



## **Effectiveness of Mechanical Hydrotherapy on Pain Management among Patients with Arthritis Pain**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Introduction:** Hydrotherapy is a warm water therapy used in relieving pain such as muscle pain, back pain and inflammation associated with the arthritis pain. In arthritic condition hydrotherapy helps to improving blood circulation. It is commonly used for treating muscle injuries and stroke and brain injuries.

**Objectives:** To determine the effectiveness of mechanical hydrotherapy on pain management among patients with arthritis pain.

**Materials and Methods:** In this study a quantitative research approach with an experimental pre-test post-test research design was used for the present study. Purposive sampling was the sampling method used to collect data from arthritis patients on the basis of standardized numerical pain rating scale (NPRS). The sample size was 70, for experimental group 35 samples and control group was 35 samples. For experimental group the mechanical hydrotherapy was given along with prescribed medicines and for control group only prescribed medicine was monitored.

**Results:** The majority of participants were male 41 (58.57%) and female 29 (41.43%) as compared

to male. In experimental group male were 22 (62.85%) and female were 13 (37.15%) and in control group male were 19 (54.28%) and female were 16 (45.72%). Before intervention on day-1 pre assessment pain mean value was 7.51 and standard deviation was 1.46 in experimental group and in control group mean value was 7.91 and standard deviation was 1.12. On day-7 post assessment pain the outcome of an experimental group after mechanical hydrotherapy with reducing pain, mean value was 1.80 and standard deviation was 1.07 and in control group mean value was 7.97 and 1.27. Statistically significant improvement seen in the level of pain regarding effectiveness of mechanical hydrotherapy on pain management among patients with arthritis pain. **Conclusion:** Hence it is statistically clear that, the mechanical hydrotherapy to arthritis patients is helpful in managing the pain effectively.

*Keywords: Arthritis; effectiveness; mechanical hydrotherapy; pain; patient.*

## 1. INTRODUCTION

Hydrotherapy is a water based therapy, it may be used external or internal in any form i.e. cold or hot, ice, and steam. It is essential for promotion of health or treatment of various musculoskeletal disease. This treatment is one of the naturopathic and used more ancient cultures in India. Hydrotherapy helps to produce various physiological and therapeutic effects on various part of the body system. The hot application helps to improve peripheral vasodilation and raise the blood flow and reduced blood thickness and stickiness [1,2].

The cold application reduced oxygen consumption and raised blood thickness and stickiness. Also it helps to reduced blood flow [3].

In India, near about 4-6 percent adult population is affected by osteoarthritis. Osteoarthritis is a chronic ageing problem, degenerative disease is responsible to cause joint failure. Due to osteoarthritic condition there are 100 million people reported worldwide in cause of disability [4].

It is currently found that, adult's age 60 years and above make up 8 percent of India's population and by 2021 that number will be 137 million. In the world, India has the second largest aged population. Near about 75 percent population lives in the rural areas in India [1].

In addition, hot water hydrotherapy is one of the best and natural home remedy in arthritic condition at ageing and patients enjoy it too, hydrotherapy helps to stimulate body system. Sometimes hydrotherapy used to relax patients, promote blood flow and for proper blood circulation, for healing process, stimulate the immune system, tone the body, and helps to reduce the pain or discomfort associated with deep muscle, joint or connective tissue ailments,

injuries. Mechanical hydrotherapy i.e. warm water soaks towel massage helps in reducing joint pain for short period among patients with arthritic condition[5].

Hydrotherapy is a water based therapy and its characteristics are to maintain health of the people and it helps to prevent and cure the diseases. Now a days, it is used as warm water therapy as complementary therapy in arthritic condition[6-8]. Hydrotherapy is needed in terms of clinical trial. It is very important to highlight the positive aspects on pain management among patients with arthritis pain[9-10].

Cold water cause constriction of superficial blood vessels, it helps to pushing blood flow away from the whole body's surface into tissues, in hydrotherapy. Hot water helps to dilates superficial blood vessels, stimulates sweat glands, and helps to remove waste from body tissue [11-13].

Hydrotherapy can be easily performed by the patients at home without any side effects. It is cost effective, cheapest complementary therapy along with the medical intervention which helps to reduce pain for short duration. As evidence, it can be used in nursing intervention to manage pain in arthritic condition in community setting also[14-15].

## 2. MATERIALS AND METHODS

In this study a quantitative research approach with an experimental pre-test and post-test research design was used. The study was conducted during month of December 2019 to February 2020. By using Purposive sampling technique, 70 samples were selected based on the calculation out of which 35 samples were included in experimental group and 35 samples were in control group.

**Sample size formula with desired error of margin**

$$n = \frac{Z_{\alpha/2}^2 \cdot P \cdot (1 - p)}{d^2}$$

Where;  $Z_{\alpha/2}$  is the level of significance at 5 percent i.e. 95 percent confidence interval = 1.96, P = Prevalence of osteoarthritis = 4% = 0.04, d = Derived error of margin = 7% = 0.07[16]. The sample size was calculated to include 31 samples were in experimental group and 31 samples in control group. However, the researcher decided to include 35 samples in bothgroup[16].

Maximum patients who were attended orthoOPD, were age between 40 to 60 and above. The arthritis patients were informed and explained about objective of the study. The written informed consent dully signed individually by them was obtained on consent form. The inclusion criteria were: (i) Patients who were of Age 40 to 60 years and above, attended Ortho OPD and already diagnosed as arthritis by orthopedic surgeon, were selected for this study; and (ii) had willing to give consent (iii) Patients who were available during data collection period. The exclusion from the study criteriawas (i) Patients who were having any major orthopedic problems (ii) age below < 40 years (iii) those who were having major orthopedic surgery (vi) Patients were not available at the time of data collection. (v) Patients had not willing to participate in the study.

Demographic variables were collected in terms of age, gender, education, occupation, monthly family income. A standardized numerical pain rating scale was used to assess level of pain before and after experiment. This is attached in Annexure 1. A numerical pain rating scale has total 10 levels of pain score range. These were classified as -0 score considered as a No pain, 1-3 as mild pain, 4-6 as moderate Pain, 7-9 as severe Pain and 10 as unbearable Pain. The numerical pain rating scale has been used on the existing literature, on clinical experiences of handling of arthritis patients and other injured patients at ICU. Used numerical pain rating scale, which was already validated by experts.

Although the tool was validated for this study, the same has been confirmed from the nursing department by the medical surgical expert group and orthopedic surgical unit. Split half method

was adopted and found as  $r = 0.86$  for reliability testing, so it was reliable.

The mechanical hydrotherapy (warm water soak towel massage) was arranged for implementation of arthritis patients. Before implementation, On day-1 pre assessment of joints pain has been done for experimental and control group and it was recorded on pain scale sheet by the researcher, then researcher demonstrated mechanical hydrotherapy to patients at their selected area and redemonstrated by patients from day 1 to day 7 at their home along with routine care and prescribed medicine for arthritis pain. Control group was on routine care for arthritis pain and on prescribed medicine. For demonstration researcher used warm water with temperature from 99<sup>o</sup> F to 104<sup>o</sup> F, water temperature level was checked by bath thermometer, even bath thermometers were provided to patients to check warm water temperature at their home to experimental group. Warm water soak towel was applied on each joints (shoulder, wrist and knee) for 3-4 second. Because mainly these joints are affected in arthritis, patients repeated this cycle for 4-8 times a day. On day-7 each of the patient's from experimental group and control group responses of joint pain were recorded by researcher on numerical pain rating scale (NPRS) sheet. The responses were arranged in tabular form to conduct statistical analyses, which are mentioned in following sections.

**2.1 Statistical Analysis**

The demographic data, collected before experiment stage, analysis was done on five open- ended questions in terms of frequency and percentage. The paired t-test was used in this study to compare before and after mechanical hydrotherapy pain level score.

The demographic variables of samples are depicted in the Table no.1 as follows.

The Table no.2 depicts that, before mechanical hydrotherapy the level of Pain score of experimental group in the range of 4-6, 20% of the patients had moderate pain, in the 7-9, 71.43% had severe pain and in range 10, 8.57% of the patients had unbearable pain.

The level of Pain score of control group was in the range of 4-6, 5.71% of the patients had moderate pain, in range 7-9, 88.57% had severe pain and in range 10, 5.71% of the patients had unbearable pain.

The effectiveness of mechanical hydrotherapy was analyzed as follows:

**H<sub>1</sub>:** There was significant difference between level of pain score before mechanical hydrotherapy and after mechanical hydrotherapy. Table no. 3 represented that, mean after hydrotherapy pain level score on day-7 in experimental group i.e. 1.80 was lower compared to day-1 and in control group on day-1 to day -7 it was same. With Mean difference in experimental group from Day-1 to Day-7 was  $5.71 \pm 1.31$  and

in control group from Day-1 to Day-7 it was  $0.05 \pm 1.05$ . This suggested that, there was significant decrease in level of pain score in experimental group as compared to control group due to mechanical hydrotherapy (i.e. warm water soak towel massage). It was also observed that, calculated 't' value in experimental group (i.e., 25.63) was higher than control group (i.e., 0.32); p- value of experimental group was 0.0001 significantly  $< 0.05$  as compared to control group i.e. 0.75 not significant i.e.  $> 0.05$ .

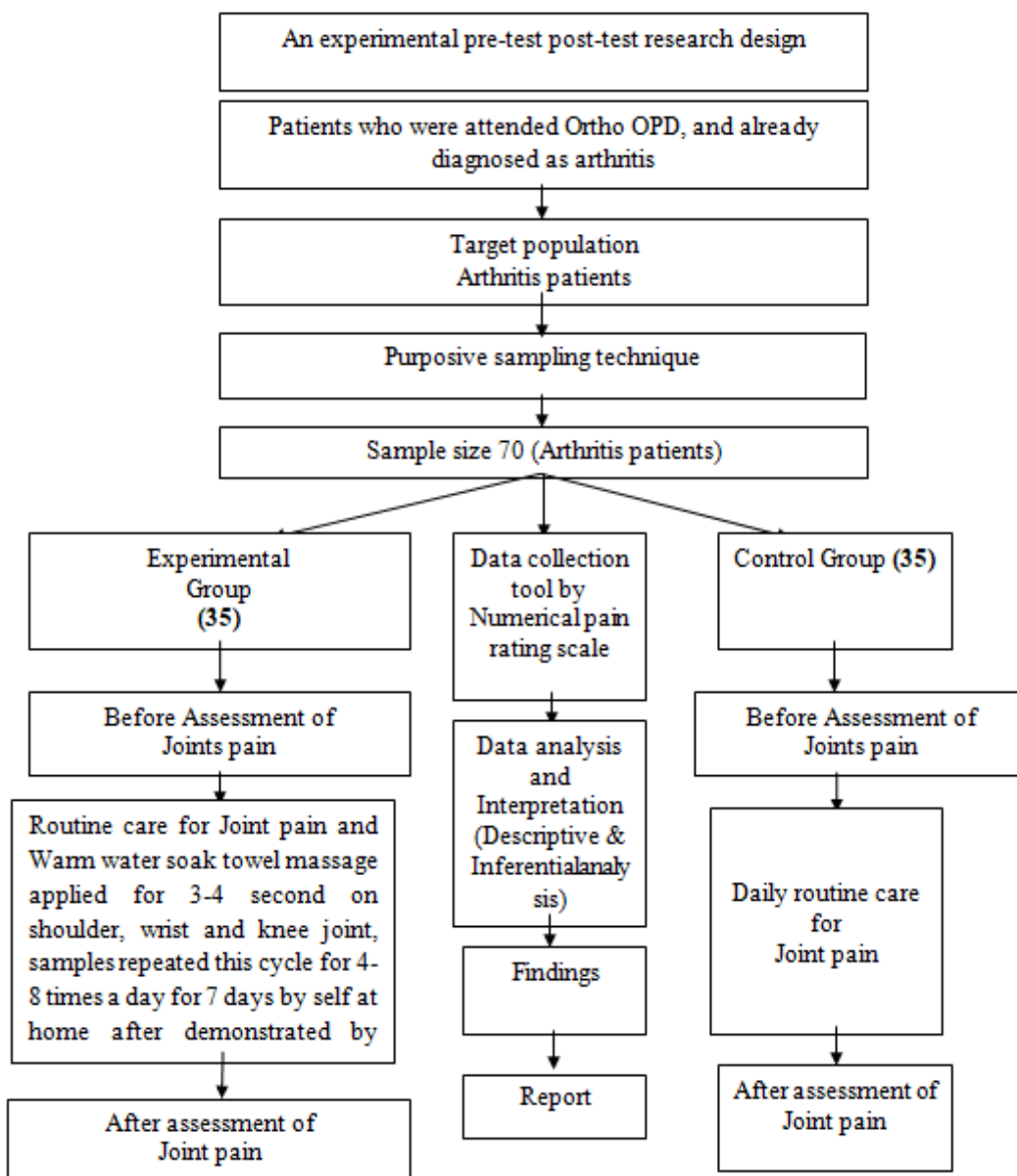


Fig. 1. The methodological steps including the statistical analysis are summarized as follows

**Table 1. Demographic variables (age, gender, education, occupation, monthly family income (n=70, 35= experimental group, 35= control group))**

Serial no.	Demographic Variable	Demographic Variable			
		Experimental Group		Control Group	
		Frequency	Percentage	Frequency	Percentage
1.	Age(yrs)				
	40-44 yrs	5	14.3	5	14.3
	45-49 yrs	4	11.4	3	8.6
	50-54 yrs	9	25.7	11	31.4
	55-59 yrs	12	34.3	12	34.3
	60-64 yrs	1	2.9	1	2.9
	65-69 yrs	2	5.7	1	2.9
	70-74 yrs	1	2.9	1	2.9
2.	75-79 yrs	1	2.9	1	2.9
	Gender				
	Male	22	62.9	19	54.3
3.	Female	13	37.1	16	45.7
	Education				
3.	Primary	1	2.9	6	17.1
	Secondary	10	28.6	6	17.1
	Higher Secondary	16	45.7	15	42.9
	Graduate	6	17.1	5	14.3
	Post Graduate and Above	2	5.7	3	8.6
4.	Occupation				
	Manager	2	5.7	3	8.6
	Teacher	5	14.3	5	14.3
	Clerk	3	8.6	9	25.7
	Housewife	8	22.9	6	17.1
	Farmer	5	14.3	5	14.3
	Carpenter	9	25.7	4	11.4
	Miner (extracts coal, Cutting, blasting)	3	8.6	3	8.6
5.	Monthly family income(Rs)				
	<5000 Rs/-	1	2.9	6	17.1
	5001-10000 Rs/-	18	51.4	18	51.4
	10001-15000 Rs/-	9	25.7	2	5.7
	>15000 Rs/-	7	20	9	25.7

**Table 2. Frequency percentage of level of pain score before mechanical hydrotherapy (n=70, 35= experiment group, 35= control group).**

Level of pain score	Score Range	Experimental group		Control group	
		Frequency	Percentage	Frequency	Percentage
No Pain	0	0	0	0	0
Mild Pain	1-3	0	0	0	0
Moderate Pain	4-6	7	20	2	5.71
Severe Pain	7-9	25	71.43	31	88.57
Unbearable Pain	10	3	8.57	2	5.71
Minimum score		4		5	
Maximum score		10		10	
Mean pain score		7.51 ± 1.46		7.51±1.46	

**Table 3. Statistical analysis of before and after mechanical hydrotherapy level of pain score in experimental group and control group (n=70, 35= experimental group, 35= control group)**

Overall	Experimental group					Control group				
	Mean	SD	Mean Difference	t-value	p-value	Mean	SD	Mean Difference	t-value	p-value
Day 1	7.51	1.46	5.71±1.31	25.63	0.0001 S,p < 0.05	7.91	1.12	0.05±1.05	0.32	0.75 NS,p >0.05
Day 7	1.80	1.07				7.97	1.27			

The study hypothesis was accepted, i.e. pain level score was significantly decreased after mechanical hydrotherapy. The data further indicated that, mean of experimental group after mechanical hydrotherapy was decreased at day-7 as compared to day-1 and in control group it remained the same.

Therefore, mechanical hydrotherapy was effective in terms of decrease level of pain in experimental group as compared to control group.

### 3. RESULTS AND DISCUSSION

The present study illustrated that, pre-test-post-test research design was implemented on pain management among patients with arthritis pain. All samples were present at the time of data collection and participated in the study with full of interest.

According to effectiveness study result, it is very effective for patients who were having joint pain, pharmacological drugs are needed to relieve joint pain but overdose sometimes may cause side effects. In case if, patients could not tolerate its doses it may affect the kidney so it's better to take warm water soak towel massage along with medicine as it will give better results. Due to this therapy, rates of the pharmacological drugs taken by patients will be ultimately reduce, so patients should practice it as a complementary therapy to manage arthritis pain effectively at home.

A descriptive study was conducted, on to assess the effectiveness of hot water and cold water therapy among old people who had joint pain. 100 samples and experimental and control group were selected to conduct the study. In experimental group, pre-test value of mean (29.3) and standard deviation (8.71) and in control group, pre-test value of mean (28.7) and standard deviation (8.78) and p value is 0.7323 and pre-test is not significant. After intervention in experimental group post-test value of mean (14.56) and standard deviation (9.92) and in control group post value of mean (29.88) and standard deviation (7.99) and p value is 0.0001 and post test value is statistically significant. The study indicate that hot water application is very effective on joint pain healing in old age people[17].

The supporting study was conducted by the researcher, the objective of this study was assess the level of pain with arthritis patients in

experimental and control group. To assess the effectiveness of hot water compress with Epsom salt to manage knee joint pain level in experimental and control group. In this study there were total 60 samples included and 30 samples were in each group. Pain level was assessed by using NPRS scale. Continuously for 10 days experiment group were given hot water compress with Epsom salt. Control group followed their daily routine treatment. The samples in the experimental group showed 58 percent of reduction in pain levels as compared to the samples in control group who had only 3 percent reduction[18].

Above study suggested that, Today people are on pharmacological treatment to relieve pain but sometimes it has side effects on body, So if we use hot water compress with Epsom salt to relieve muscle pain which has been proved in this study, then it will be economical and culturally accepted, Hydrotherapy can be practiced safely at home and it has less side effect as compared to pharmacological treatment.

The present research study highlighted the effects of mechanical hydrotherapy (i.e. warm water soak towel massage) as a complementary therapy to manage arthritis pain. The 't' value of present study of experimental group was 25.63 ( $p=0.0001$ ,  $S$ ,  $p < 0.05$ ) and the t value of similar study was 10.03 ( $p0.001$ ) for experimental group.

A research study was conducted on effectiveness of hydrotherapy in women with knee osteoarthritis. The researcher were provided, overall hydrotherapy intervention plan to experimental group in a heated pool for twice per week for six weeks and also educational protocol were provided, while the control group only provided an educational protocol and no intervention. Before and after treatment Knee extender and flexor muscle strength were assessed by an isokinetic dynamometer. The research study findings were better outcomes for pain in the experimental group (adjusted mean difference=11points, 95 percent CI: 3---18) and works (adjusted mean difference = 12 points, 95 percent CI: 5---18)[19].

Another research had reported on randomized or controlled ice or heat clinical trials for patients with rheumatoid arthritis compared with placebo or active treatments studies of case-control and of cohort. Three trials (79 subjects) met the requirements for inclusion. There was no impact

on objective indicators of disease activity of either ice versus control or heat versus control. Patients reported that, they preferred heat therapy to no therapy (94 percent like heat therapy better than no therapy). No adverse effects were reported on ice or heat. Since patients enjoy thermotherapy and no adverse effects are present, thermotherapy should be recommended as a treatment that can be administered as needed to alleviate pain [20, 21]. to present the report, all of the above studies were funded and it is very inexpensive in economic terms for patients with arthritis pain.

All above studies were supported to present study and it is very economically affordable to patients who have been suffering from arthritis pain.

#### **4. CONCLUSION**

The conclusions were drawn from above present study, before mechanical hydrotherapy and after mechanical hydrotherapy there was a significant difference in the mean score of the patients with arthritis pain i.e. Hot water soaks towel massage and on the study findings it was noticed that, there is an evidence to suggest that, mechanical hydrotherapy has a positive role in reducing pain with arthritis and improving the health condition of patients as compared to no or other interventions in the short term.

#### **5. RECOMMENDATION**

It is very cost effective therapy; patients can easily perform at home. So that mechanical hydrotherapy can be used for health promotion of arthritis patients [20].

#### **6. LIMITATION**

The study was limited to sample size i.e. 70 (35= experimental group, 35= control group). This might be inadequate to generalize the study findings. More time duration would give more relevant results with variations of any research, but the investigator planned to complete the research work within one month to get more feasibility of getting sample. Therefore, sufficient number of sample and time duration was required to establish the effects of mechanical hydrotherapy to manage arthritis pain, in general.

#### **CONSENT**

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

#### **ETHICAL APPROVAL**

The study conducted after getting the Institutional ethics committee permission, [Ref. No. MIMS (DU)/IEC/Dec-2019/8643] as well as from governing body of selected area.

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#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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