

Cryotherapy and Ultrasoundtherapy on Pain Relief in Osteoarthritis of Knee Patients with Different Pain Intensities

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Abstract: Millions of people worldwide suffer from the common ailment known as osteoarthritis of the knee. Physiotherapy is a non-invasive treatment that effectively manages the symptoms of osteoarthritis in the knee by reducing pain, enhancing function, and improving quality of life. Cryotherapy, ultrasound therapy, stretching and strengthening exercises, and patient education regarding self-management techniques including weight loss and activity adjustment are the primary interventions. For the best results in treating knee osteoarthritis, a combination of cryotherapy and ultrasound therapy—two distinct interventions—is advised, depending on the preferences of the patient. **Background:** As one of the main causes of musculoskeletal impairment, knee osteoarthritis is best managed without the use of pharmaceuticals or surgery. Evidence has been shown, nevertheless, that a physiotherapy routine can effectively address the multi-structural physical, physiological, and functional deficits linked to knee osteoarthritis. **Objectives:** This study's primary goal is to assess how well patients with osteoarthritis respond to planned, therapist-supervised patient education combined with modalities like cryotherapy and ultrasound therapy on their level of pain and knee function. **Method:** It is an experimental study. There were eighteen convenient samples used in the investigation. The treatment takes four weeks to complete, with four sessions per week lasting between thirty and forty minutes each. Two categories—mild to moderate and moderate to severe—are used to group the patients. The Numerical Pain Rating Scale was the outcome variable under investigation. **Results:** The study's findings showed that among the most examined outcome indicators in the intervention group, physiotherapy protocol modalities like cryotherapy and ultrasound therapy significantly improved the condition. **Conclusion:** It was discovered that the supervised physical therapy regimen was more successful in reducing knee joint pain and functional deficits as well as the many physiological problems related to the overall joint condition.

Keywords: knee osteoarthritis, physiotherapy, cryotherapy, ultrasound therapy, pain management

1. Introduction

Osteoarthritis is a non-inflammatory degenerative disease of the joints that is typified by the production of new bone called osteophytes and the deterioration of articular cartilage [1]. Osteoarthritis (OA) is a possibility if your knee hurts when you move it and feels stiff for some time after resting. The cartilage that covers the joint surfaces thins and becomes less protective in knee OA. The most prevalent joint disease and one of the main causes of disability, osteoarthritis (OA) primarily affects adults 40 years of age and older [2]. More often than not, women are impacted than men. The frequency increases up to 40% in people over the age of 70. Age, weight, and repetitive motion injuries to the knee, especially from squatting and kneeling, are important risk factors for osteoarthritis (OA) knee [3]. Both physical and psychological aspects of quality of life may be significantly impacted by OA. Osteoarthritis (OA) of the knee is a chronic illness affecting the entire joint, including the articular cartilage, meniscus, ligaments, and peri-articular muscle, caused by several pathophysiological pathways. It is not a localized disease of the cartilage alone [4].

The development of OA knee is largely influenced by factors such as weight and obesity, joint laxity, and knee surrounding muscle weakening [4]. Prolonged knee discomfort, stiffness in the morning, decreased function, crepitus, limitation of joint movement, expansion of the bone, and loss of joint range of motion are all indicative of osteoarthritis (OA) [5]. Advanced cases may manifest as synovitis, which causes pain when at rest. Advanced cases may manifest as synovitis, which causes pain when at rest. Patients with OA knees may have brief episodes of knee

stiffness lasting less than 30 minutes in the morning or after periods of inactivity. During a physical examination, tenderness to palpation of the affected joints may be noticeable [1]. There may be joint effusions, which usually show increased protein, normal viscosity, and mild pleocytosis. Walking or joint motion is more likely to cause crepitus [4].

2. Objective

To treat patients with knee osteoarthritis by using cryotherapy and ultrasound therapy to reduce pain.

An experimental study

Methods

18 participants were added to the study after the participants provided information. In the current study, eighteen subjects—six women and twelve men—with acute, moderate, and severe OA knee sufferers took part.

They were classified into 2 groups:

- 1) Acute Moderate Group (A)
- 2) Moderate - Severe Group (B)

These groups were categorized by NPRS score (intensity of pain):

- 1 - 5 (mild to moderate pain group).
- 6 - 10 (moderate to severe pain group).

These groups are divided in regarding pain.

These two groups had cryotherapy sessions, which involved stretching the knee-supporting muscles and subsequently strengthening them. The pain rating scale is a numerical tool used to assess the intensity of pain. Both before and after a four-week rehabilitation program, this was done. Every week, there were four sessions for the treatment, lasting forty minutes each. As a result, the study now has 18 participants.

Participants:

Patients with osteoarthritis of the knee who were sent to SIDDHA hospital and BIRRD trust hospital in Tirupati made up the patient sample pool. The age range that was covered was 45 to 60. clinical diagnosis confirming osteoarthritis in the knee.

The following groups include:

Mild - Moderate pain group (A):

Table 1

Sl.no	Name	Age	Gender
1	V. Kamakshamma	56	F
2	M. Ramachandra	54	M
3	V. Venkateshulu	58	M
4	P. Shahid pasha	48	M
5	S. Susheelamma	55	F
6	A. Arunamma	52	F
7	D. Ramana	60	M
8	M. Sukanya	58	F
9	T. Ademma	55	F

Moderate - Severe pain group (B):

Table 2

S. No	Name	Age	Gender
1	N. Ramesh babu	59	M
2	K. Sridhar reddy	63	M
3	L. Chinna yadhavulu	66	M
4	D. Srinivasulu	67	M
5	L. Anjaneyulu	53	M
6	S. Afroz pasha	58	M
7	P. Rajesh	55	M
8	A. Udaykumar	49	M
9	K. Lakshamma	55	F

Outcome Measure:

The Numerical Pain Rating Scale (NPRS), a visual analogue scale that depicts a straight line indicating the boundaries of pain with no pain at all and the severe pain at either end, was used to assess the primary outcome measure of pain intensity. During the pre- and post-test assessment, the patient was asked to indicate on the scale how much pain they felt, taking into account the subjective character of the suffering. The genuine variation in pain magnitude was reflected in the difference between the two variously reported places on the scale by a participant at separate times [6].

THE CRITERIA FOR CATEGORIZING KNEE OA are:

After patients had been bearing weight for five minutes (walking or standing), the severity of their knee pain was assessed using the Numerical Pain Rating Scale (NPRS). Each patient was asked to rate their level of discomfort on a

scale of 0 to 10, with 0 denoting no pain and 10 representing excruciating pain.

The participants were classified based on criteria (NPRS) :

0- no pain

1-4 mild pain

5-7 moderate pain

7-10 severe pain

Numerical Pain Rating Scale:

The Numeric Pain Rating Scale Instructions General Information:

Three ratings of pain are requested from the patient: current, best, and worst pain during the last 24 hours. The patient's pain level for the preceding 24 hours was represented by the mean of the three assessments. Instructions for Patients To help us better understand your needs, please rate your discomfort on a scale from 0 (no pain) to 10 (worst agony imaginable) during the last 24 hours.

Treatment Programme

Cryotherapy:

Another name for cryotherapy is ice application.

It is also the most traditional method of treating wounds. It is thought to reduce pain by causing local anesthetic.

Additionally, it reduces local blood flow, cellular metabolism, oedema, and nerve conduction velocities [7].

The patient should lie in a comfortable position and apply ice pack for eight to ten minutes, two to three times a day. Extended cryotherapy may result in damage to peripheral nerves, particularly in athletes with limited subcutaneous fat tissue [7].

Mechanism:

There are several ways that cryotherapy, which includes subjecting the body to extremely low temperatures, might reduce pain, inflammation, and soreness in the muscles:

Heat exchange

Vasoconstriction, or the narrowing of blood vessels in response to cold, lowers blood flow to the affected area. This may aid in lowering inflammation and edema [7].

Nerve endings

Additionally, the freezing temperature has the ability to numb nerve endings, which can relieve pain. Cryotherapy may help relieve pain by slowing down the speed at which pain fibers transmit pain signals, according to some research [7].

Circulatory system

Injuries can benefit from reduced blood flow because it stimulates the circulatory system, which promotes healing and muscle fiber regeneration [7].

Ultrasound Therapy:

The patient might be in a calm sitting or lying position, depending on how comfortable they are.

Gel using ultrasound technology is applied to the painful area.

Because it is safe, ultrasound therapy is frequently used to treat a variety of illnesses, including joint inflammation, osteoarthritis, and sprains and other sports injuries. In general, functional limitations, discomfort of all sorts, and movement restrictions are improved by ultrasound therapy. This approach to physical therapy is both effective and safe [8].

Mechanism:

Deep heating of the body's soft tissue structures is possible with ultrasound. Metallic probes are used in ultrasound therapy. Applying gel to the skin or directly onto the probe head is the first step in the process. In essence, this gel facilitates uniform sound wave penetration into the skin. This probe is then dragged over the chosen area continuously for more than five to ten minutes after the gel has been administered. The intended outcome determines how strong or weak the ultrasonic wave is. During this therapy, some patients may experience a faint pulse, while others may notice a tiny warming in the targeted location. Benefits of deep heating tendons, muscles, or ligaments include improved tissue circulation, accelerated wound healing, reduced discomfort, and enhanced flexibility [9].

Exercise therapy programme

Hamstring Stretch

Your range of motion, or how far your joints can move in different directions, is improved and your flexibility is maintained by stretching. It also lessens the likelihood of discomfort and harm. Always start your workout with a five-minute stroll. When you're ready to release your hamstrings, lie down. Around your right foot, loop a bed sheet. To assist with raising the straight leg, use the sheet. After 20 seconds of holding, lower the leg. Do this twice. Next, change your legs [10].

Calf Stretch

Use a chair as a balance aid. Bend your leg to the right. With your left leg, take a step back and slowly extend it behind you. Step your left heel down toward the ground. Your posterior leg's calf should feel stretched. Hold on for a full minute. After two repetitions, switch legs. Lean forward and bend your right knee more for a more intense stretch, but make sure it stays between your toes [10].

Straight Leg Raise

Boost your muscular mass to support your ailing joints. With your elbows supporting your upper body, lie on the floor.

Left knee bent, foot flat on the ground. Maintain a straight right leg with your toes pointed up. Raise your right leg and contract your thigh muscles. As indicated, pause for three seconds. As you gradually lower your leg to the floor, maintain your thigh muscles taut. Caress and lift once again. Perform two sets of ten reps. After every set, switch legs [10].

Quad Set

Is raising your legs straight too difficult? Instead, perform quad sets. You don't lift your leg while using these. Just squeeze the quadriceps, or thigh muscles, of one leg at a time. Lie down on the floor to begin. Keep both legs relaxed and on the ground. For five seconds, flex and maintain a tight left leg. Unwind. Perform two sets of ten reps. After every set, switch legs [11].

Pillow Squeeze

By strengthening the inner of your legs, this exercise helps stabilize your knees. With both knees bent, lie on your back. Put a cushion in between your knees. Squeeze the cushion between your knees as you squeeze them together. Hold on for five seconds. Unwind. Perform two sets of ten reps. After every set, switch legs. Too rigid? This exercise can also be done in a seated position [10].

Heel Raise

Hold the back of a chair for support as you stand tall. Raising yourself up on both feet's toes, lift your heels off the floor. For three seconds, hold. Bring both heels down to the floor slowly. Perform two sets of ten reps. Too complex? Perform the identical exercise while seated [10].

Low-Impact Activities

Water aerobics, swimming, and cycling are other low-impact exercises that are easy on the knees. Exercise in the water releases pressure from sore joints. Classes for those with arthritis are available in a lot of community and hospital wellness facilities, gyms, and swimming pools. Engaging in physical activity can also aid in weight loss, relieving stress on your joints. Ask your doctor or physical therapist how to safely reduce the pain in your favorite hobbies, such as golf [11].

Treatment Time:

Depending on the patient's state, no more than 8 to 12 minutes.

Data Analysis

Mild - Moderate pain group (A)

Table 3

SL.NO	Name	Age	Gender	NPRS score Pre Rx	NPRS score Post Rx	Change in NPRS score
1	V. Kamakshamma	56	F	3	1	2
2	M. Ramachandra	54	M	2	0	2
3	V. Venkateshulu	58	M	3	1	2
4	P. Shahid pasha	48	M	3	1	2
5	S. Susheelamma	55	F	2	2	0
6	A. Arunamma	52	F	2	1	1
7	D. Ramana	60	M	6	3	3
8	M. Sukanya	58	F	5	2	3
9	T. Ademma	55	F	5	2	3

Paired t test results:

P value and statistical significance:

The two - tailed P value equals **0.0003**

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pre Rx minus Post Rx of NPRS score equals to **2.0** 95% confidence interval of this difference: From **1.23** to **2.77**.

N- (Sample size)

Intermediate values used in calculations:

t = 6.0000 df = 8 standard error of difference = 0.333 df (degrees of freedom)

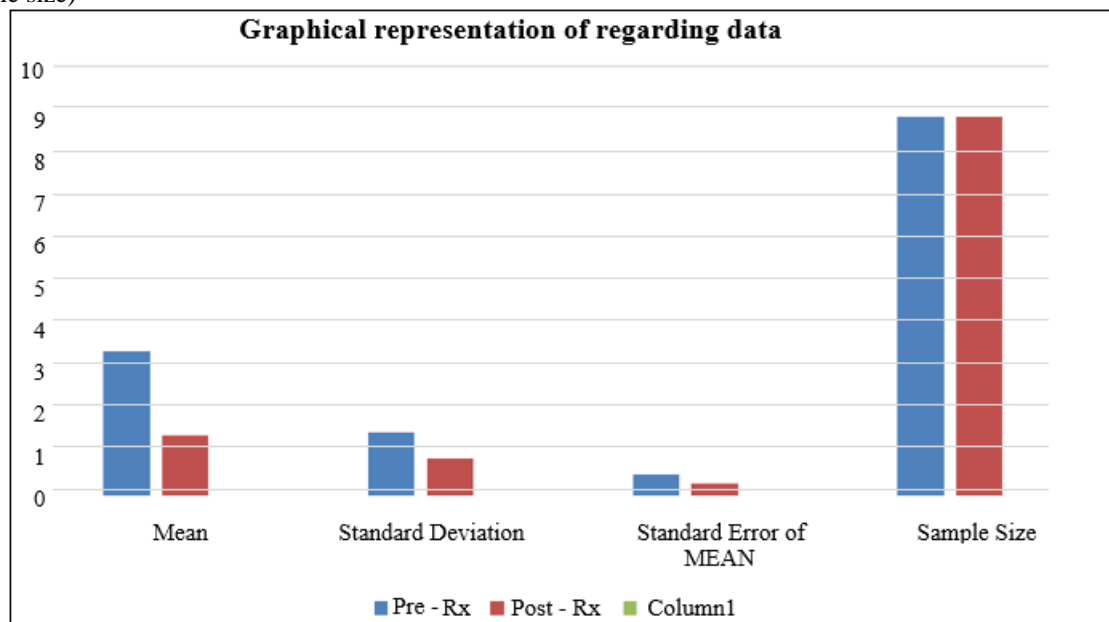
Data Review

Table 4

Group	Pre - Rx	Post - Rx
Mean	3.44	1.44
SD	1.51	0.88
SEM	0.50	0.29
N	9	9

SD - (Standard Deviation)

SEM- (Standard error of mean)



Graph 1

Moderate – Severe Pain group (B)

S.NO	Name	Age	Gender	NPRS score Pre Rx	NPRS score Post Rx	Change in NPRS score
1	N. Ramesh babu	59	M	6	2	4
2	K. Sridhar Reddy	63	M	6	1	5
3	L. Chinna Yadhavulu	66	M	5	2	3
4	D. Srinivasulu	67	M	9	4	5
5	L. Anjaneyulu	53	M	8	3	5
6	S. Afroz Pasha	58	M	9	4	5
7	P. Rajesh	55	M	8	2	6
8	A. Uday kumar	49	M	8	3	5
9	K. Lakshamma	55	F	9	3	6

Paired t test results

P value and statistical significance

The two - tailed P value is less than **0.0001**

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of Pre Rx minus Post Rx of NPRS score equals to **4.89** 95% confidence interval of this difference : From **4.18** to **5.60**.

Intermediate values used in calculations:

t = 15.8053 df = 8 standard error of difference = 0.309 df (degrees of freedom)

Data Review

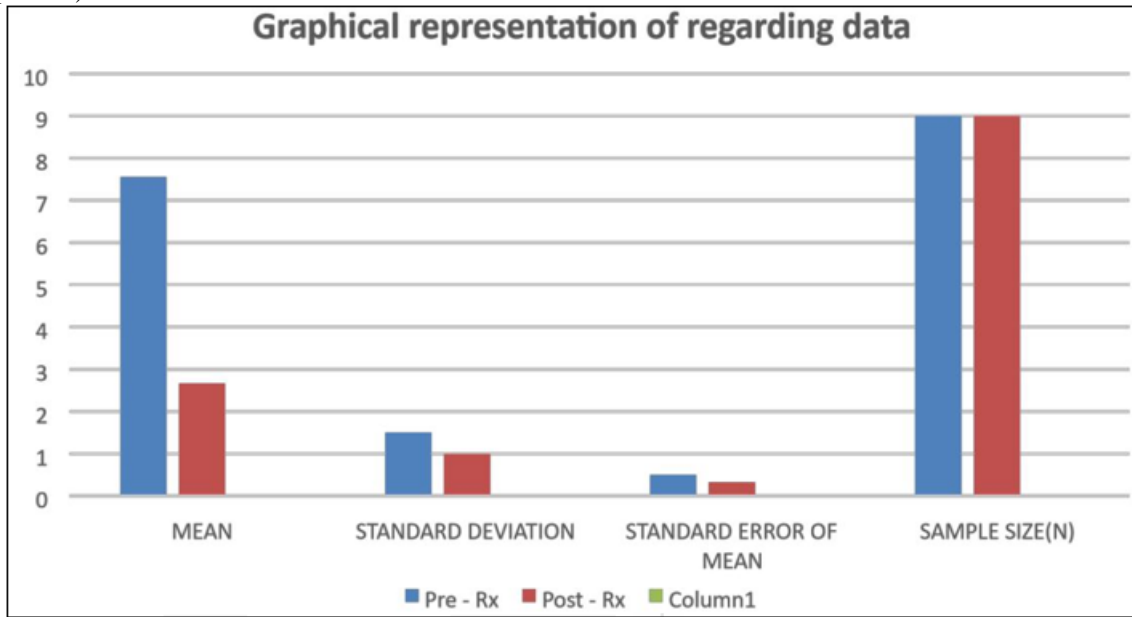
Table 6

GROUP	Pre - Rx	Post - Rx
Mean	7.56	2.67
SD	1.51	1
SEM	0.5	0.33
N	9	9

SD - (Standard Deviation)

SEM - (Standard error of mean)

N- (Sample size)



Graph 2

Unpaired t test results of both Group(A) and Group(B):

P value and statistical significance:

The two - tailed P value equals **0.0142**

By conventional criteria, this difference is considered to be extremely statistically significant.

Confidence interval:

The mean of **Group- A** Post Rx minus **Group - B** Post Rx of NPRS score equals to **1.22** 95% confidence interval of this difference: From **2.16** to **0.28**.

Intermediate values used in calculations:

t = 2.7500 **df = 16** **standard error of difference = 0.444** **df (degrees of freedom)**

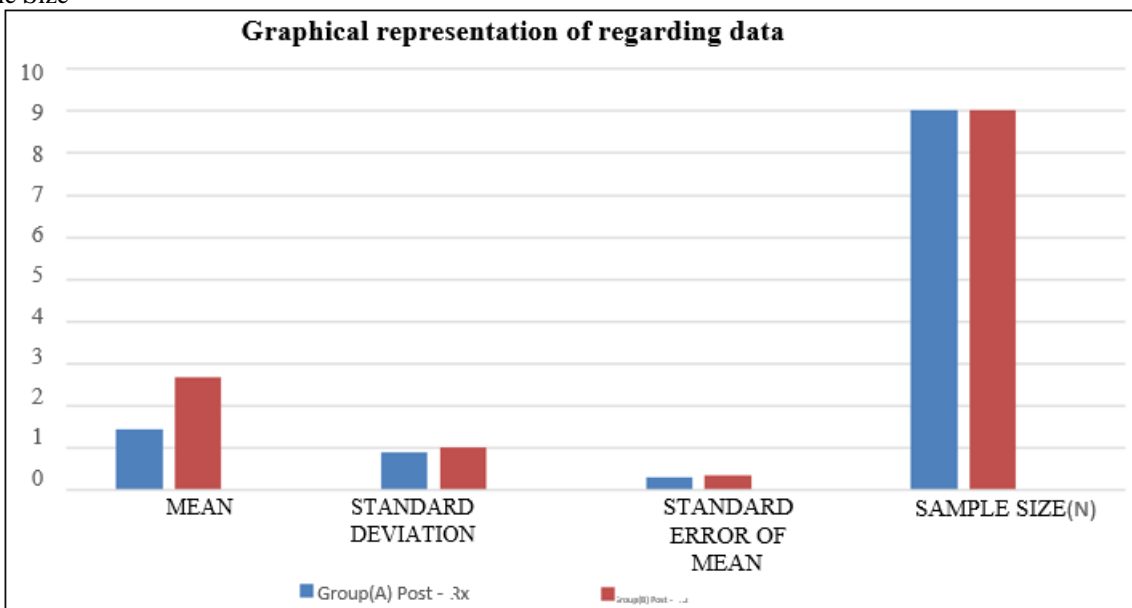
Table 7: DATA Review

Group	Group (A) Post - Rx	Group(B) Post - Rx
Mean	1.44	2.67
SD	0.88	1
SEM	0.29	0.33
N	9	9

SD - (Standard Deviation)

SEM - (Standard error of mean)

N- Sample Size



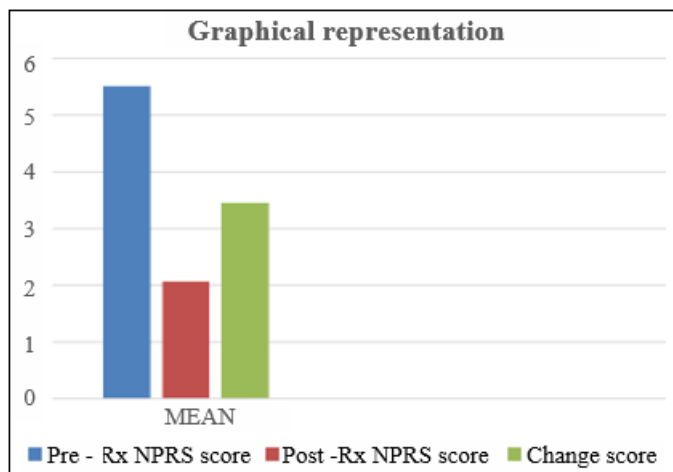
Graph 3

Overall Data

The entire group's information, including the pre- and post-intervention NPRS scores as well

Table 8

S. No	Name of the Patient Name /age /gender	NPRS score		
		Pre Rx	Post Rx	Change score
1	V. Kamakshamma, 56/F	3	1	2
2	M. Ramachandra, 54/M	2	0	2
4	P. Shahid pasha, 48/M	3	1	2
5	S. Susheelamma, 55/F	2	2	0
6	A. Arunamma 52/F	2	1	1
7	D. Ramana 60/M	6	3	3
8	M. Sukanya 58/F	5	2	3
9	T. Ademma 55/F	5	2	3
10	N. Ramesh babu, 59/M	6	2	4
11	K. Sridhar reddy, 63/M	6	1	5
12	L. Chinna yadhavulu, 66/M	5	2	3
13	D. Srinivasulu 67/M	9	4	5
14	L. Anjaneyulu 53/M	8	3	5
15	S. Afroz pasha 58/M	9	4	5
16	P. Rajesh 55/M	8	2	6
17	A. Udaykumar 49/M	8	3	5
18	K. Lakshamma, 55/F	9	3	6
	MEAN SCORE	5.5	2.05	3.44

**Graph 4****3. Results**

The numerical pain rating scale (NPRS) score's descriptive statistics.

The table displays the results for the two groups (groups A and B).

The mild-to-moderate pain group's pre-intervention NPRS score was lower than that of the moderate-to-severe pain group.

In two groups, there was a noteworthy decrease in pain intensity as a result of the intervention.

4. Conclusion

The results of this study indicate that, after one week of cryotherapy for OA knee patients, pain decreased by 20%. Before therapy, the mean average NPRS score was around

5.5, and after treatment, the mean average NPRS score was approximately 2.05.

3.44 is the difference in the NPRS scores before and after therapy.

Later on, there is a more notable difference in pain reduction of approximately 40% when ultrasound therapy is combined with gentle knee muscle stretches.

The level of pain decreased by 80% after this combination of cryotherapy and ultrasound therapy was used for 4–5 weeks. Thus, we may draw the conclusion that this kind of pain therapy for individuals with osteoarthritis (OA) knees improves functional activity and range of motion before strengthening.

This demonstrates how cryotherapy and ultrasonography, in addition to extending the muscles surrounding the knee, can more effectively and quickly relieve pain and improve knee function.

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