THE EFFECT OF RETROWALKING PROGRAMME ON WALKING PATTERN AND FUNCTIONAL ABILITY IN KNEE OSTEOARTHRITIS PATIENTS AT HASANUDDIN UNIVERSITY HOSPITAL

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Abstract

This study aims to determine the effect of retrowalking programme (RWP) on walking patterns and functional abilities in knee osteoarthritis patients with a pretest-posttest quasi-experimental design with 2 groups. The sample in this study amounted to 30 people who were randomly divided into 2 groups. The first group (experimental group) was given conventional physiotherapy intervention and RWP and the second group (control group) was only given conventional physiotherapy intervention. Before the intervention was given, a pretest was conducted in the form of a GAIT questionnaire to assess walking patterns and WOMAC to assess functional abilities in knee OA patients. Post test was conducted after both groups were given intervention 3 times a week for 5 weeks. The paired T test was used to determine changes before and after treatment in both groups. Then an unpaired T test was conducted to determine the comparison of effectiveness between the two groups. The results showed that there was a decrease in GAIT and WOMAC scores in both groups (p=0.000). The comparison test of the two groups showed that the difference in GAIT values in the experimental group was 10.47 ± 3.50 higher than the control group 7 ± 2.23 with a value of p = 0.003. The difference in WOMAC scores in the experimental group 20.93±5.02 was higher than the control group 11.33±3.15 with a value of p = 0.000. Conventional physiotherapy intervention combined with RWP is more effective than conventional physiotherapy intervention alone in improving walking patterns and functional abilities in knee OA patients.

Keywords: Conventional Physiotherapy Intervention, Retrowalking Programme, Walking Pattern, Functional Ability, Knee Osteoarthritis

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1. Introduction

Globally, life expectancy continues to increase year after year. But chronic diseases also continue to grow, resulting in most people living with poor health (Dantas, 2021). One of the chronic and disability-causing diseases is osteoarthritis (OA). It is the tenth largest contributor to global disability and its prevalence has doubled in the last 10 years (Dantas, 2021).

Osteoarthritis (OA) of the knee is a common disease in the elderly and is a degenerative disease of the synovial joint characterised by chondropathy (loss of cartilage) and concomitant proliferation of new bone with *remodelling of the* joint contour (Wadhwa, 2016,). Pain and joint stiffness that arise in patients with knee OA can cause problems in carrying out daily activities such as changing positions from sitting or lying down, walking, climbing stairs, standing for too long, praying, and in more severe circumstances causing disability so that it requires an assistive device to walk. These symptoms can cause disruption of daily activities such as walking (Chen, 2021).

Approximately 10% of the population over the age of 60 years is affected by OA; 80% of this population has movement limitations, and 25% have functional limitations that interfere with the performance of daily activities (Alcalde, 2017). This decrease in productivity of the elderly group occurs due to a decrease in function, which will cause the elderly group to experience a decrease in carrying out daily activities such as eating, going to the bathroom, dressing, and others in their daily activities / *Activities Daily Living* (ADL) (Wardojo, 2021).

The walking pattern is a walking cycle that starts with one foot in contact with the ground and ends with the next ground contact by the same foot . The walking pattern consists of 2 phases, namely the standing phase and the swinging phase.

A meta-analysis by Boekesteijn et al in 2022 on walking patterns found that the walking speed of OA patients was slower with a lower swing phase in the sagittal plane, less *pelvic* movement and lower *foot strike* angle and *toe-off* angle compared to healthy people. So to overcome the decline in knee biomechanics, management is needed to reduce side effects. One of the things that can be done is walking exercise for limb muscle strengthening and for patients with *genu varus/genu vagus*. Walking exercise can be an alternative because it is considered to help improve the decline in function that occurs in patients with knee OA. Based on these circumstances, patients with knee OA need appropriate exercises to reduce pain and increase functional activity.

In recent years, exploration related to alternative treatment methods or therapeutic methods for knee OA continues to grow, such as *Backward Walking exercise* or commonly called the *Retro Walking Programme* (RWP). A recent meta-analysis proved that RWP as an adjunctive therapy with conventional treatment is effective and feasible for patients with knee OA (Balasukumaran, 2019). Other studies have also revealed that RWP has the potential to improve balance performance and prevent falls for healthy subjects (Cha, 2016) and people with stroke (kim, 2017) or *cerebral palsy* (Elnahhas, 2019). In addition, RWP combined with conventional treatment showed pain reduction and improved static stability in patients with knee OA after 4 weeks of RWP training (Chen, 2021).

Based on literature studies that have been conducted, RWP is able to improve daily activities, but there is no research related to the effect of RWP on walking patterns in knee OA patients. So the researcher is interested in conducting a study with the title "The effect of *Retrowalking Program* on walking patterns and functional abilities in knee osteoarthritis patients".

2. Materials and Methods

This study used a quasi-experimental design with a pre-post test control group which aims to determine the effect of *retro walking exercise* on walking patterns and functional abilities in knee osteoarthritis patients at Hasanuddin University Teaching Hospital. The sampling method used purposive sampling technique with inclusion criteria; patients with knee OA, aged 55-85 years, willing to become research samples, cooperative, willing to follow the exercise programme in the study, willing to sign research consent. With exclusion criteria using a walker, having neurological and cardiovascular disorders and having undergone arthroplasty. The total sample was 30 people who were randomly divided into two groups. The experimental group was given conventional physiotherapy intervention with RWP and the control group was only given conventional physiotherapy intervention.

Procedure

Pretest was in the form of GAIT (Gait Assessment and Intervention Tool (GAIT) questionnaire to assess walking pattern and WOMAC (The Western Ontario and McMaster Universities Osteoarthritis Index) to assess functional ability. The experimental group received conventional physiotherapy intervention. Furthermore, the RWP procedure included a warm-up of 5 steps forward then 4 steps backward then RWP for 10 minutes per session.

Conventional physiotherapy intervention is the provision of interventions according to KNGF 2019 standards in the form of muscle strength training, aerobic exercise and functional exercise. Conventional physiotherapy interventions were carried out 3 times a week for 5 weeks. RWP is walking backwards starting from the toe on phase of the limb to the next toe on phase of the same limb. Each session consisted of 4 minutes of RWP 2 minutes rest for 2 sets performed 3 times a week for 5 weeks.

The second group, namely the control group, was only given conventional physiotherapy interventions according to the 2019 KNGF standard for knee osteoarthritis patients. Each respondent received the intervention 3 times a week for 5 weeks and then conducted a posttest.

The data used was primary data which was then tested for normality, using the Shapiro Wilk test. Changes before and after the intervention were analysed using the paired T test, while to measure the difference in effectiveness between the two groups was analysed using the unpaired T test. All data were processed using SPSS 25.

3. Results and Discussion

Characteristics of Research Samples

Table 1. Sample Characteristics Based on Age, Gender and Body Mass Index

Characteristic	**Experiment Group**		**Control Group**	
	N	**%**	**N**	**%**
Age				
56-70 years old	12	80	14	93.3
71-85 years old	3	20	1	6.7
Total	15	100	15	100
Gender				
Man	5	33.3	5	33.3
Woman	10	66.7	10	66.7
Total	15	100	15	100
BMI				
Underweight	0	0	0	0
Normal	4	26.7	6	40
Overweight	11	73.3	9	60
Total	15	100	15	100

Based on the age characteristics in table 1, the most respondents were in the age group 56-70 years, totalling 26 people, then in the age group 71-85 years, totalling 4 people.

Based on the characteristics of respondents in table 1, there were 20 female respondents compared to 10 male respondents. In the characteristics of BMI, there were 20 overweight respondents compared to 10 respondents with normal BMI.

Table 2: Test of Effect Before and After Treatment of the experimental group and control group

Group	Walking Pattern (GAIT)		Functional Ability (WOMAC)	
	Mean±SD	P value	Mean±SD	P value
Experiment				
Pretest	26.53±4.26	0.000**	61.07±7.03	0.000**
Post Test	16.07±4.15		12±(9-14)	
Control				
Pre-Test	24.53±6.43	0.000**	60±7.21	0.000**
Post-Test	17.4±5.91		49±7.21	

Based on the results of the effect test before and after treatment in table 2, there was a decrease in GAIT values in both groups, but the decrease in GAIT values was greater in the experimental group from 26.53 ± 4.26 to 16.07 ± 4.15 compared to the control group from 24.53 ± 6.43 to 17.4 ± 5.91. Similar to the GAIT value, the WOMAC value in both groups also decreased, but the decrease in WOMAC value was greater in the experimental group from 61.07±7.03 to 40.13±5.53 compared to the control group from 60±7.21 to 49±7.21. The p value in both groups is 0.000, where $p < 0.05$ so it can be concluded that there is a very significant difference between before and after treatment in both groups.

Table 3. Effect test before and after treatment on walking pattern and functional ability in the experimental group based on sample characteristics

Group Experiment	Walking Pattern (GAIT)		Functional Ability (WOMAC)	
	Mean±SD	P value	Mean±SD	P value
Age				
56-70 years (n=12)				
Pre-Test	26,08±4,36	0.000	61±7,64	0.000
Post Test	15,67±4,14		38,83±5,29	
71-85 years (n=3)				
Pre-Test	28,33±4,04	**0,083**	61,33±4,93	0,031
Post Test	17,67±4,62		45,33±3,06	
Gender				
Male (n=5)				
Pre-Test	24,8±2,87	0,001	56±9,14	0,001
Post Test	15,8±4,77		37,6±6,43	
Female (n=10)				
Pre-Test	27,4±4,7	0,000	63,6±4,28	0,000
Post Test	16,2±4,08		41,4±4,89	
IMT				
Normal (n=4)				
Pre-Test	28±5,48	0,33	62,75±2,88	0,008
Post Test	18,25±4,43		42,5±3,7	
Obese (n=11)				
Pre-Test	26±3,9	0,000	60,45±8,07	0,000
Post Test	15,27±3,92		39,27±5,97	

Based on the results of the paired t test in the experimental group in table 3, in age characteristics, very significant changes were at the age of 56-70 years with *pretest* 26.08 ± 4.36 and *posttest* 15.67 ± 4.14, with a difference value of 10.41; in the decline in functional ability values, very significant at the age of 56-70 years, WOMAC with a *pretest value* of 61 ± 7.64 and *posttest* 38.83 ± 5.29, with a difference value of 22.17. Based on the decline in the value of walking patterns of gender characteristics, very significant changes were in women with a *pretest of* 27.4 ± 4.7 and a *posttest of* 16.2 ± 4.08, with a difference value of 11.2; in the decline in functional ability values, very significant in women, WOMAC with a *pretest value* of 63.6 ± 4.28 and a *posttest of* 41.4 ± 4.89, with a difference value of 22.2. Based on BMI, both the decrease in the value of walking patterns and functional abilities is very significant in respondents with BMI in the Obesity category.

Table 4 Effect test before and after treatment on walking pattern and functional ability in the control group based on sample characteristics

Control Experiment	**Walking Pattern (GAIT)**		**Functional Ability (WOMAC)**	
	Mean±SD	P value	Mean±SD	P value
Age				
56-70 years (n=14)		0,000		0,000
Pre Test	24,21±6,55		59,5±7,21	
Post Test	17,36±6,07		48,64±7,34	
71-85 years (n=1)		-		-
Pre Test	29		67	
Post Test	20		54	
Gender				
Male (n=5)		0,000		0,004
Pre Test	22,8±4,71		56,2±8,64	
Post Test	17,2±5,02		45,4±9,37	
Female (n=10)		0,000		0,000
Pre Test	25,4±7,21		61,9±5,97	
Post Test	17,7±6,53		50,8±5,57	
IMT				
Normal (n=6)		0,001		0,000
Pre Test	26±8,51		60,67±7,52	
Post Test	18,33±7,73		49,67±6,71	
Obese (n=9)		0,000		0,000
Pre Test	23,56±4,95		59,56±7,41	
Post Test	17±4,74		48,56±7,89	

Based on Table 5, there is a decrease in the value of walking patterns and functional abilities in the age group 56-70 years so it can be concluded that conventional physiotherapy interventions are effective in improving walking patterns and functional abilities in OA patients. But in the 71-85 age group, the effect cannot be seen statistically because it only has one respondent, but there is still a decrease in the value of walking patterns and functional abilities with the difference between *pretest* and *posttest*, namely 9 points for GAIT and 13 points for WOMAC.

Pretest and *posttest of the* control group based on gender, showed a statistically significant decrease in GAIT and WOMAC values in both men and women. Whereas in BMI characteristics, both normal and obese categories, showed a statistically significant decrease in GAIT and WOMAC values.

Comparison Test of Exercise Provision between Experimental Groups on Walking Pattern and Functional Ability

Table 5 Comparative Test of the Effect of Exercise Provision between Experimental Groups on Walking Pattern and Functional Ability

Group	TUG		30SCS	
	Mean±SD	P value	Mean±SD	P value
Experiment Group	10.47±3.50	0,003	20.93±5.02	0,000
Control Group	7±2,23		11.33±3.15	

Based on table 5.7, it is known that the mean in the difference data before and after treatment of the GAIT value of the experimental group is higher than the control group. From the results of the comparison test using the unpaired t test on the difference value of GAIT before and after treatment, p is 0.003 ($p < 0.05$), so the difference is very significant between the experimental group and the control group. The lower the GAIT value, the better the walking pattern of the respondents, so it can be concluded that conventional physiotherapy intervention plus RWP is more effective in improving walking pattern compared to conventional physiotherapy intervention alone.

The mean on the difference data before and after treatment on the WOMAC value of the experimental group is higher than the mean on the difference data before and after treatment in the control group. From the results of the comparison test using the unpaired t test on the difference value of WOMAC before and after treatment, the p value = 0.000 ($p < 0.05$) was obtained, so there was a very significant difference between the experimental group and the control group on the difference value of WOMAC before and after treatment. The lower the WOMAC value in the sample, the better the functional ability, so it can be concluded that conventional physiotherapy intervention plus RWP is more effective in improving functional ability compared to physiotherapy intervention alone.

Effect of Conventional Physiotherapy Intervention on Walking Pattern and Functional Ability in Knee OA Patients

In traditional rehabilitation programmes, physiotherapy interventions in knee OA patients consist of a series of heat therapy interventions, joint mobilisation, stretching and strengthening exercises to reduce pain and improve specific muscle activity. Conventional physiotherapy interventions were found to be more effective when combined with walking exercises (Balasurkarman, 2018).

The results of our study showed that the provision of conventional physiotherapy interventions had a significant effect on walking patterns and functional abilities in patients with knee OA.

In knee OA patients, there is an imbalance of vastus medialis oblique (VMO) and vastus lateralis (VL) muscle activity causing excessive pressure on the lateral patella and friction on the lateral femoral condyles leading to increased articular surface pressure and inducing pain (Balasukarman, 2018).

The majority of patients with patellofemoral instability will experience lateral movement of the patella during walking, as the knee approaches full extension. Painful overstretching of the structures supporting the patella leads to biomechanical disturbances of the patellofemoral joint, increased stress on the joint and wear of the articular cartilage (Klemenov, 2021).

Strengthening exercises help stabilise the knee, protecting the joint from stress (Gondhalekar, 2013). Strengthening exercises in knee OA patients focus on knee joint muscles such as hamstring muscles and quadriceps muscles. In addition, strengthening of hip muscles such as the iliopsoas muscle, gluteus muscle and tensor fascia lata is also carried out (Djohan, 2022).

The results of research by Djohan (2022), related to strengthening the hip and knee muscles are that strengthening exercises increase muscle strength significantly.

Exercise provides neuromuscular adaptation in the long term. Physiologically, the increase in muscle strength depends on the recruitment of motor units. Within a few weeks of training, most of the adoption involves the ability to recruit motor units that lead to muscle fibre contraction. In response to strengthening exercises, neuronal activity increases and makes the amount of actin and myosin in muscle fibres also increase. This leads to an increase in myofibril hypertrophy and causes an increase in muscle strength. Thus, strengthening exercises can reduce pain and increase functional activity in knee OA patients (Djohan, 2022).

Strengthening exercises with the hold relax method where this method begins with an isometric contraction of the antagonist muscle. The contraction of the antagonist muscle will have an impact on stimulating the Golgi Tendon Organ (TGO) so that it can arouse the inhibitor mechanism, which can inhibit the strength of the motor impulse to the antagonist muscle. The decrease in the motor impulse of the antagonist muscle has an impact on weakening the contraction of the antagonist muscle so that it can inhibit the work of the agonist muscle down, as a result the movement to the agonist becomes easier. In addition, a decrease in antagonist contraction means the same as a decrease in muscle tension which causes the stimulus to *nociceptors* (organs receiving pain stimuli) to also decrease, as a result it does not cause pain, and can accelerate the increase in functional knee joint activity.

One of the conventional physiotherapy interventions is muscle stretching. Muscle stretching counter relax method, can restore muscle elasticity by reducing muscle spasm and neurological effects that stimulate mechano-receptor activity derived from muscle *spindles* and glogi tendon organs that can block nociceptor activity so that gradually pain decreases. The effect of stretching the counter-relax method can produce longitudinal stress on the structure of collagen tissue formed in the *taut band of* muscle fibres and tear extensive adhesions and restore the elasticity of muscle fibres (Djohan, 2021).

Effect of Conventional Physiotherapy Intervention combined with *Retrowalking Programme* on Walking Pattern and Functional Ability in Knee OA Patients

Chronic disease, namely OA, is a disease that can cause disability in sufferers and this continues to increase in prevalence (Dantas, 2021). Joint pain and stiffness due to OA can interfere with daily activities such as walking and functional ability (Chen, 2021).

Physical activity and exercise therapy can reduce symptoms and improve physical function in patients with knee OA (Dantas, 2022). Moderate intensity aerobic exercise for 2 times/week is beneficial for OA patients. In addition, quadriceps muscle training can reduce pain so that knee OA patients can perform normal activities (Dantas, 2022).

The results of our study showed that the provision of exercise combined with RWP in knee OA patients showed very significant changes in walking patterns with functional abilities compared to only providing conventional physiotherapy interventions.

Previous studies have shown that RWP can improve lower limb muscle strength and balance. This is due to neuromuscular, proprioceptive and protective reflex control mechanisms. (Shu, 2016. In addition, Zhang et al (2015) concluded the biomechanics of BWE can reduce knee joint load during walking because during RWP, the knee flexion movement is smaller than *Forward Walking Exercise* (FWE).

Chen et al. (2021) conducted research related to static stability, proprioceptive, pain and physical function in patients with OA Knee. In this study, Chen et al compared 2 groups, namely OA knee patients who received RWP exercises and conventional exercises and OA Knee patients who only received conventional exercises. The result was that there were significant changes after 4 weeks of intervention regarding static stability, pain, proprioceptive and physical function in patients who received RWP exercises than patients who only followed conventional exercises. This suggests that the additional intervention of RWP has a better effect on patients with *patellofemoral* disorders.

Increased EMG activity during BWE is associated with pain reduction in OA Knee patients. Patients with anterior knee pain showed greater quadriceps muscle inhibition associated with pain levels at the *patellofemoral* joint (Abdelraouf et al. 2019).. Hasan et al (in Abdelraouf et al, 2019) found increased quadriceps maximum contraction after knee pain was reduced in knee OA patients. Kedia and Saurabh (in Abdelraouf et al, 2019) showed significantly reduced pain levels in patients with knee pain after RWP for four weeks, which assumed that the increased quadriceps activity during RWP may be due to decreased quadriceps inhibition due to pain.

It has been argued that RWP is better than FWE. The FEW starts with *hell strike* and ends with *toe contact*, whereas the RWP starts with *toe contact* and ends with *heel* off. (Abdelraouf et al. 2019).. During the RWP phase there is a displacement of the knee joint curve. During FWE, the knee flexes just after *heel strike* and during the loading response sub-phase. In contrast, during RWP, the knee joint is initially in a flexion position and continues to extend during the standing phase of movement (Abdelraouf et al. 2019).. This is in line with the research of Naderi, Mohammadipour, and Amir Seyfaddini (2017) on the comparison of lower limb kinematics between RWP and FWE. The researchers concluded that RWP will reduce the knee adduction angle so that the loading on the medial compartment of the knee is reduced.

RWP reduces excess adductor moment at the knee joint, reducing compressive forces on the medial compartment of the knee joint (Dantas, 2022). The walking phase of RWP lacks the heel contact of the initial standing phase resulting in lower compression forces at the patellofemoral joint and decreased force absorption at the knee joint. In addition, during RWP, lower limb muscle motorisation is higher (Balasukarman, 2018). The absence of visual cues during RWP results in smaller spatial and temporal gait parameters. Therefore, RWP is considered a treatment strategy to improve gait (Balasukarman, 2018).

Balasukarman's 2018 metaanalysis concluded that the incorporation of backward walking exercises in conventional physiotherapy interventions was more effective in patients suffering from *musculoskeletal* walking conditions compared to walking disorders associated with neurological conditions.

Statistically significant improvement in function was seen in both groups. However, the improvement in the experimental group was greater than the control group. The improvement in function can be attributed to the reduction in pain, kinetics and kinematics during functional movements and improved muscle activity patterns. RWP creates more muscle activity. The advantages of RWP include improved muscle activity patterns, reduced adductor moment at the knee during the walking phase and increased stretching of the hamstring muscle group during stepping. It will also reduce disability in knee OA patients thus leading to improved function (Gondhalekar, 2013).

Flynn and Soutas Little (in Rangey et al., 2016) concluded that RWP provides greater benefits for certain conditions such as lower extremity overuse injuries and *patellofemoral* dysfunction. Similarly, Shankar and Kedia (in Rangey et al., 2016) suggested chronic OA and *patellofemoral* pain syndrome. The decrease in pain occurs because during the backward movement, there is a reaction in the *patellofemoral* joint and a reduction in the eccentric load on the *patellar* tendon. The pressure on the *patellofemoral* joint is lower in RWP than FWE. In addition, the pain subsides due to the reduction of adductor muscle moment at the knee joint which decreases the compressive force on the medial compartment of the knee joint (Rangey et al., 2016). Gondhalekar (in Rangey et al., 2016) suggests strengthening exercises for the hip and knee help stabilise the knee and provide additional protection against shock and stress. Research by Shu et al. (2016) related to the biomechanics of RWP also concluded that during RWP, reverse plantar control occurs, which can improve lower limb function and stimulate proprioceptive control and the neuromuscular system.

Rangey (2016) proved that RWP can reduce pain and can improve physical function and quality of life. This will ultimately reduce the burden on the individual's life and can perform *activities of daily living* (ADL) without complaints. Thus, RWP can be used to improve the functional independence of individuals with OA Knee.

Moon et al (2016) examined the effect of RWP on joint range of motion (LGS) and pain (VAS) after 4 weeks of exercise. The result was an increase in LGS in knee flexion and knee extension movements. Pain-related VAS scores also decreased significantly after 4 weeks of RWP.

Literature review conducted by Klemenov (2021) concluded that RWP is a new concept in physiotherapy and rehabilitation, especially for patients with knee problems. RWP is proven to increase quadriceps muscle strength as a major factor for recovery from *patellofemoral* symptoms while increasing aerobic capacity and reducing joint stress.

RWP also exercises proprioceptive and balance, strengthens the hip extensors which leads to reduced hip flexion moment during the standing phase thus preventing abnormal load on the knee joint.

Research conducted by Abdelrauf,2019 which compared RWP with forward walking exercise, proved that the electromyographic (EMG) activity in vastus lateralis (VL) and vastus medialos oblique (VMO) was more significant compared to forward walking exercise. Increased EMG activity in the knee extensors may be related to increased cortical activity during RWP. There is an increase in oxygenated haemoglobin concentration in the supplementary motor area, pre-central gyrus and superior parietal lobule during RWP (Abdelrauf, 2019). The greater activity in the medial sensorimotor cortex during RWP reflects the greater demand for controlling lower limb movements.

The RWP walking phase begins with toe contact and ends with heel off, causing the joint angular displacement curve to be reversed when compared to forward walking. During RWP, the knee joint initially flexes at toe contact and continues to extend during most of the standing phase. The reversal of knee joint kinematics changes the type of quadriceps muscle activity. During RWP, knee extension during the initial stance is achieved by concentric contraction of the quadriceps muscle to prevent lowering the body's centre of gravity and pushing the body backwards. The conversion of eccentric quadriceps activation during the forward walk into concentric activation during RWP. RWP reduces the compressive force on the patellofemoral, so it is considered a safe closed kinetic chain exercise (Abdelrauf, 2019). RWP reduces the force contraction of the quadriceps muscle, but during RWP the quadriceps muscle is isometric and concentric.

The increased hip extension in the standing phase of RWP is due to the use of a reverse control mechanism rather than a forward walk. The peak flexion angle is smaller in the swing phase, the self-protection function of neuromuscular control is also responsible for preventing falls due to the elimination of visual cues (Shu, 2016).

In addition to load reduction, RWP can also reduce low back pain and improve lumbar muscle function in postural stability and dynamic function by showing greater low back motion in the sagittal plane and lesser motion in the coronal plane (Shu, 2016).

4. Conclusion

Based on the research that has been conducted, interventions in the form of conventional physiotherapy and combined with RWP given 3 times a week for 5 weeks are effective in improving walking patterns and functional abilities in knee OA patients. The comparison test between the two groups showed a significant difference between the two groups, where physiotherapy intervention with RWP was more effective than only physiotherapy intervention in improving walking patterns and functional abilities in knee OA patients.

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