Osteoarthritis Knee on an Octogenarian Subject – Evidenced Study. *Case Studies Journal*, 6(7), 9–14.
7. Zarei, P., & Rahnama, N. (2017). Comparison of the Effects of the Two Strengthening and Balanced, Strengthening, Balanced, and Core-stability Exercise Protocols on the Balance and Fear of Falling in Women with Knee Osteoarthritis. *JPSR*, 7.
8. Khisty, A. (2019). Effect Of Core Stability Exercises In Patients With Unilateral Osteoarthritis Of Knee. *International Journal of Innovative Knowledge Concept*, 7 (5).
9. Kisner, C., & Colby, L. (2011). *Therapeutic Exercise: Foundation and Techniques*. (Fifth Edit). Philadelphia: F. A. Davis Company, 1915 Arch Street.
10. Kibler, W. Ben, Press, J., & Sciascia, A. (2006). The Role of Core Stability in Athletic Function. *Sport Med*, (June 2014). <https://doi.org/10.2165/00007256-200636030-00001>