



## EFFECTIVENESS OF HEAT AND COLD APPLICATION WITH RANGE OF MOTION ON PAIN, JOINT STIFFNESS AND PHYSICAL ACTIVITY AMONG OLDER ADULTS WITH KNEE OSTEOARTHRITIS – PILOT STUDY

### Nursing

**K. Meena\***

M.Sc(N), M.Sc(Psy), MBA(HM) Professor Cum HOD of Community, Health Nursing, Arun College of Nursing, Vellore-01 \*Corresponding Author

**Dr. R. Vijayaraghavan**

Research Director, Saveetha University, Thandalam, Chennai.

**Dr. C. Anbuselvam** Guide, Professor, Rajas Dental College and Hospital, Thirunelveli.

### ABSTRACT

**Back ground:** Osteoarthritis is the most common articular disease of the developed world and a leading cause of chronic disability of the knee osteoarthritis. Incidence of knee osteoarthritis is raised by increasing average age of general population.

**Methods:** comparative quasi experimental design of two independent groups with two pre-test and two post-test was adopted. 20 primary knee osteoarthritis were selected using purposive sampling technique. The study were explained and informed consent was taken after which they were assigned into experimental group 1- heat application and experimental group 2- cold application. twenty older adults with primary knee osteoarthritis were selected from the orthopaedic units of Indira Gandhi Government General Hospital. Five Instruments were used to collect the data from the participants. Semi-structured interview schedule, Anthropometric measurements, Visual analogue scale, Kellgrans and Lawrence classification, Goniometer, Modified WOMAC Index.

**Results:** Mann-Whitney rank sum test was used for the comparison of pre- test level of pain, stiffness and physical activity scores between the experimental group 1 and group 2. Which was not significant at the pre-test level. The comparison of post test level of pain, stiffness and physical activity was significant at the level of  $p < 0.001$ .

**Conclusion:** Heat and cold application with range of motion exercise was effective on reduction of pain joint stiffness and promotion of physical activity in both the experimental groups. It was significant at the level of  $p < 0.001$ .

### KEYWORDS

Knee osteoarthritis, Pain, Joint stiffness, Physical activity, Range of motion

### 1. INTRODUCTION

Osteoarthritis (OA) is a chronic degenerative disorder of multifactorial etiology characterized by the loss of articular cartilage, hypertrophy of bone at the margins, sub chondral sclerosis and many biochemical and morphological alterations of the synovial membrane and joint capsule<sup>16</sup>. Pathological changes are the late stage of osteoarthritis that includes softening, ulceration and focal disintegration of the articular cartilage. Typical clinical symptoms are pain, particularly after prolonged activity and stiffness is experienced after in activity. It is probably not a single disease but represents the final end result of various disorders leading to joint failure. Primary osteoarthritis is mostly related to aging<sup>1</sup>. It can present as localized, generalized, or as erosive osteoarthritis<sup>17</sup>. Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India and more common in women than men. The prevalence increases with age. Nearly, 45% of women over the age of 65 years have symptoms of radiological evidence and 70% of those over 65 years<sup>17</sup>.

#### 1.1. Prevalence of knee osteoarthritis

Osteoarthritis affects almost in all joints but the most commonly affected joints are the knee and hip joints. Globally, it is estimated that 10% -15% of all adults aged over 60 had some degree of osteoarthritis. The prevalence was higher among women than men (WHO-2017). The prevalence of symptomatic knee osteoarthritis in the USA is 12.1% as per NHANESIII data and 16.3 % in people aged 55-64 of Johnston country<sup>9</sup>. The data produced by the Dutch Institute of Public Health on the prevalence of knee osteoarthritis in those age 55 and above was 15.6% in men and 30.5% in women respectively<sup>3</sup>. A study done in Asian countries of India, Pakistan and Bangladesh showed a higher prevalence of knee osteoarthritis. Prevalence was 13.7% in rural areas and 6.9% in urban areas. Community survey data in rural and urban areas of India showed the prevalence of osteoarthritis to be in the range of 17% - 60.6%<sup>18</sup>. In India approximately 40% population of more than 70 years showed osteoarthritis, in which nearly 2% had severe knee pain and disability. Increment in age exponentially increases the allied risk of osteoarthritis, due to progressive changes in routine diet, working conditions and lifestyle patterns. A survey based study revealed that, India is predicted as chronic disease capital by 2025<sup>8</sup>. Prevalence study reported that nearly 80% of population showed a symptoms of osteoarthritis. Among that cases, approximately 20% of the people reported incapability in daily activities and around 11% need peculiar care<sup>5</sup>.

#### 1.2 Need for the study

Heat and cold treatments helps to reduce inflammation and ease the pain and stiffness due to arthritis. It is required to evaluate that which therapy works best for pain, and find out the right combination of hot packs and cold packs to get the best relief from pain. Clinical research study stated that the heat and ice intervention can be selected to give best relief from pain associated with osteoarthritis<sup>12</sup>. A study was conducted on responses to superficial heating and cooling differ in men and women with knee osteoarthritis. Results reported that, women were more likely reported clinically meaningful improvement in pain and symptoms after intervention<sup>6</sup>. Cryotherapy or cold application decreases tissue blood flow by causing vasoconstriction and reduces tissue metabolism, oxygen utilization, inflammation and muscle spasm. Clinical research study supported that the use of ice for treating both soft tissue and bone after an acute traumatic injury to a large joint. The common health belief of topical cold modalities are useful only for immediate care of acute injuries and are safe with only short duration of treatment<sup>11</sup>. Topical heat treatment applied directly on the skin increases the deep tissue temperature and blood flow<sup>10</sup>. Along with heat and cold application active assisted range of motion exercises can support and protect joints that are affected by arthritis.

#### 1.3. Statement of the problem

A comparative study to evaluate the effectiveness of heat and cold application with range of motion on pain, joint stiffness and physical activity among older adults with knee osteoarthritis.

#### 1.4. Objectives

1. To assess and compare the health status of pain, joint stiffness and physical activity among older adults with knee osteoarthritis after heat and cold application.
2. To assess and compare the effectiveness of heat and cold application with range of motion exercise among older adults with knee osteoarthritis.

### 2. MATERIALS AND METHODS

**2.1. Participants :** comparative quasi experimental design of two independent groups with two pre test and two post test was adopted. Purposive sampling technique was used for this study. The study was conducted after getting the written approval from the Institutional Human Ethics Committee of Saveetha University, Tamilnadu (010/11/2013/IEC/SU; dated on 15.11.2013) and Indira Gandhi

Government General Hospital and Post Graduate Institute ,Puducherry (NO.GHSAC/2017;dated on 23.8.2017). Written consent was obtained from the older adults with primary knee osteoarthritis for their participation in this study. The total sample consisted of 10 in the experimental group 1 and 10 in the experimental group 2.

**2.2. Inclusion and exclusion criteria :** Primary knee osteoarthritis with the age group between 40 to 70 years, both men and women on oral medications were included. Knee osteoarthritis with other associated medical problems such as cardio vascular problem, renal problem along with secondary knee osteoarthritis with other interventions like topical application of medications, infra-red therapy were excluded.

**2.3. Methodology**

Using purposive sampling techniques 20 primary knee osteoarthritis were selected. The study details were explained and informed consent was taken after which they were assigned into experimental group 1-heat application and experimental group 2- cold application. The total sample consisted of 10 in the experimental group 1 and 10 in the experimental group 2. The details about the research procedure and its benefits were explained to the knee osteoarthritis participants. Written consent was obtained from the older adults with primary knee osteoarthritis for their participation in this study. The tools used were demographic and clinical proforma to collect baseline information. Pre assessment on the level of pain intensity was analysed by using visual analogue scale. The pain intensity score was interpreted as no pain (0 –4 mm), mild pain (5–44 mm), moderate pain (45–74 mm) and severe pain (75–100 mm). The kellgrans and lawrence classification measures the severity of knee osteoarthritis, using five grades. In this study grade 1 and grade 2 were included. Goniometer was used to assess the range of motion of the knee joint. Modified WOMAC index is a standardized scale was taking into account of assessing pain, stiffness and functional limitation. Consisting of 24 items divided into 3 subscales. Sub scale 1, consisting of pain (5 items) includes walking, using stairs, in bed, sitting or lying, and standing upright position. Sub

scale 2, consisting of stiffness (2 items) which includes early morning waking and later in the day. Sub scale 3, physical function (17 items). The score was interpreted as none (0), mild pain(1), moderate pain(2), severe pain(3). Instructions were given in the local language and the total score was recorded. Intervention and its benefits had been explained to the participants.

**2.4. Data collection procedure**

Experimental group 1 participants were received heat application by using hot pack wrapped in a cotton bag for 15- 20 minutes . After 10 minutes of interval the active assisted range of motion exercise was administered for 30 minutes, Thereafter 10 minutes of interval once again heat application was administered for 15-20 minutes for each participant respectively and continued for the period of 2 weeks. Experimental group 2 participants were received cold application by using cold pack wrapped in a cotton bag for 15- 20 minutes of temperature . After 10 minutes of interval, the active assisted range of motion exercise was administered for 30 minutes, Thereafter 10 minutes of interval once again cold application was administered for 15-20 minutes for each participant respectively, intervention was given minimum 1 hour per day and continued for 2 weeks. After 2 weeks of intervention the post test was carried out with the same parameters to compare the effectiveness of experimental group 1 and experimental group 2 .

**2.5. Statistics**

The data was explained as mean, standard error, median and percentile, non parametric test was used for the comparison of means of experimental group1 and group 2 by using Wilcoxon signed rank sum test ,and Mann-Whitney rank sum test. The analysis and interpretation of data were explained by using tables. The analyses were carried out using Sigma plot 12.0(Systat Software Inc., USA).

**RESULTS AND DISCUSSION**

Based on objectives, the results are discussed below,

**Table 1 :Comparison of pretest and post test scores in pain, stiffness and physical activity with in experimental group1 and experimental group 2. N =20**

parameter	Group	Mean±S.E	Median	Wilcoxon signed rank test	
				Heat pre & post test	Cold pre & Posttest
Pain	Heat-Pretest	14.80±0.53	15.50 (13.0–16.0)	P=0.005 Z = 2.807	P=0.026 Z = 2.232
	Cold-Pretest	14.80±0.53	15.50 (13.0–16.0)		
	Heat-Post	2.50±0.67	2.0 (0.0–5.0)		
	Cold-Post	13.70±0.65	14.0 (12.5 – 16.0)		
Stiffness	Heat-Pretest	6.10±0.28	6.0 (5.75 – 6.25)	P=0.005 Z = 2.820	P=0.046 Z = 2.000
	Cold-Pretest	6.10±0.28	6.0 (5.75- 6.25)		
	Heat-Post	1.20±0.07	0.00 (0.0-4.0)		
	Cold-Post	5.70±0.26	5.50 (5.0 – 6.25)		
Physical Activity	Heat-Pretest	51.40±0.0.92	50.50 (50.0 – 53.0)	P=0.005 Z = 2.809	P=0.023 Z = 2.271
	Cold-Pretest	54.70±0.52	55.0 (53.0- 56.0)		
	Heat-Post	13.70±0.42	13.0 (12.0 – 15.0)		
	Cold-Post	53.50±0.56	53.50 (52.0 – 55.25)		
Overall	Heat-Pretest	72.30±2.47	73.0 (70.50 – 75.0)	P=0.005 Z = 2.807	P=0.007 Z = 2.680
	Cold-Pretest	75.60±0.62	75.0 (74.50 – 77.25)		
	Heat-Post	17.40±1.07	17.0 (14.0 – 20.0)		
	Cold-Post	72.90±0.0.92	73.50 (70.75 – 74.50)		

**Table 1: level of pain with in the experimental group1 and group 2 among older adults with knee osteoarthritis:** level of pain score of mean, standard error and median scores among older adults with knee osteoarthritis with in the experimental group1 and group2. Pre and post test pain scores were explained in table 1 . The pre and post test median score of experimental group1and group 2 were 15.50 ,15.50 and 2.0,14.0 respectively, and post test score was 13.50 scores lesser than pre-test score in the experimental group1 .Where as in the experimental group 2 post test score was 1.50 scores lesser than pre-test score .The data were analysed using non-parametric Wilcoxon signed rank sum test, which showed significant difference found in the pre and post test scores of pain among older adults with knee osteoarthritis.

**level stiffness score with in the experimental group1 and group 2 among older adults with knee osteoarthritis:** level of stiffness score of mean, standard error and median scores among older adults with knee osteoarthritis with in the experimental group1 and group 2 . Pre

and post test stiffness scores were explained in table 1 . The pre and post test median score of experimental group1and group 2 were 6.0 ,6.0and 0.00,5.50 respectively, and post test score revealed significant improvement in the experimental group1 .Where as in the experimental group2 post test score was 0.50 scores lesser than pre-test score. The data were analysed using non-parametric Wilcoxon signed rank sum test, which showed marginal difference was found in the pre and post test scores of joint stiffness among older adults with knee osteoarthritis.

**level of physical activity score with in the experimental group1 and group 2 among older adults with knee osteoarthritis:** level of physical activity score of mean, standard error and median scores among older adults with knee osteoarthritis with in the experimental group1 and group 2. Pre and post test physical activity scores were explained in table 1. The pre and post test median score of experimental group1and group 2 were 50.50 ,55.50 and 13.0,53.50 respectively and post test score was 37.50 scores lesser than pre-test

score in the experimental group 1. Where as in the experimental group 2 post test score was 2.0 scores lesser than pre-test score. The data were analysed using non-parametric Wilcoxon signed rank sum test, which

showed significant difference found in the pre and post test scores of physical activity among older adults with knee osteoarthritis.

**Table 2: Comparison of pretest and post test scores in pain, stiffness and physical activity between experimental group 1 and experimental group 2 . N = 20**

parameter	Group	Mean±S.E	Median		Mann Whitney rank sum test	
					Heat & Cold Pretest	Heat & Cold Posttest
Pain	Heat-Pretest	14.80±0.53	15.50	(13.0–16.0)	T=50.0	T=0.000
	Cold-Pretest	14.80±0.53	15.50	(13.0–16.0)	P=.1.000	P<0.001
	Heat-Post	2.50±0.67	2.0	(0.0–5.0)	Z=0.000	Z=3.810
	Cold-Post	13.70±0.65	14.0	(12.5 – 16.0)		
Stiffness	Heat-Pretest	6.10±0.28	6.0	(5.75 – 6.25)	T=50.0	T=0.000
	Cold-Pretest	6.10±0.28	6.0	(5.75- 6.25)	P=1.000	P<0.001
	Heat-Post	1.20±0.07	0.00	(0.0-4.0)	Z=0.000	Z=3.907
	Cold-Post	5.70±0.26	5.50	(5.0 – 6.25)		
Physical Activity	Heat-Pretest	51.40±0.0.92	50.50	(50.0 – 53.0)	T=14.50	T=0.000
	Cold-Pretest	54.70±0.52	55.0	(53.0- 56.0)	P=.0.007	P<0.001
	Heat-Post	13.70±0.42	13.0	(12.0 – 15.0)	Z=2.710	Z=3.810
	Cold-Post	53.50±0.56	53.50	(52.0 – 55.25)		
Overall	Heat-Pretest	72.30±2.47	73.0	(70.50 – 75.0)	T=16.0	T=0.000
	Cold-Pretest	75.60±0.62	75.0	(74.50 – 77.25)	P=.0.008	P<0.001
	Heat-Post	17.40±1.07	17.0	(14.0 – 20.0)	Z=2.636	Z=3.794
	Cold-Post	72.90±0.0.92	73.50	(70.75 – 74.50)		

**Table 2 : level of pain, stiffness and physical activity between the experimental group 1 and group 2 among older adults with knee osteoarthritis:** Level of pain, stiffness and physical activity of mean, standard error and median scores among older adults with knee osteoarthritis between the experimental group 1 and group 2. Pre and post test scores were explained in table 2 .The comparison of pre test level of pain, stiffness and physical activity scores between the experimental group 1 and group 2, by using Mann-Whitney rank sum test .Which was not significant at the pre test level. The comparison of post test level of pain, stiffness and physical activity was significant at the level of p<0.001. it shows the improvement after intervention.

**CONCLUSION**

The present study was reported that the intervention of heat application and cold application with range of motion exercise among older adults with knee osteoarthritis were effective and brought markable changes in the groups. Both the experimental group 1 and group 2 were received intervention. After 2 weeks of intervention , symptoms of pain, joint stiffness related to knee osteoarthritis had been reduced. In the experimental group 1 and group 2 knee osteoarthritis symptoms of pain was reduced and improvement was shown in the physical activity. Hence, the experimental group 1 was effective than the experimental group 2 in reducing pain, joint stiffness and promotion of physical activity.

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