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Effects of the MWM Technique Accompanied by Trunk Stabilization Exercises on Pain and Physical Dysfunctions Caused by Degenerative Osteoarthritis

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Abstract. [Purpose] This study aimed to identify how treatment with the Mulligan technique of mobilization with movement (MWM) influences pain and physical function of patients with degenerative osteoarthritis. [Subjects] Thirty patients diagnosed with degenerative osteoarthritis were divided into an experimental group (n=15), and a control group (n=15). [Methods] The experimental group was treated with general physical therapy, trunk stabilization exercises, and performed the MWM using the Mulligan technique. The control group was treated with general physical therapy, and then performed trunk stabilization exercises. [Results] Statistically significant differences were found after the intervention in the experimental group in the visual analog scale and Western Ontario and McMaster Universities osteoarthritis index pain, stiffening, and physical function scores. [Conclusion] We consider the treatment of degenerative osteoarthritis patients using the MWM technique is effective for reducing pain and improving physical functions.
Key words: Osteoarthritis, MWM, Knee

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INTRODUCTION

Humans repeat transfer activities such as walking and running to manage their daily lives. Identifying the transfer activities of humans in mechanical terms is necessary to understand neuromuscular control[1)]. In particular, the knee joint plays an important role in walking and other transfer activities.

The recent increase in human life expectancy resulting from scientific and medical advances has increased elderly populations, which has, in turn, caused a higher incidence of degenerative diseases. In particular, chronic degenerative osteoarthritis, which is one of several musculoskeletal diseases, has become a leading geriatric disease with a high prevalence. Degenerative osteoarthritis is emerging as an important area of interest as it creates a number of obstacles to elderly peoples' daily lives and physical activities, thereby lowering their quality of life[2, 3)].

Degenerative osteoarthritis can be accompanied by joint pain, joint dysfunction, stiffening, pressure pain, joint hypertrophy, and muscle weakening. In addition, it gradually limits the range of motion (ROM) and reduces functional activities of the knee joint[4)].

Both drug-based and a variety of non-drug treatments are used to treat degenerative osteoarthritis. Drug treatments are effective at pain reduction and symptom improvement, but carry the risks of side effects and drug overdose. Non-drug treatments include physical therapies such as electrotherapy, hyperthermia, phototherapy, exercise therapy, and manual therapy. These treatments reduce patients' reliance on drugs and pain, and improve muscular endurance, coordination, and muscular strength[5)].

Mulligan techniques are a kind of manual therapy for spinal or upper and lower extremity pain which use NAG (Natural Apophyseal Glide), SNAG (Sustained Natural Apophyseal Glide), or MWM (Mobilization with Movement) techniques.

Mulligan techniques do not cause patients pain and have no side effects. These techniques are also not physically intensive for therapists to practice due to their use of belts and patients' voluntary movements. Moreover, they are easy to learn, which makes them useful for clinical applications. If applied properly, they have some effect on various types of pain. However, most studies of Mulligan techniques have investigated their effect on diseases of the lumbar and thoracic regions. In this study, aimed to identify how the application of the MWM Mulligan technique influences pain and physical function of patients with degenerative osteoarthritis when walking.

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Table 1. General characteristics of the subjects (Mean ± SD)

	Experimental group (n=15)	Control group (n=15)
Age (years)	66.13 ± 7.376	64.20 ± 8.62
Weight (kg)	61.13 ± 10.59	60.07 ± 13.14
Height (cm)	159.33 ± 9.88	156.13 ± 10.12
Duration of symptoms (months)	44.80 ± 32.35	48.73 ± 40.64
Gender (male / female)	4 (26.7) / 11 (73.3)	4 (26.7) / 11 (73.3)
Affected side (left / right)	8 (53.3) / 7 (46.7)	6 (40) / 9 (60)

SUBJECTS AND METHODS

Subjects

This study selected 30 outpatients visiting the J orthopedic hospital, who had been diagnosed with degenerative joint arthritis by orthopedists, based on radiographic findings. This study's purpose and test method were fully explained to potential subjects and those who volunteered to participate were included (Table 1).

Methods

The subjects were measured before the treatment commenced and again six weeks afterwards. The experimental group was treated with hot packs for 10 minutes, interferential current therapy for 20 minutes, and ultrasound therapy for 5 minutes. Upon completion of this treatment, the group performed trunk stabilization exercises and then received MWM using Mulligan techniques. The control group was treated with general physical therapy, and then performed trunk stabilization exercises. Both groups received their treatment three times a week over a six-week period. The subjects did not limit their daily movements or usual occupational activities until the end of the treatment, and were instructed not to receive any treatments other than MWM during the experimental period.

In the trunk stabilization exercise program, subjects lay prone and lifted both legs through cross extension without knee flexion. The patient then repeated the motion of maintaining the earlier condition for 10 seconds at an extent that caused no pain, and then lowered the legs ten times. The exercise program consisted of three sessions and a 30-second break was provided between each session. During the exercise, the therapist fixed the patient's lumbar region to prevent corresponding activities of the upper extremities.

The MWM technique is a manual therapy that combines active physiological exercises generated by the motions of patients. In this technique, small vibrations, compression, and stretching are applied to the end points of the affected body region without causing pain. In addition, these techniques are practiced in a direction that causes no pain.

The technique is now recognized in manual therapy worldwide. In this study, the therapist first placed each patient's leg on the affected side on a 30 cm high table. After positioning himself or herself behind the patient, the therapist held the patient's lower leg with both hands and rotated the tibia inward upon the thigh while the patient flexed his/her knee. The patient was then instructed to perform the motion of knee flexion ten times.

The present study's program was performed within a range that caused no pain. The subjects repeated the motion of knee joint gliding without pain. The program consisted of three sessions and after the end of each session, a 30-second break was provided.

The degree of pain was scored between a minimum of 0 mm and a maximum of 100 mm on a Visual Analogue Scale (VAS). The subjects marked their own scores before the treatment began and again six weeks after the treatment had been completed. A VAS score closer to 0 mm denotes a lower level of pain[6].

The Western Ontario and McMaster Universities osteoarthritis index (WOMAC) measures specific diseases, personal health management, and physical conditions. It is a clinically important functional evaluation tool in terms of pain, stiffening, and physical function of patients with osteoarthritis and coxarthritis. This index consists of 24 categories (5 categories for pain, 2 categories for stiffening, and 17 categories for physical function), and its assessment can be completed within 5 minutes.

The WOMAC is used for the functional evaluation of osteoarthritis and coxarthritis throughout the world. It is a tool for identifying clinically important changes in the physical conditions of osteoarthritis and coxarthritis[7]. This tool can evaluate disorders exhibited by patients with osteoarthritis and coxarthritis during their physical activities in daily life, based on the categories of joint pain, stiffening, and physical function.

In this study, the Korean-WOMAC, which was modified to suit the evaluation of Koreans, was employed. The Korean-WOMAC is also divided into the subcategories of pain, stiffening, and physical function, and is based on a 5-point scale (none, a little bit, normal, serious, very serious).

SPSS for Windows (Version 20.0) was used to statistically analyze the data. Differences in the general characteristics of the subjects were analyzed by performing the independent samples t-test. In order to examine differences in the effects of the intervention between the experimental and control groups, the independent samples t-test and paired t-tests were performed. The statistical significance level was chosen as 0.05[8].

RESULTS

The control group showed statistically significant differences in VAS pain scores and WOMAC physical function scores between the pre- and post-tests ($p<0.05$) (Table 2).

Table 2. Comparison of the VAS and K-WOMAC of the control group at the pre-test and post-test (Mean± SD)

		Pre-test (n=15)	Post-test (n=15)
VAS*		58.13 ± 22.20	54.00 ± 20.11
K-WOMAC	Pain*	5.87 ± 1.76	5.27 ± 1.62
	Stiffening	6.13 ± 1.55	5.87 ± 1.12
	Physical function*	6.07 ± 1.53	5.47 ± 1.40

*p<0.05, VAS=Visual analog scale, K-WOMAC=Korean-Western Ontario and McMaster Universities osteoarthritis index

Table 3. Comparison of the VAS and K-WOMAC of the experimental group at the pre-test and post-test (Mean ± SD)

		Pre-test (n=15)	Post-test (n=15)
VAS*		58.00 ± 16.67	37.00 ± 13.20
K-WOMAC	Pain*	5.93 ± 1.33	4.27 ± 0.96
	Stiffening	6.07 ± 1.75	5.27 ± 1.38
	Physical function*	6.07 ± 1.28	4.07 ± 0.96

*p<0.05, VAS=Visual analog scale, K-WOMAC=Korean-Western Ontario and McMaster Universities osteoarthritis index

Table 4. Comparison of the VAS and K-WOMAC between groups (Mean ± SD)

		Pre-test (n=15)	Post-test (n=15)
VAS*		21.00 ± 4.71	4.13 ± 3.46
K-WOMAC	Pain*	1.93 ± 0.70	0.42 ± 0.49
	Stiffening*	0.80 ± 0.77	0.27 ± 0.88
	Physical function*	1.93 ± 0.70	0.42 ± 0.49

*p<0.05, VAS=Visual analog scale, K-WOMAC=Korean-Western Ontario and McMaster Universities osteoarthritis index

The experimental group showed statistically significant differences in the VAS pain scores and WOMAC pain, stiffening, and physical function scores between the pre- and post-tests ($p<0.05$) (Table 3). The experimental and control groups showed statistically significant between group differences in VAS pain scores and WOMAC pain and physical function scores ($p<0.05$) (Table 4).

DISCUSSION

This study was performed using an experimental group that underwent general physical therapy, trunk stabilization exercises, and MWM using Mulligan techniques and a control group that received only general therapy and trunk stabilization exercises. Each group consisted of 15 subjects, and over a six-week period, three treatment sessions were conducted weekly. During the practice of the manual therapy on the knee joint, changes in the patients' pain, stiffening, and physical functions were evaluated.

Osteoarthritis is the most common type of arthritis that causes disabilities or problems in elderly populations[9]. Women have a higher incidence of degenerative osteoarthritis than men. In addition, if the condition is untreated, it increases the risk, as patients age, of their being injured in falls which, in turn, decreases human life expectancy[10]. While degenerative osteoarthritis has not clearly been defined to date, it is a disease that exhibits local degenerative changes due to the physical activities that place repetitive or large loads on the articular cartilage[11].

As people age, they experience functional deterioration and weakening of their body parts. Likewise, the articular cartilage exhibits limited regenerative abilities and degeneration with aging. A study which performed radiographic tests on groups of various ages reported that about 80% of the population aged 60 or older, and about 95% of the population aged 75 or older exhibit symptoms of degenerative osteoarthritis[12].

The degrees of pain and functional disorders caused by degenerative osteoarthritis are highly complicated and their clinical mechanism has not been firmly established. However, some researchers have put forward a plausible biomechanical regarding the mechanism of the occurrence of pain due to degenerative osteoarthritis[13, 14]. Degenerative osteoarthritis is a chronic disease that progresses over a long period of time. Therefore, pain becomes an indicator of degenerative osteoarthritis and the treatment of the condition is focused on reducing pain rather than dealing with the progress of arthritis[15].

A complete recovery from degenerative osteoarthritis is difficult and the prevention of its pathological progress is often problematic. Thus, the purpose of its treatment should be the inhibition of the causes of degenerative osteoarthritis, pain reduction, and improvement in physical function[16]. One study noted that the purpose of treating degenerative osteoarthritis patients is to maintain the best possible physical function and reduce pain[17]. Among joint diseases that damage the articular cartilage due to aging or weight-bearing during walking, degenerative osteoarthritis frequently occurs in elderly populations. It is also considered a key disease that causes physical dysfunction[18].

The goal of treatment for degenerative osteoarthritis patients is to control pain, minimize the side effects of treatments, and improve patients' knee joint functions and quality of life. Patients also need to be educated to control loads on the knee joint, through changes in life patterns, exercises, control of physical activities, and weight loss. In this study, MWM using Mulligan techniques, which were implemented while the patients placed their knee joint on the affected side on a 30 cm high table, is similar to the motions of lunge and a single limb squat. These motions are closed chain exercises as well as functional exercises for the knee joint, and thus, are frequently used in lower-extremity rehabilitation exercises[19].

A study by Fisher[20] reported that, after the implementation of muscular function improvement exercises for degenerative osteoarthritis patients for 16 weeks, the patients showed reductions of 40%, 10%, and 30% in pain, reliance, and dysfunction, respectively. Previous studies related to degenerative osteoarthritis have reported that manual therapy MWM is an effective treatment for pain and physical dysfunction caused by degenerative osteoarthritis. A comparison of the experimental and control groups of the present study revealed that the experimental group showed greater improvements in both pain and physical function. Damage of the joints causes pain and limitation of motion (LOM) due to sprain of soft tissues. Pain and LOM cause more damage to the joint. Joint control of MWM can reduce the emission of noxious stimuli from a damaged joint, and when pain is reduced, LOM is also reduced leading to improvement in physical function[21].

In the present study, regarding Mulligan Technique MWM was verified as effective at ameliorating pain and physical dysfunction caused by degenerative osteoarthritis. Therefore, MWM can be suggested as an effective treatment for relieving pain and physical functions in degenerative osteoarthritis patients.

Limitations of this study include the small number of subjects, which makes it difficult to make generalizations of the findings, and the selection of subjects within a limited geographical area, which precludes comparison with other regions. In addition, the effects of subjects' physical characteristics, life patterns and personal post-treatment exercises could not be entirely controlled. Therefore, further research is necessary investigation the MWM technique for other diseases and body regions.

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