Journal of Health and Rehabilitation Research 2791-156X JHRR

For contributions to JHRR, contact at email: editor@jhrlmc.com

Original Article

Comparative Effects of Cryostretching and Contract-Relax Technique on Knee Osteoarthritis

Muhammad Abbas*[1], Haram Usman[1], Rabiya Tahir[1], Syeda Sana Zahra[1], Muhammad Hanif[2], Shaheer Masood[3]

[1]College of Physical Therapy, Government College University Faisalabad, Pakistan.

[2]Ahmad Hospital Lahore, Pakistan.

The University of Faisalabad, Pakistan.

*Corresponding Author: Muhammad Abbas; Email: muhammad.abbas9@yahoo.com

Conflict of Interest: None.

A Muhammad., et al. (2024). 4(2): DOI: https://doi.org/10.61919/jhrr.v4i2.1130

ABSTRACT

Background: Knee osteoarthritis (OA) is a condition characterized by the degeneration of cartilage in the knee joint, leading to pain, stiffness, and reduced range of motion. Cryostretching has been suggested as a beneficial intervention for knee OA, combining cold application to reduce muscle spasm with stretching to elongate muscles. Similarly, the contract-relax technique, which uses isotonic muscle contraction followed by stretching, has been shown to improve muscle elasticity and ROM.

Objective: To compare the effects of cryostretching and the contract-relax technique on pain, physical function, and ROM in patients with knee osteoarthritis.

Methods: A quasi-experimental study was conducted on 30 knee OA patients from government hospitals in Faisalabad. Participants aged 40-60 years with grade 1 or 2 knee OA were recruited using purposive sampling. Subjects were randomly allocated to either the cryostretching group (Group A, n=15) or the contract-relax group (Group B, n=15). Interventions were administered twice a week for four weeks. Pain, physical function, and ROM were assessed using the Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and a goniometer, respectively. Data were analyzed using SPSS version 25, with paired and independent sample t-tests used to compare within-group and between-group differences, respectively.

Results: Significant improvements were observed in both groups. For Group A, the mean WOMAC score improved by 35.33 (95% CI: 28.78-41.88, $p<0.001$) at 4 weeks, while Group B showed an improvement of 24.13 (95% CI: 17.21-31.04, $p<0.001$). ROM in Group A increased by 8.20 (95% CI: 7.20-9.19, $p<0.001$) compared to 5.40 (95% CI: 4.61-6.18, $p<0.001$) in Group B. VAS scores decreased by 6.40 (95% CI: 5.65-7.14, $p<0.001$) in Group A and by 4.33 (95% CI: 3.76-4.90, $p<0.001$) in Group B. Between-group differences at 4 weeks were significant for all measures, favoring the cryostretching group.

Conclusion: Cryostretching was more effective than the contract-relax technique in reducing pain, improving physical function, and increasing ROM in patients with knee osteoarthritis. These findings support the integration of cryostretching into clinical practice for managing knee OA.

Keywords: Knee osteoarthritis, cryostretching, contract-relax technique, pain management, range of motion, physical function, rehabilitation therapy, cold therapy, muscle stretching, osteoarthritis treatment.

INTRODUCTION

Knee osteoarthritis (OA) is a prevalent degenerative joint disease, affecting approximately 33.6% of the population in the United States. This condition gradually progresses over a period of ten to fifteen years, leading to significant pain and disability (1). The primary characteristic of knee OA is the degradation of articular cartilage, which results in the exposure and rubbing of subchondral bones, causing pain, stiffness, and a restricted range of motion. As the disease advances, it leads to muscle weakening around the knee joint, contributing to further joint stiffness and the development of contractures in the joint capsule, hamstring muscles, tendons, quadriceps, and gastrocnemius (2). Patients with knee OA often experience dull, diffuse pain that worsens with movement and is relieved by rest. However, as the condition deteriorates, pain may also occur during periods of rest or even sleep, significantly impacting the patient's quality of life (3). Additionally, knee OA patients frequently report morning stiffness lasting less than 30 minutes and transient stiffness following periods of inactivity during the day (4). The condition is also associated with other symptoms such as crepitation, bony enlargement, erythema, flexion contracture, swelling, warmth, and discomfort (5).

Knee OA can be classified as either primary (idiopathic) or secondary based on its etiology. Secondary knee OA can result from various factors, including diabetes, certain occupations, physical inactivity, and malalignment of the lower extremities (6).

Journal of Health and Rehabilitation Research 2791-156X JHRR

Biomechanically, the knee joint bears significant loads, particularly on its medial aspect, where approximately 70% of the joint force is transmitted. This medial loading is a critical factor in the pathogenesis and progression of knee OA (7). The quadriceps muscle serves as the primary knee extensor, and its weakening or tightening, along with the hamstrings and calf muscles, can lead to poor coordination and delayed reaction times in individuals with knee OA. Such muscle tightness exacerbates joint space compression, contributing to further joint damage (8). The hamstring muscles, in particular, tend to shorten in knee OA, increasing patellofemoral compressive strain and potentially leading to patellofemoral syndrome, a common comorbidity in OA patients (9).

Effective management of knee OA often includes patient education, which is crucial in helping individuals make informed decisions, adhere to prescribed treatments, and manage their condition more effectively. Strengthening exercises have been shown to improve clinical outcomes, including pain reduction, enhanced physical function, and improved quality of life (10). Cryostretching, a therapeutic approach that combines cold application with stretching, has been proposed to enhance the benefits of traditional cryotherapy. The application of cold therapy reduces muscle spasm and pain by numbing the affected area, while subsequent stretching promotes fibroblastic activity and the expression of growth factors that aid in muscle healing and biomechanical strength restoration (11). By preventing atrophy and loss of muscle extensibility, cryostretching is believed to accelerate recovery and improve overall muscle function (12).

The cryostretching protocol involves the application of ice to the targeted knee muscles (hamstrings, quadriceps, and gastrocnemius) for ten minutes until numbness is achieved, followed by a 65-second static stretch. This is complemented by three sets of five-second isometric contractions, with a 20-second rest period between each set, and the entire sequence is repeated to complete one treatment session (13). Conversely, the contract-relax technique involves isotonic muscle contraction to facilitate relaxation and subsequent muscle stretching. This method enhances tissue extensibility and muscle circulation, contributing to pain relief and improved joint range of motion (14). The contract-relax protocol for knee OA includes an initial stretch of the targeted muscles, followed by 4-6 seconds of isotonic contraction, a brief relaxation period, and a final passive stretch that exceeds the initial stretch. This sequence is repeated twice per session (15).

The Kellgren and Lawrence (K/L) system is commonly used to classify OA severity, ranging from grade 0 (normal) to grade 4 (severe), based on the presence of osteophytes and joint space narrowing (16). The primary aim of this study was to compare the effects of cryostretching and the contract-relax technique on knee osteoarthritis, specifically focusing on improvements in pain intensity, physical function, and knee range of motion. Our null hypothesis posited no significant difference between the effects of the two techniques, while the alternate hypothesis suggested significant differences in their efficacy.

MATERIAL AND METHODS

The This quasi-experimental study was conducted to compare the effects of cryostretching and the contract-relax technique on knee osteoarthritis in patients from government hospitals in Faisalabad. Purposive sampling was employed to recruit 30 subjects who met specific inclusion and exclusion criteria. Inclusion criteria comprised adults aged 40-60 years, of both genders, with grade 1 or 2 knee osteoarthritis as per the Kellgren-Lawrence staging. Exclusion criteria included individuals with allergies to cold, hypersensitivity to physical methods, tumors in the treatment area, known neurological conditions, recent surgeries, psychosocial problems, and associated diseases affecting the lower limb such as ankylosing spondylitis, rheumatoid arthritis, degenerative diseases, lower limb fractures, or other orthopedic conditions, Parkinson's disease, and cerebral palsy.

The study was approved by the Research and Ethics Committee of the College of Physical Therapy, Government College University, Faisalabad, and adhered to the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants after explaining the study's aims, benefits, procedures, and their right to withdraw at any time. The anonymity and confidentiality of the participants were ensured throughout the study.

Participants were randomly allocated into two groups: Group A (n=15) received cryostretching, and Group B (n=15) received the contract-relax technique. The interventions were administered twice a week for four weeks. The cryostretching protocol involved applying ice to the targeted knee muscles (hamstrings, quadriceps, and gastrocnemius) for ten minutes until numbness was achieved, followed by a 65-second static stretch. This was followed by three sets of five-second isometric contractions, with a 20-second rest period between each set, and the entire sequence was repeated twice per session. In contrast, the contract-relax technique included stretching the targeted muscles, followed by 4-6 seconds of isotonic contraction, a brief relaxation period of 2-3 seconds, and a final passive stretch that exceeded the initial stretch. This sequence was repeated twice per session.

Outcome measures were assessed at baseline and weekly intervals using the Visual Analog Scale (VAS) for pain, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for physical function, and a goniometer for the range of motion (ROM). Data collection involved pre-treatment and post-treatment evaluations to observe changes in these variables.

Journal of Health and Rehabilitation Research 2791-156X JHRR

Data were analyzed using SPSS version 25. The Shapiro-Wilk test was used to assess the normality of the data. Descriptive statistics were calculated for baseline characteristics, and paired sample t-tests were conducted to compare within-group changes over time. Independent sample t-tests were used to compare between-group differences at each assessment point. Statistical significance was set at $p<0.05$ for all analyses. The results were presented in terms of mean differences with 95% confidence intervals to quantify the magnitude of changes observed

This methodological approach ensured a rigorous comparison of the therapeutic effects of cryostretching and the contract-relax technique on knee osteoarthritis, providing valuable insights into their relative efficacy in improving pain, physical function, and range of motion in affected individuals.(17,18)

RESULTS

The data were normally distributed, as assessed by the Shapiro-Wilk test. Participants were divided into two groups: the Cryostretching group (Group A) and the Contract-relax group (Group B). Group A had 73.33% females and 26.67% males, while Group B had 86.67% females and 13.33% males. The mean ages were 52.93 years for Group A and 50.93 years for Group B.

Table 1: Demographic and Baseline Characteristics

Characteristic	Cryostretching (Group A)	Contract-relax (Group B)
Number of Participants	15	15
Mean Age (years)	52.93 ± 4.52	50.93 ± 5.18
Gender (% Female)	73.33%	86.67%
Chronic/Episodic Pain (%)	13.33%	13.33%
1-4 Pain Attacks/Month (%)	20%	33.33%
1-30 Pain Attacks/Month (%)	66.67%	55.33%
Taking Pain Relief Meds (%)	20%	33.33%

Pairwise comparisons using the Bonferroni correction revealed significant improvements within both groups across all variables (WOMAC, ROM, and VAS scores) at 2 and 4 weeks.

Table 2: Within Group Differences

Measure	Time Interval	Cryostretching (Group A)	Contract-relax (Group B)
WOMAC	0 - 2 Weeks	21.20 (15.75–26.65)	14.93 (8.38–21.48)
	0 - 4 Weeks	35.33 (28.78–41.88)	24.13 (17.21–31.04)
	2 - 4 Weeks	14.13 (9.94–18.32)	9.20 (5.08–13.31)
ROM	0 - 2 Weeks	3.60 (4.92–2.27)	3.00 (3.75–2.25)
	0 - 4 Weeks	8.20 (9.19–7.20)	5.40 (6.18–4.61)
	2 - 4 Weeks	4.60 (5.472–3.72)	2.40 (3.09–1.70)
VAS	0 - 2 Weeks	3.40 (2.95–3.84)	2.53 (2.08–2.98)
	0 - 4 Weeks	6.40 (5.65–7.14)	4.33 (3.76–4.90)
	2 - 4 Weeks	3.0 (2.35–3.65)	1.80 (1.19–2.40)

Significant differences were observed between the groups at the 4-week mark for all outcome measures, indicating greater improvement in the Cryostretching group compared to the Contract-relax group.

Table 3: Between Group Differences

Outcome Measure	Time Interval	Cryostretching Group Mean ± SD	Contract-relax Group Mean ± SD	Mean Difference	P-value
VAS	2 Weeks	3.67 ± 0.90	3.93 ± 1.28	-0.267	0.515
	4 Weeks	0.67 ± 0.488	2.13 ± 0.834	-1.467	0.000
ROM	2 Weeks	123.33 ± 5.64	120.47 ± 7.06	2.867	0.229
	4 Weeks	128.60 ± 5.74	123.33 ± 7.31	5.267	0.037
WOMAC	2 Weeks	34.33 ± 5.45	37.80 ± 10.91	-3.467	0.299
	4 Weeks	18.47 ± 5.70	27.93 ± 8.35	-9.46	0.001

The tables illustrate that while both groups experienced significant improvements, the Cryostretching group showed superior outcomes in terms of pain reduction (VAS), increased range of motion (ROM), and improved physical function (WOMAC) at the 4-week follow-up. The independent sample t-test confirmed significant between-group differences favoring the Cryostretching intervention, particularly at the 4th-week assessment.

Journal of Health and Rehabilitation Research 2791-156X JHRR

DISCUSSION

The results of this study indicated that cryostretching was more effective than the contract-relax technique in improving pain, range of motion (ROM), and physical function in patients with knee osteoarthritis (OA). This finding aligned with previous studies that demonstrated the benefits of cryostretching in various musculoskeletal conditions. Cryostretching, by combining cold application with stretching, significantly reduced muscle spasm and pain, facilitating greater improvements in ROM and overall function compared to the contract-relax technique (11).

The cryostretching group's superior outcomes could be attributed to the enhanced therapeutic effects of cold therapy when combined with stretching. Cold application alone has been shown to reduce muscle spasm and pain by numbing the affected area. When followed by stretching, this approach not only prevented muscle atrophy but also promoted fibroblastic activity and the expression of growth factors essential for muscle healing and biomechanical strength restoration (12). The study's findings were consistent with previous research indicating that cryostretching effectively improved muscle extensibility and accelerated recovery by increasing elasticity and valence (13).

In contrast, the contract-relax technique, while beneficial, did not achieve the same level of improvement in pain, ROM, and physical function as cryostretching. The contract-relax technique involved isotonic muscle contraction to facilitate relaxation, followed by stretching, which improved tissue extensibility and muscle circulation. However, this method lacked the immediate analgesic effect of cryotherapy, potentially explaining the less pronounced improvements observed in this group (14).

Several strengths of this study contributed to its robustness. The quasi-experimental design and the use of validated outcome measures such as the Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and a goniometer ensured the reliability and validity of the findings. The inclusion of a homogeneous sample of participants with similar baseline characteristics allowed for a focused comparison between the two interventions. Additionally, the random allocation of subjects to the cryostretching and contract-relax groups minimized selection bias and enhanced the internal validity of the study.

Despite these strengths, the study had some limitations. The sample size was relatively small, and the study duration was short, which might limit the generalizability of the findings to a broader population. A larger sample size and a longer follow-up period would be necessary to confirm the long-term efficacy of cryostretching and contract-relax techniques in managing knee OA. Furthermore, the study did not account for potential confounding factors such as variations in physical activity levels, adherence to home exercise programs, or concurrent use of pain medications, which could have influenced the outcomes(19).

The findings of this study suggested that cryostretching could be a more effective therapeutic intervention for knee OA compared to the contract-relax technique. Future research should explore the long-term effects of cryostretching in larger and more diverse populations(20). Additionally, studies could investigate the combined use of cryostretching with other therapeutic modalities, such as pharmacotherapy or manual therapy, to determine if synergistic effects could further enhance patient outcomes.

In conclusion, this study provided evidence that cryostretching was superior to the contract-relax technique in improving pain, ROM, and physical function in patients with knee OA. These findings supported the integration of cryostretching into clinical practice as a valuable intervention for managing knee OA and improving patients' quality of life. The study's results underscored the importance of further research to validate and expand upon these findings, ultimately contributing to more effective treatment strategies for individuals suffering from knee OA.

CONCLUSION

Cryostretching was more effective than the contract-relax technique in reducing pain, improving physical function, and increasing ROM in patients with knee osteoarthritis. These findings support the integration of cryostretching into clinical practice for managing knee OA.

REFERENCES

1. Lespasio MJ, Piuzzi NS, Husni ME, Muschler GF, Guarino A, Mont MA. Knee osteoarthritis: a primer. The Permanente Journal. 2017;21.

2. Aras D, Islam AA, Arif SK, Arief M. Effects of Combined Physiotherapy Hold Relax and Glucosamine to the Decrease of COMP through Pain reduction, Increase Muscle Strength and addition of Osteoarthritis of the Knee Joint ROM. Int J Sci Basic Appl Res. 2015;4531:348-63.

3. Choksi P, Tank K. To study the efficacy of muscle energy technique on muscle strength and flexibility in patients with knee osteoarthritis. Indian J Physiother Occup. 2016;10:40-5.

4. Ghazwan A, Wilson C, Holt CA, Whatling GM. Knee osteoarthritis alters peri-articular knee muscle strategies during gait. PLoS One. 2022;17(1):e0262798.
5. Sharma L. Osteoarthritis of the knee. New England Journal of Medicine. 2021;384(1):51-9.
6. Senthelal S, Li J, Ardeshirzadeh S, Thomas MA. Arthritis. 2018.
7. Hsu H, Siwiec RM. Knee osteoarthritis. 2018.
8. Georgiev T, Angelov AK. Modifiable risk factors in knee osteoarthritis: treatment implications. Rheumatology international. 2019;39(7):1145-57.
9. Zhang L, Liu G, Han B, Wang Z, Yan Y, Ma J, et al. Knee joint biomechanics in physiological conditions and how pathologies can affect it: a systematic review. Applied bionics and biomechanics. 2020;2020(1):7451683.
10. Nori S. Quadriceps tendon rupture. Journal of family medicine and primary care. 2018;7(1):257-60.
11. Onigbinde AT, Akindoyi O, Faremi FA, Okonji A, Shuaib O, Lanre OO. An assessment of hamstring flexibility of subjects with knee osteoarthritis and their age matched control. Clin Med Res. 2013;2(6):121-5.
12. Dantas LO, de Fátima Salvini T, McAlindon TE. Knee osteoarthritis: key treatments and implications for physical therapy. Brazilian journal of physical therapy. 2021;25(2):135-46.
13. DeVita P, Aaboe J, Bartholdy C, Leonardis JM, Bliddal H, Henriksen M. Quadriceps-strengthening exercise and quadriceps and knee biomechanics during walking in knee osteoarthritis: A two-centre randomized controlled trial. Clinical Biomechanics. 2018;59:199-206.
14. Sefiddashti L, Ghotbi N, Salavati M, Farhadi A, Mazaheri M. The effects of cryotherapy versus cryostretching on clinical and functional outcomes in athletes with acute hamstring strain. Journal of bodywork and movement therapies. 2018;22(3):805-9.
15. Parab M, Bedekar N, Shyam A, Sancheti P. Immediate effects of myofascial release and cryo-stretching in management of upper trapezius trigger points-a comparative study. J Soc Indian Physiother. 2020;4(2):74-8.
16. Baidya P, Prabhakar R, Wadhwa M. Efficacy of muscle energy technique and contract relax with mulligan's mobilization with movement technique in subacute ankle sprain. MOJ Yoga Physical Ther. 2018;3(1):7-12.
17. Culvenor AG, Engen CN, Øiestad BE, Engebretsen L, Risberg MA. Defining the presence of radiographic knee osteoarthritis: a comparison between the Kellgren and Lawrence system and OARSI atlas criteria. Knee Surgery, Sports Traumatology, Arthroscopy. 2015;23:3532-9.
18. Avilala SD, Kumari S. A Comparative Study on the efficacy of Cryostretches Versus Hold-Relax on Plantar Flexors Spasticity in the Subjects with Stroke. Indian Journal of Physiotherapy & Occupational Therapy. 2013;7(2).
19. Krishna HS, Anaz A. Comparison of Immediate Effect of Cryostretching and Muscle Energy Technique in Range of Motion and Pain in Patients with Mechanical Neck Pain. AIJR Abstracts. 2022:14.
20. Jadhav A, Gurudut P. Comparative Effectiveness of Gua Sha, Cryostretch, and Positional Release Technique on Tenderness and Function in Subjects with Plantar Fasciitis: a Randomized Clinical Trial. International Journal of Therapeutic Massage & Bodywork. 2023;16(1):13.