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## THE EFFECT OF CONCENTRIC-ECCENTRIC QUADRICEPS EXERCISE AND NEUROMUSCULAR TAPING WITH COMPRESSION AND DECOMPRESSION TECHNIQUES TO IMPROVE FUNCTIONAL PERFORMANCES ON OSTEOARTHRITIS PATIENTS

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### Abstract

**Introduction:** Osteoarthritis is a common articular disease that leading to disability among aged population. Pain is the main symptom of knee OA that inhibiting quadriceps to work properly, in chronic condition quadriceps muscle become weak and atrophy, there are three problems arises among OA patients, pain, stiffness and functional limitation. By using manual therapy concentric-eccentric exercise and Neuromuscular Taping (NMT) compression and decompression techniques will reduce pain, prevent quadriceps loose their strength and gain performance of functional activity. **Objective:** The objective of this study is to compare the eccentric-concentric quadriceps exercise, NMT with compression techniques and decompression technique to improve functional performances using Western Ontario McMaster University Arthritis Index (WOMAC). **Method:** the subjects were taken from 90 OA patients on Fitasoma clinic at Karanganyar, subjects divided into three groups, Group 1 (n=30) OA patients received concentric and eccentric exercise, Group 2 (n=30) received NMT compression technique and Group 3 (n=30) received NMT with decompression technique, before and after intervention WOMAC assessed. **Result:** After 8 weeks intervention there was a significant difference in the total WOMAC score for all groups ( $p < 0.001$ ), Group 3 was better than other groups with mean value at  $0.12 \pm 0.04$ , and Group 2 was better than group 1 with mean value at  $0.22 \pm 0.07$ , the mean difference between Group 3 and group 1 was  $-0.179$ , while mean difference between Group 3 and Group 2 was  $-0.097$ . **Conclusion:** After the intervention, Group 3 reported better in reducing total WOMAC score than other groups.

**Keywords:** *Concentric-eccentric quadriceps exercise, Neuromuscular taping compression, Neuromuscular taping decompression, Functional activity performances, Osteoarthritis*

### Introduction

Osteoarthritis (OA) is an increasingly common problem in our community, many individuals with arthritis are affected by pain, stiffness or some loss of function and are dealing with a disease that is long lasting<sup>1</sup>.

OA is characterized as a progressive loss of articular cartilage, joint degeneration involves all of the tissue that form synovial joint which are the subchondral and metaphyseal bone, synovium, ligaments, joint capsules and the muscle acting across the joint<sup>2</sup>.

OA is a disorder involving movable joints characterized by cell stress and extracellular matrix degradation initiated by micro and macro injury that activates maladaptive repair responses including pro-inflammatory pathways of innate immunity. The disease manifests first as a molecular derangement (abnormal joint tissue metabolism) followed by anatomic, and/or physiologic derangements (characterized by cartilage degradation, bone remodeling, osteophyte formation, joint inflammation and loss of normal joint function), that can culminate in illness<sup>3</sup>.

This disease causes pain, functional limitation and disability, and its incidence rate is gradually rising with an increase in the elderly population. Since knee osteoarthritis causes

pain and restricts the mobility of joints, it interferes with walking and activities of daily living. An elderly person with knee osteoarthritis is at greater risk of falling down, and it has been reported that about 30% of the elderly population aged 65 and older experience a fall at least once a year<sup>4</sup>.

Three major physical impairments, such as knee pain, stiffness, and decreased quadriceps strength, are highly associated with knee OA and are believed to contribute to physical disability and progression of the disease<sup>5</sup>.

Patients with Knee OA typically presents weak quadriceps's contraction, that can be attributed to muscular atrophy and muscular inhibition<sup>6</sup>. Inability for muscles to fully activate is a problem termed Atrogenic Muscle Inhibition, the muscle become weak and impairs physical function<sup>7</sup>.

Several treatments that usually knee OA patients had including pharmaceutical medication, exercise, external walking aids and surgery, these treatments either invasive, expensive or do not treat mechanical etiology<sup>8</sup>.

The Osteoarthritis Research Society International (OARSI) recommended non-pharmacological methods including patient education programs, weight reduction, coping strategies, and exercise programs for treatment of knee<sup>9</sup>.

Unfortunately many people with osteoarthritis are encourage to rest or they provided with a tablet to help their pain. There is great deal of scientific research proved that exercise can help people with osteoarthritis to reduce the pain and improve their functional performance.

Physiotherapy programs are able to help people with osteoarthritis by using evidence based and clinical reasoning to select and apply the appropriate programs. There are many programs can be applied by using electrotherapy, manual therapy, knee taping, functional training etc.

Therapeutic knee taping has potential to offer an inexpensive, simple and effective for the clinical management of knee pain among knee OA population<sup>8</sup>.

Tiwari et al (2017) in their study with 30 knee OA patients, divided into 2 groups, which Group A (n=15) received kinesio taping once a week along with exercise program for 3 weeks and Group B (n=15) received exercise program only, thrice weekly for 3 weeks found that Group A has shown significant improvement in Numeric Pain Scale (NPRS), Range Of Motion (ROM) and WOMAC score in comparison to Group B<sup>10</sup>.

There are many techniques in using kinesiotaping, such as Neuromuscular Taping (NMT) there are two different techniques, decompression techniques or compression technique.

Basic functions of NMT are alleviates pain, normalize muscle tension, eliminates lymphatic and venous congestion, improve blood vascularization, correct joint alignment and improves posture<sup>11</sup>.

In this study we compared the effectiveness of concentric eccentric quadriceps exercise, neuromuscular taping compression techniques and neuromuscular decompression techniques to improve functional performances by using Western Ontario McMaster Arthritis Index (WOMAC).

The WOMAC is a specific questionnaire measurement for OA, it consists of three aspects, pain (5 questions), stiffness (2 questions) and function (17 questions). Total scores of WOMAC will show the total functional performances for OA patients, the higher the total scores considered to be the worse performances.

## **Subject and Method**

This study type was randomized controlled trials. The subjects for this study were taken from 90 patients with knee osteoarthritis who were treated at Fitasoma Clinic. The criteria for inclusion were as follows (1) male and female patients diagnosed as knee OA, (2) meets with Altman criteria and subjects were excluded if they had neurology problems, pregnancy, knee or spinal deformity, osteoporosis. Subjects divided into three Groups by chance in lottery, Group 1 (n=30) received concentric-eccentric quadriceps exercise, Group 2 (n=30) received intervention of neuromuscular taping compression technique and Group 3 (n=30) received neuromuscular taping decompression technique. The outcome measure for

this study were total scores of Western Ontario McMaster Arthritis Index (WOMAC), the measurement were taken at baseline week 0 and at the end of trial at week 8.

### Result

The general characteristics of the subjects were recorded and consisted of age, gender, weight, height and Body Mass Index (BMI). General characteristic of subjects in this study analyzed by its category for each groups showed in Table 1.

**Table 1 Characteristics of Data Samples by Category**

Group	Gender				Age	Height	Weight	BMI
	Male		Female		$\bar{x}$ , Std	$\bar{x}$ , Std	$\bar{x}$ , Std	$\bar{x}$ , Std
	n	%	n	%				
Group 1	10	11.1	20	22.2	50.96 ± 7.45	1.57 ± 0.07	77.13 ± 13.65	31.27 ± 6.05
Group 2	7	7.8	23	25.5	50.96 ± 8.13	1.55 ± 0.07	78.1 ± 11.54	32.38 ± 4.22
Group 3	7	7.8	23	25.5	48.86 ± 7.44	1.56 ± 0.06	71.26 ± 12.28	29.41 ± 5.56
p	0.608				0.477	0.545	0.079	1

Table 1 shows there is no significant difference in gender, age, height, weight and Body Mass Index (BMI) among three groups ( $p > 0.05$ ), Group 1 consisted of 10 male and 20 female with mean age was  $50.96 \pm 7.45$ , mean BMI was  $31.27 \pm 6.05$ . Group 2 consisted of 7 male and 23 female with mean age was  $50.96 \pm 8.13$ , mean BMI was  $32.38 \pm 4.22$ , while Group 3 consisted of 7 male and 23 female with mean age was  $48.86 \pm 7.44$ .

**Table 2 Normality and Homogeneity of WOMAC Scores Test**

WOMAC Scores	Normality	
	Pre Test	Post Test
	P	p
Group 1	0.555	0.116
Group 2	0.088	0.193
Group 3	0.064	0.228
Homogeneity	1	0.026

Table 2 shows the pre and post test of the WOMAC scores in all three groups were normally distributed, Saphiro-Wilk test was performed ( $p > 0.05$ ) and the subjects in every groups were homogens with  $p > 0.05$ , so these data was able to analyze and compare with One-way ANOVA test. One-way ANOVA and Post hoc test for multiple comparisons were used to see the differences between the groups, multiple comparison of mean difference of pre and post data and mean of follow up data were used for comparison among the groups, the tests were applied at 95% confidence interval on p value set at 0.05.

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 performances on OA patients**

**Table 3 WOMAC Scores Paired Sample Test**

WOMAC Scores	Paired Differences	
	$\bar{x}$ , Std	p
Group 1	0.37 ± 0.64	<0.001
Group 2	0.49 ± 0.08	<0.001
Group 3	0.59 ± 0.08	<0.001

Table 3 shows there was a significant difference in pre and post WOMAC scores for all three groups, paired sample test was performed  $p < 0.001$ , in which Group 1 had mean difference  $0.37 \pm 0.64$ , Group 2 had mean difference  $0.49 \pm 0.08$  and Group 3 had mean difference  $0.59 \pm 0.08$ .

**Table 4 WOMAC Scores Pre and Post Test**

WOMAC Scores	Group 1 n=30	Group 2 n=30	Group 3 n=30	p
	$\bar{x}$ , Std	$\bar{x}$ , Std	$\bar{x}$ , Std	
Pre Test	0.67 ± 0.07	0.7 ± 0.07	0.71 ± 0.08	0.118
Post Test	0.29 ± 0.07	0.21 ± 0.07	0.12 ± 0.04	<0.001
p	<0.001	<0.001	<0.001	

Table 4 shows that there was no significant difference in pre test WOMAC scores between three groups ( $p > 0.05$ ), it means that the subjects in every groups were relative had same condition according to WOMAC scores, One-way ANOVA test was performed ( $p = 0.118$ ), while in post test WOMAC scores showed a significant difference with  $p < 0.001$ , it means that after received intervention for 8 weeks, every groups had significant different WOMAC scores. pre and post test WOMAC scores analyzed by paired sample test in every groups and found significant difference with  $p < 0.001$ .

**Table 5 WOMAC Scores Post Test with Post Hoc Analyzed**

		WOMAC Scores Post Test	
		Mean Difference	p
Group 1	Group 2	0.08167*	<0.001
	Group 3	0.17900*	<0.001
Group 2	Group 1	-0.08167*	<0.001
	Group 3	0.9733*	<0.001
Group 3	Group 1	-0.17900*	<0.001
	Group 2	-0.9733*	<0.001

\*The mean difference is significant at the 0.05 level

Table 5 Shows there was significant difference between groups  $p < 0.001$  post hoc analyzed was performed, in which Group 3 had better WOMAC scores than other groups, showed by the mean difference between Group 3 and Group 1 was -0.179 and between Group 3 and Group 2 was -0.9733.

## **Conclusion**

The study on “the effect of concentric-eccentric quadriceps exercise and neuromuscular taping with compression and decompression techniques to improve functional performances on osteoarthritis patients” that was conducted in May thru June 2018 in Fitasoma Clinic at Colomadu Karanganyar with 90 subjects showed a result as follow (1) concentric eccentric quadriceps exercise is effective to improve functional performances in OA patients, (2) neuromuscular taping with compression technique is effective to improve functional performances in OA patients, (3) neuromuscular taping with decompression technique is effective to improve functional performances in OA patients and (4) neuromuscular taping with decompression technique is better than others to improve functional performances in OA patients.

## **Discussion**

In this study we found that Neuromuscular Taping (NMT) with decompression technique may induce decompressive stimulus to increase interstitial spaces, reduce skin and subcutaneous tissue compression and enables normal blood and lymphatic circulation to be restored. In knee OA patients, quadriceps muscle tend to be weakened, atrophied and can not fully activated due to perception of pain. Increase blood circulation can be wash out chemicals of pain substances which released into the area around the damage tissue by NMT decompression technique, so pain’s perception reduced during daily activities. Decreasing pain’s perception allowed quadriceps muscle generate more force to contract and increased functional performances of knee joint, thus NMT with decompression technique is better than compression technique and concentric-eccentric exercise to improve functional performances in OA patients.

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