

Effect of Oxygen Compressed Cold Application VS Conventional Cold Application Level of Pain among Patients Musculoskeletal Disorders: A Randomized Control Trial

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Abstract: ***Background:** Musculoskeletal disorders (MSDs) are injuries or pain which includes joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck and back. Global prevalence of varies from age and diagnosis, between 20%–33% of people across the live with a painful musculoskeletal condition. Cold application used in the management of acute injury/trauma, chronic pain, muscle spasm, inflammation, and edema. The study finding reveals the efficacy of oxygen compressed cold application in level of pain among patients with musculoskeletal disorders with high level of significance. This findings can be implicated for all patients with generalized musculoskeletal disorders with pain. **Aims:** 1) To assess the level of pain among patients with musculoskeletal disorders in both Group I, Group II and Group III during pre-test and post – test. 2) To compare the effectiveness of conventional cold application vs oxygen compressed cold application on level of pain among patients with musculoskeletal disorders in Group I, Group II and Group III. 3) To associate the level of pain among patients with musculoskeletal disorders with selected demographic variables. **Methods:** Randomized control trail design was adopted for the study. The population of the study was patients pain in musculoskeletal disorders. 90 samples were selected by purposive sampling technique. Pain outcome of the patients with musculoskeletal disorders was assessed by visual analogue scale and numerical rating scale. **Results:** The result shows that both conventional cold application and oxygen compressed cold application were effective on pain among patients with musculoskeletal disorders. **Conclusion:** This study proves that the oxygen compressed cold application was found to effective as the conventional cold application. In modern day ward setup oxygen compressed cold application can be used as a replacement for conventional cold application*

Keywords: conventional cold application, oxygen compressed cold application, musculoskeletal disorders

1. Introduction

Musculoskeletal conditions which include muscles, bones, joints and associated tissues such as tendons and ligaments. It was diagnosis more than 150 diagnoses that affect the locomotor system are broadly put into they are typically characterised by pain will cause limitations in mobility, dexterity and functional ability, lessening individuals' capacity to work and partake in social jobs with related effects on mental prosperity, and at a more extensive level effects on the success of communities.¹The most common and disabling conditions are osteoarthritis, fractures associated with bone fragility, injuries and systemic inflammatory conditions such as rheumatoid arthritis. According to the ICD 11, chronic musculoskeletal pain states that “persistent or recurrent pain that arises as part of a disease process directly affecting bones, joints, muscles, or related soft tissue(s).² Global prevalence of musculoskeletal condition varies from age between 20%–33% of individuals over the live with a difficult pain condition.³The second most basic reason for cause around the worldwide, estimated by years lived with incapacity statement by (YLDs), with low back pain one of the most incessant condition.⁴WHO’s Study on global AGEing and adult health (SAGE) statement point to the high pervasiveness of joint inflammation in low class and middle class, especially among those in a lower financial position.⁵ They are diverse group with regard to pathophysiology but are linked anatomically and by their association with pain

and impaired physical function encompass spectrum of conditions, from those of acute onset and short duration to lifelong conditions are osteoarthritis, rheumatoid arthritis, osteoporosis, and low back pain. Prevalence of many of these conditions increases with age, and many are affected by lifestyle factors, such as obesity and lack of physical activity etc. Increase number of older people and the changes in lifestyle throughout the world mean that the burden on people and society will increase dramatically.⁶

Cryotherapy means cold therapy otherwise known as ice application.⁷ It is helps to control pain. It also decreases edema, nerve conduction velocities, cellular metabolism and local blood flow.⁴In this study setting, cold application with some degree application of concomitant static compression is routinely applied immediately after an acute phase of musculoskeletal injury as prophylaxis for chronic orthopedic sports problems. Inthe management certain principals follows soft tissue trauma remains protection, rest, ice, compression and elevation.⁸ This literature review provides information for practitioners on the use of cold application therapies based on the mechanisms of action, physiological effects, evidence based support in their clinical use. Physiological effects of cold application include reductions in pain, blood flow, edema, inflammation, muscle spasm, and metabolic demand. Randomized clinical trials (RCTs) supporting literally the use of cold application following musculoskeletal conditions helps to relieve the pain.⁴

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Cold compression is locally or systemically used for therapeutic purposes and provides which helps to drop in tissue temperature. For the treatment of knee OA, the aim is to improve the quality of life helps to reduce the level of pain, stiffness and other symptoms, slowing the progression of the disease, increasing and maintaining the physical function of the patient. In this respect, it is thought that cold application may help treatment because it is having low side effects, easy application and non-invasive application.⁹

1.1 Objectives

- To assess the level of pain among patients with musculoskeletal disorders in both Group I, group II and Group III during pre-test and post – test.
- To compare the effectiveness of conventional cold application vs oxygen compressed cold application on level of pain among patients with musculoskeletal disorders in Group I, Group II and Group III.
- To associate the level of pain among patients with musculoskeletal disorders with selected demographic variables.

1.2 Hypotheses

- H1– Level of pain differs before and after oxygen compressed cold application on pain among patients with musculoskeletal disorders.
- H2 - Effect of oxygen compressed cold application varies effect of conventional cold application on pain among patients with musculoskeletal disorders.
- H3–Association exists between levels of pain among patients with musculoskeletal disorders and selected demographic variables.

2. Materials and Methods

The research design adopted for the study was Randomized control trail carried out. The study was conducted among 90 samples level of pain among patients with musculoskeletal

disorders. Purposive sampling technique was used. The samples were selected based on inclusion and exclusion criteria. The sample size was calculated based on power analysis at the power 90%. The Institutional Human ethical clearance was obtained. The informed consent samples was obtained. Interview schedule was used to collect the demographic variables and standardized visual analogue scale and numerical pain rating scale was used to assess the level of pain among patients with musculoskeletal disorders. The data collection was done for a period of 6 weeks.

After self- introduction a pretest was done to assess the level of pain among patients with musculoskeletal disorders visual analogue scale and numerical pain rating scale. Conventional cold application, oxygen compressed cold application for group I given to group II and nil intervention given to the group III. Post test was done using visual analogue scale and numerical pain rating scale.

2.1 Criteria for Sample Selection

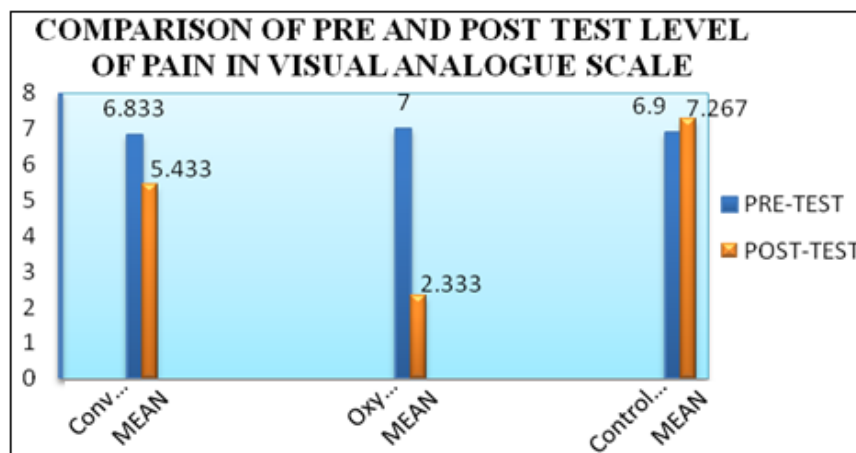
a) Inclusion Criteria

- Patient diagnosed with musculoskeletal disorders
- Patient with age more than 18 years
- Patient who is conscious.
- Patient who are willing to participate.

b) Exclusion Criteria

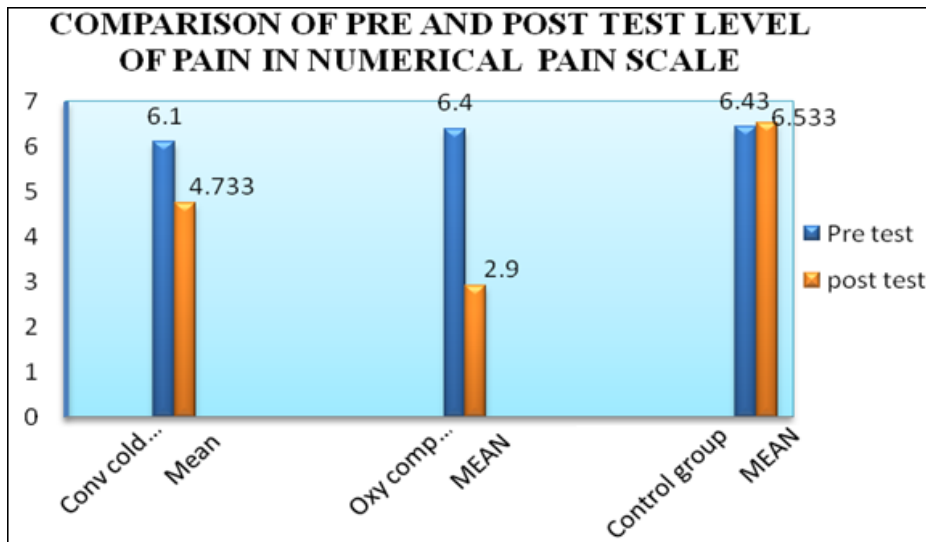
- Patient who is restless.
- Unresponsive patient.
- Systemic complications
- Patient who are diagnosed as sensorial deficit and impaired vascular circulation in hand and feet.
- Patients who are critically ill, Raynaud's disease, lower limb ischemia, cold allergy.

3. Results



Frequency and percentage wise distribution of Pre-test and post- test of the level of pain (visual analogue scale) among patients with musculoskeletal disorders in oxygen compressed cold application group. **In pre-test**, Majority of the musculoskeletal pain patients 19 (63.3%) had severe

level, 8(26.7%) had moderate level and 3 (10%) had mild level of pain. **In post-test**, Majority of the musculoskeletal pain patients 25 (83.3%) had mild level and 5 (16.7%) moderate level of pain.



Frequency and percentage wise distribution of Pre-test and post- test of the level of pain (numeric pain intensity scale) among patients with musculoskeletal disorders in oxygen compressed cold application group. **In pre-test**, Majority of the musculoskeletal pain patients 19 (63.3%) had severe level, 6(20%) had mild level and 5 (16.7%) had moderate level of pain. The mean and standard deviation of the level of pain (numeric pain intensity scale) among musculoskeletal pain patients in pre-test is (6.40 ± 2.44) .

In post-test, Majority of the musculoskeletal pain patients 23 (76.7%) had mild level and 7(23.3%) had moderate level of pain.

Table 1: Comparison of pre and post test of Mean musculoskeletal pain level of Group I, group II, and Group III level of pain among patients with musculoskeletal disorders

Test	Groups	Mean	Standard Deviation	“z” Value One Way Anova Test	p- Value
Pre -test	Group I	6.833	1.858	0.070	0.933
	Group II	7.0	1.875		
	Group III	6.90	1.446		
Post-test	Group I	5.433	1.775	94.4	0.001**
	Group II	2.33	0.758		
	Group III	7.267	1.484		

Table 1 shows that, the mean score of pre-test level of pain among patients with musculoskeletal disorders in the group I was 6.833 ± 1.858 , the mean score in the group II was 7.0 ± 1.875 and the mean score in the control group III was 6.90 ± 1.446 respectively. The calculated one way ANOVA test value of $z = 0.070$ shows statistically not significant between Comparison of the level of pain (visual analogue pain scale) among patients with musculoskeletal disorders in pretest.

The mean score of posttest level of pain among patients with musculoskeletal disorders in the group I was 5.433 ± 1.775 , the mean score in the group II was 2.33 ± 0.758 and the mean score in the group III was 7.267 ± 1.484 respectively. The calculated one way ANOVA test value of $z = 94.4$ shows statistically highly significant between

Comparison of the level of pain (visual analogue pain scale) among patients with musculoskeletal disorders in posttest.

Table 2: Comparison of the effectiveness of conventional cold application vs oxygen oxygen compressed cold application vs control group on pain (numeric pain intensity scale) among patients with musculoskeletal disorders

Test	Groups	Mean	Standard Deviation	“z” Value One Way Anova Test	p- Value
Pre -test	Group I	6.100	1.953	0.230	0.795
	Group II	6.400	2.443		
	Group III	6.433	1.851		
Post-test	Group I	4.733	1.855	29.90	0.001**
	Group II	2.900	1.422		
	Group III	6.533	2.112		

Table - 2 shows that, the mean score of pre-test level of pain among patients with musculoskeletal disorders in the group I was 6.100 ± 1.953 , the mean score in the group II was 6.400 ± 2.443 and the mean score in the c group III was 6.433 ± 1.851 respectively. The calculated one way ANOVA test value of $z = 0.230$ shows statistically not significant between Comparison of the level of pain (numeric pain intensity scale) among patients with musculoskeletal disorders in pretest.

The mean score of posttest level of pain among patients with musculoskeletal disorders in the group I was 4.733 ± 1.855 , the mean score in the group II was 2.900 ± 1.422 and the mean score in the group III was 6.533 ± 2.112 respectively. The calculated one way ANOVA test value of $z = 29.90$ shows statistically highly significant between Comparison of the level of pain (numeric pain intensity scale) among patients with musculoskeletal disorders in posttest.

Table 3: Shows that by using chi-square it was evidenced that the demographic variables any other pain relieving measures and frequency of follow up is statistically significant and other variables had not shown statistically significant association with the Post-test of the level of pain (visual analogue pain scale) among patients with musculoskeletal disorders with their selected demographic

variables in oxygen compressed cold application group respectively.

Demographic Variables					df	p-Value	
Age in years							
18-30	2	66.7	1	33.3	8.82	3	0.032*
31-40	9	90	1	10			
41-50	4	44.4	5	55.6			
Above 51	8	100	0	0			
Frequency of follow up							
Weekly once	0	0	0	0	3.758	1	0.053*
Monthly once	7	58.3	5	41.7			
Twice a year	16	88.9	2	11.1			
Any other pain relieving measures							
Alternative therapies	4	57.1	3	42.9	4.5	1	0.034*
Use of splints	0	0	0	0			
Use of traction	0	0	0	0			
Others	21	91.3	2	8.7			
None	0	0	0	0			
Frequency of follow up							
Weekly once	0	0	0	0	4	1	0.046*
Monthly once	12	100	0	0			
Twice a year	13	72.2	5	27.8			

Table 3: Shows that by using chi-square it was evidenced that the demographic variables age and frequency of follow up is statistically significant and other variables had not shown statistically significant association with the Post-test of the level of pain (numeric pain intensity scale) among patients with musculoskeletal disorders with their selected demographic variables in oxygen compressed cold application group respectively.

4. Discussion

In the study in which musculoskeletal disorders patients were treated with conventional cold application and oxygen compressed cold application, it was identified that difference between the experimental group I, group II and control group III pre test was done by visual analogue scale and numerical rating scale according pain score level patient are categorized by mild, moderate, and severe. Intervention given to both experimental group I, group II and intervention given to control group III pain level was reduced to severe to moderate to mild both group I, group II.

Like similar study which emphasized that Melzack's ice massage treatment was effective in line with the study of Clarke et al. which pointed out that ice treatment could result in an improvement in pain parameters in three weeks. In a study done by Melzack, ice massage and TENS treatment were compared among patients with back pain and it was reported that ice massage applied to trigger points of muscle pain, skeleton pain, soft tissue pain and joint pain provided a relief and relaxation and it was concluded that ice massage was an effective therapeutic method alternative to as stated by TENS.¹⁰

The pain intensity of patients with musculoskeletal disorders differs before and after administration of conventional cold application and oxygen compressed cold

application in all three groups. Hence the stated Hypothesis (H₁) and (H₂) were accepted.

Compare the effectiveness reveals pretest mean level of pain on musculoskeletal disorders in group I, II, III was 6.833, 7.000, 6.900 respectively. The post test mean 5.433, 2.333 and 7.267 Value was <0.05, in post test which is significant at p<0.001, which implies that oxygen compressed cold application was effective than conventional cold application group I and group III control group. Undertaken to assess cold compression among musculoskeletal disorders cases concurred with the current study in terms of improvement in pain score level.

Similar study, patients continued pharmacological treatment. Physiological effects of cold are vasoconstriction, slowing down in cell metabolism, local anesthesia, reduce in blood flow, oxygen, metabolite flux to the site and waste products. Therefore, local cold compression exerts such effects as reducing/terminating pain, preventing edema and slowing down inflammation process by providing local anesthesia therapeutically. Therefore, importance of cold compression among arthritis patients has been emphasized.^{11,12}

There is also significant between the any other pain relieving measures and Frequency of follow up is statistically significant and other variables had not shown statistically significant association with the Post-test of the level of pain (visual analogue pain scale) among patients with musculoskeletal disorders with their selected demographic variables in oxygen compressed cold application group respectively.

By using chi-square it was evidenced that the demographic variables age and frequency of follow up is statistically significant and other variables had not shown statistically significant association with the Post-test of the level of pain (numeric pain intensity scale) among patients with musculoskeletal disorders with their selected demographic variables in oxygen compressed cold application group respectively. There is an association between demographic variables.

The current impetus and likely future direction of oxygen compressed cold application is in the use of stand alone, dedicated devices that provide both modalities in a controlled, regulated and quantifiable manner. Devices that incorporate cold and compression in a controlled fashion will likely be the best option. providing the patient with the maximum degree of comfort and the shortest time to functional recovery of musculoskeletal pain.

This study has several limitations, Until there is a definitive trial of the clinical effects of a defined cold application method and a defined compression modality, the real benefit and therefore the clinical application of generic cold compression therapy will remain unclear and evidence-based decisions about its use poorly guided. Dedicated devices that provide both modalities in a controlled, regulated and quantifiable manner. This mitigates the possibility of excessive cooling causing tissue damage that can occur with direct ice application.

5. Recommendation

- The study can be replicated with a large sample for better generalization
- More studies can be conducted on measures to reduce the level of pain among patients with musculoskeletal disorders by using oxygen compressed cold application.

6. Conclusion

Conclusion and implications for nursing In the current study done to assess effect of conventional cold application vs oxygen compressed cold application level of pain among patients with musculoskeletal disorders in the experimental group I (conventional cold application) group II (oxygen compressed cold application) and the control group III were compared and it was found that the difference was statistically significant in the experimental group II p-value is **(0.001)** are statistically highly significant respectively) assessed by scales visual analogue scale and numerical rating scale. Group I (conventional cold application) oxygen compressed cold application was very effective than group I and group III. group I (conventional cold application). Thus, it was concluded oxygen compressed cold application effective on pain among patients with musculoskeletal disorders.

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