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## **Effects of Therapeutic Exercises on Pain and Physical Disability in Adults with Knee Osteoarthritis**

<sup>1</sup>D. Beulah Jebakani, <sup>2</sup>Gowri Sethu, <sup>3</sup>Arumugam Pahinian, <sup>4</sup>R. Megala Devi, <sup>5</sup>Shashidaran Kotian and <sup>6</sup>Larissa Martha Sams

<sup>1</sup>Department of Physiotherapy, Mother Theresa Postgraduate and Research Institute of Health Sciences, Pondicherry, India

<sup>2</sup>Department of Physiology, Saveetha Dental College, Saveetha University, Chennai, India

<sup>3</sup>College of Physiotherapy, Sri Venkateswara Medical College, Pondicherry, India

<sup>4</sup>Physiotherapist, Pondicherry, India

<sup>5</sup>Department of Community Medicine, Kasturba Medical College, Mangalore, India

<sup>6</sup>Lakshmi College of Nursing, Mangalore, India

*Corresponding Author: D. Beulah Jebakani, Department of Physiotherapy, Mother Theresa Post Graduate and Research Institute of Health Sciences, Puducherry, India*

### **ABSTRACT**

The effect of therapeutic exercises on reducing pain and physical disability in adults with knee osteoarthritis was explored in the study. The participants were randomly selected (n = 118) in our final analysis. Two groups were followed with the treatment group (group I) prescribed with standardized therapeutic exercise program and hotpacks for 4 weeks on a 3-session-per-week basis. The control group (group II) followed a conventional physiotherapy with hotpacks and static quadriceps exercise. Pre-test and 4-week post-test measurements were taken using Knee Injury and Osteoarthritis Outcome Score and Visual Analog Scale. Both strengthening and balance exercises were included in the treatment of knee osteoarthritis. The results imply that therapeutic exercise is effective in greatly reducing the pain and physical disability of adults with knee osteoarthritis as hypothesized.

**Key words:** Osteoarthritis, knee osteoarthritis, pain, exercise, adult, KOOS

### **INTRODUCTION**

For patients with osteoarthritis, therapeutic exercise is recommended as one form of treatment modality. The American College of Rheumatology strongly recommends therapeutic exercise under nonpharmacologic treatment modality for the management of osteoarthritis, especially knee osteoarthritis and urges patients to participate in aerobic and/or resistance land-based exercise, aquatic exercise and for those who are overweight, to lose weight (American College of Rheumatology, 2000). Patients could benefit greatly by following even moderate-level exercise on a regular basis, which was shown to reduce pain and morbidity in patients with osteoarthritis, provided the exercise regime is directed towards controlling pain, increasing flexibility and improving muscle strength and endurance (American Geriatrics Society Panel on Exercise and Osteoarthritis, 2001). Studies show that the effectiveness of therapeutic exercise, especially that includes aerobic exercise, in improving a patient's functional status, gait, pain and aerobic capacity is independent of the level of physical activity, whether involving high-intensity or low-intensity exercise (Brosseau *et al.*, 20003a).

Because biomedical approaches are aimed towards controlling acute diseases, these approaches do not work well in cases of chronic diseases; osteoarthritis in this instance. Therefore, self-management should be employed in the treatment of such chronic illnesses (Bandura, 2005). Experts have found that supervised exercise regimes are more beneficial over home-based programs and that different exercise modalities are equally effective (Bennell and Hinman, 2005). Exercise plus dietary weight loss have also shown improvement in the mobility of patients with osteoarthritis (Focht *et al.*, 2005). Previous studies investigated the use of ice massage, coldpacks and hotpacks in the treatment of knee osteoarthritis, in which hotpacks improved function and knee strength, whereas cold packs reduced swelling (Brosseau *et al.*, 2003b).

Ongoing surveys on the rural prevalence of rheumatic-musculoskeletal symptoms/diseases are aimed to identify new cases and risk factors and educate people (Chopra *et al.*, 2001; Coleman *et al.*, 2008). Some studies suggest that for patients with mild to moderate knee osteoarthritis, muscle strengthening and aerobic exercise should be aimed not just on the knee muscles but on the hip muscles too (Iwamoto *et al.*, 2011).

Although, several studies have revealed that exercise improves knee joint function and decreases symptoms, the effective combination of exercise and dosage remains unclear (Bandura, 2005; Bennell and Hinman, 2005). Traditionally, rehabilitation programs focus on impairments associated with knee osteoarthritis, including range of motion, muscle strength and aerobic capacity. Including a focus on motor function, which is essential for daily functional activities, in the balance exercise regime can improve the overall physical function. Few studies have included both strengthening and balance exercises in the treatment of knee osteoarthritis and studied their combined effects.

The present study was intended to study the effects of therapeutic exercise programs that use a combination of exercises in the reduction of pain and physical disability. Osteoarthritis is considered to be associated with several disability problems, such as decreased social activity, decreased quality of life, increased health risk of inactivity and decreased employment. Improving health status, physical fitness and quality of life can help minimize these disability problems.

It is known that therapeutic exercise, which includes various types of exercise regimes for targeting flexibility, strength and balance, can reduce pain and physical disability and thereby improves psychological well-being, overall health status, physical fitness and quality of life.

This study was based on the following assumption: There will be a significant difference in pain and physical disability in therapeutic exercise-trained experimental group versus control group.

The aims of the study include the following objectives in relation to knee pain and physical disability of patients with knee osteoarthritis: (1) To measure and compare the effectiveness of therapeutic exercise and outcome measures between experimental and control groups, (2) To analyze the different factors involved and (3) To explore the association of post-test with selected demographic variables.

## **METHODOLOGY**

One hundred twenty-four participants were selected randomly but due to dropout, 118 were included in the final analysis (Table 1). The experimental or therapeutic exercise group (group I) totaled 28 men and 31 women and the control group (group II) had 19 men and 40 women.

The treatment group (therapeutic group/group I) followed a closely supervised standardized knee exercise program and hotpacks for 4 weeks with 3 sessions per week. The program had exercise regimes that included warm-up, active range-of-motion exercises for the knee, muscle

Table 1: Sample characteristics

Variables	Therapeutic exercise		Control	
	F	%	F	%
<b>Age (years)</b>				
50-55	29	49.20	25	42.40
56-60	23	39.00	18	30.50
61-65	7	11.90	16	27.10
<b>Gender</b>				
Male	28	47.50	19	32.00
Female	31	52.50	40	67.80
<b>Occupation</b>				
House Wives	26	44.10	36	61.00
Workers	28	47.50	20	33.90
Retired	5	8.40	3	8.50
<b>Marital status</b>				
Married	59	60.00	60	100.00
<b>BMI</b>				
<18.5	2	3.40	-	-
18.6-24	12	20.30	11	18.60
25-29	21	35.60	31	52.50
≥30	24	40.70	17	28.80
<b>Side</b>				
Right	27	45.80	33	55.90
Left	32	54.20	26	44.06
<b>Site</b>				
Medial	27	45.80	23	39.00
Lateral	8	13.60	7	11.90
General	24	40.70	29	4.20
<b>Type of pain</b>				
Intermittent	33	55.90	41	69.50
Constant	26	44.10	18	30.50
<b>Duration (years)</b>				
3-6	38	64.40	31	52.40
7-12	21	35.60	28	47.45
<b>Education</b>				
High school	39	66.10	44	74.60
Secondary	9	15.30	2	3.40
Graduate	11	18.60	13	22.00

strengthening exercises for the hip and knee, muscle stretching for the lower limbs and cool down. Group II followed a conventional physiotherapy with hotpacks and static quadriceps exercise. Pre-test measurements and 4-week post-test measurements using Visual Analog Scale (VAS) and Knee Injury and Osteoarthritis Outcome Score (KOOS) were taken.

**VAS for Self-Reported Pain:** The severity of pain was measured using a VAS for knee pain a week before the start of therapy. Visual Analog Scale represents the severity dimensions using a 10 cm plain line with two anchor points of “no pain” and “worst pain”. The patients were informed to draw a line at the point that best describes his or her pain level. Visual Analog Scale is the most widely used scale in the assessment of pain in the clinical setting.

**KOOS for Self-reported physical disability:** Self-reported physical disability (pain, physical function, knee-related quality of life) was measured using KOOS. It is a three-dimensional, disease-specific, self-administered health status measure that assesses five indicators: Pain, symptoms, physical function, sport and recreation function and knee-related quality of life. It has a validity of 0.68. It has a high test-retest reliability (ICC >0.75). Standardized answer choices are given (5 Likert boxes) and each question is scored from 0 to 4. A normalized score (100 indicating no symptoms and 0 indicating extreme symptoms) is calculated for each subscale (Shereif and Hassanin, 2011). For this study, four subscales, pain, symptoms, physical function and knee-related quality of life, were used.

The study began in April 2012 and ended in December 2013. During the course of the study, no side effects were observed in the therapeutic group. One limitation or a source of potential bias in our experiment was that diet was not controlled.

## RESULTS

An important observation was that therapeutic exercise reduced not only pain but also physical disability to a greater extent in patients with knee osteoarthritis. Statistical analyses were conducted using SPSS software (version 17.0) and statistical significance was set at 0.05. Independent t-tests were performed to compare baseline statistics between randomized groups. Paired t test showed a significant difference between pre-test and post-test scores of VAS in the therapeutic group. There was a decrease in VAS score post-intervention in the therapeutic group (from 6.234-3.292;  $p < 0.001$ ; Table 2).

For all dimensions of KOOS, there was a significant difference between therapeutic and control groups at 0.001 level (Table 3). Post-test scores in therapeutic group for all the subscales of KOOS were higher than their pre-test scores and these differences were significant ( $p < 0.01$ ). In the control group none of the subscales showed significant difference between pre and post-test scores at 0.05 level of significance (Table 4).

Table 2: Paired t-test showing significant difference between pre-test and post-test scores of VAS in therapeutic group

VAS	Pre-test	Post-test	Paired difference	t-value	p-value
Therapeutic	6.234±0.953	3.292±1.044	2.942±1.232	18.352	<0.001
Control	6.008±1.255	6.170±1.285	0.161±0.711	1.740	<0.001

Table 3: Comparison of therapeutic and control group KOOS post-test scores

Parameters	Control group	Therapeutic group	t-value	p-value
KOOS pain	38.323±7.746	69.694±12.507	16.38	<0.001
Symptoms	42.206±10.197	68.828±11.51	13.30	<0.01
Activity of daily living	37.718±6.312	65.772±12.05	15.84	<0.01
Quality of life	37.414±6.006	62.910±13.464	13.283	<0.01

Table 4: Paired difference of KOOS pre-test and post-test scores in therapeutic group

Parameters	Pre-test	Post-test	Paired difference	t-value	p-value
KOOS pain	41.378±12.013	69.69±12.073	-28.315±14.610	-14.886	<0.01
Symptoms	45.420±12.375	68.83±11.51	23.680±16.67	-11.651	<0.01
Activity of daily living	36.620±12.049	65.77±7.477	-29.144±14.338	-15.613	<0.01
Quality of life	39.850±13.464	62.85±12.465	23.020±16.94	-10.382	<0.01

## **DISCUSSION**

This study investigated whether a 4-week therapeutic exercise was more effective than conventional exercise at reducing pain and physical disability in adult patients with knee osteoarthritis. Physical disability was the primary outcome and pain was the secondary outcome in this study. Pain and physical disability are the most common features in patients with knee osteoarthritis. Knee pain and physical disability in patients with knee osteoarthritis are associated with articular, kinesiological and psychological factors (Huang *et al.*, 2003).

The therapeutic exercise program was designed to be simple and least depended on equipment use. The therapeutic exercise appeared to have a greater impact on improving actual functional measures and reducing pain. It is generally accepted that a rehabilitation program improves functional capacity, pain and sensorimotor functions of patients but there is lack of agreement about what should go into such a rehabilitation program (Roddy *et al.*, 2005).

In this study, VAS was used to assess pain. VAS score post-intervention in the therapeutic group reduced from 6.234 to 3.292;  $p < 0.001$ . A reduction in pain in the therapeutic group is consistent with a previous study of dynamic and isometric resistance training that reduced knee joint pain (Topp *et al.*, 2002). For all dimensions of KOOS, there was a significant difference between therapeutic and control groups at 0.001 level showing that self-reported physical disability reduced in therapeutic group comparing to control group. Literature indicates that exercise seems to have a small to moderate effect on joint pain and functional outcome measures with a more moderate effect on self-perceived measures of functioning. A Cochrane meta-analysis of land-based exercise for knee osteoarthritis, which included 32 randomized controlled trials of exercise for persons with symptomatic osteoarthritis or knee pain, concluded that exercise yielded small but significant benefits for self-reported pain and function (Fransen and McConnell, 2008). Pain is a major factor to the disability in patients with osteoarthritis of the knee. Hence, in the present study, a reduction in pain can explain a concomitant reduction in the physical disability of patients. Disability in osteoarthritis is due not only to the arthritis but also to the inactivity associated with the disease and with aging. Supervised exercise appears to yield greater benefits compared with home exercise, likely due to the fact that patients can receive encouragement and are monitored. Exercises to strengthen the quadriceps relieve joint pain in patients with osteoarthritis of knee. The results of the present study show marked differences between therapeutic exercise group and control group on all variables and offer a strong evidence to incorporate therapeutic exercise program as a nonpharmacologic treatment for patients with knee osteoarthritis.

## **CONCLUSION**

Therapeutic exercise program that includes warm-up period, active range-of-motion exercises for the knee, muscle strengthening exercises for the hip and knee, muscle stretching for the lower limbs, balance exercise and cool down period reduced pain and improved physical disability in adults with knee osteoarthritis.

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## REFERENCES

- American College of Rheumatology, 2000. Recommendations for the medical management of osteoarthritis of the hip and knee. *Arthritis Rheum.*, 43: 1905-1915.
- American Geriatrics Society Panel on Exercise and Osteoarthritis, 2001. Exercise prescription for older adults with osteoarthritis pain: Consensus practice recommendations. *J. Am. Geriatr. Soc.*, 49: 808-823.
- Bandura, A., 2005. The primacy of self-regulation in health promotion. *Applied Psychol.*, 54: 245-254.
- Bennell, K. and R. Hinman, 2005. Evidence-based clinical statement: Knee joint osteoarthritis. Australian Physiotherapy Association, Central Victoria, Australia, September, 2005, pp: 1-41.
- Brosseau, L., L. MacLeay, V. Robinson, G. Wells and P. Tugwell, 2003a. Intensity of exercise for the treatment of osteoarthritis. *Cochrane Database Syst. Rev.*, Vol. 2. 10.1002/14651858.CD004259
- Brosseau, L., K.A. Yonge, V. Welch, S. Marchand, M. Judd, G.A. Wells and P. Tugwell, 2003b. Thermotherapy for treatment of osteoarthritis. *Cochrane Database Syst. Rev.*, 10.1002/14651858.CD004522
- Chopra, A., J. Patil, V. Billempelly, J. Relwani and H.S. Tandle, 2001. Prevalence of rheumatic diseases in a rural population in western India: A WHO-ILAR COPCORD Study. *J. Assoc. Phys. India*, 49: 240-246.
- Coleman, S., N.K. Briffa, G. Carroll, C. Inderjeeth, N. Cook and J. McQuade, 2008. Effects of self-management, education and specific exercises, delivered by health professionals, in patients with osteoarthritis of the knee. *BMC Musculoskeletal Disorders*, Vol. 9. 10.1186/1471-2474-9-133
- Focht, B.C., W.J. Rejeski, W.T. Ambrosius, J.A. Katula and S.P. Messier, 2005. Exercise, self-efficacy and mobility performance in overweight and obese older adults with knee osteoarthritis. *Arthritis Rheum.*, 53: 659-665.
- Fransen, M. and S. McConnell, 2008. Exercise for osteoarthritis of the knee. *Cochrane Database Syst. Rev.*, 10.1002/14651858.CD004376.pub2
- Huang, M.H., Y.S. Lin, R.C. Yang and C.L. Lee, 2003. A comparison of various therapeutic exercises on the functional status of patients with knee osteoarthritis. *Sem. Arthritis Rheumat.*, 32: 398-406.
- Iwamoto, J., Y. Sato, T. Takeda and H. Matsumoto, 2011. Effectiveness of exercise for osteoarthritis of the knee: A review of the literature. *World J. Orthop.*, 2: 37-42.
- Roddy, E., W. Zhang and M. Doherty, 2005. Aerobic walking or strengthening exercise for osteoarthritis of the knee? A systematic review. *Ann. Rheum. Dis.*, 64: 544-548.
- Shereif, W.I. and A.A. Hassanin, 2011. Comparison between uses of therapeutic exercise and heat application on relieve pain, stiffness and improvement of physical function for patient with knee osteoarthritis. *Life Sci. J.*, 8: 388-396.
- Topp, R., S. Woolley, J. Hornyak III, S. Khuder and B. Kahaleh, 2002. The effect of dynamic versus isometric resistance training on pain and functioning among adults with osteoarthritis of the knee. *Arch. Phys. Med. Rehab.*, 83: 1187-1195.