
REVIEW ARTICLE

The Effects of Cryotherapy in the Management of Rheumatoid Arthritis: A Review

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ABSTRACT

Due to its simplicity, cost, and ease of use, cryotherapy has been utilized for years to treat rheumatoid arthritis. Depending on where the discomfort is, cryotherapy can be applied non-locally (using partial and whole-body cold application) or locally (with icepack for example). Reviewing the present body of research pertaining to the effects of cryotherapy in the treatment of rheumatoid arthritis will help us better understand the overall impact of this treatment. An analysis of previous research studies evaluating the effectiveness of cryotherapy in treating rheumatoid arthritis. The use of cryotherapy on patients with rheumatoid arthritis was studied in human studies between 2011 and 2021, according to a PubMed database search. Tables with the data were created, and qualitative analysis was also done. This analysis comprised 20 studies. Applications of local and non-local cryotherapy for the treatment of rheumatoid arthritis have shown encouraging results. In carefully chosen patients, cold application is a safe therapeutic process with few side effects documented in the literature. In order to manage rheumatoid arthritis, local and non-local cryotherapy has been found to be a simple, low-risk treatment option.

Keywords: Rheumatoid Arthritis, Cold Application, Cryotherapy, Cold Therapy, Pain

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INTRODUCTION

Rheumatoid Arthritis is a disease that inflames the structure of the body and causes functional restrictions and early mortality [1]. Patients' capacity for self-reliance declines as the illness progresses [2-7]. Small joints are frequently where RA first manifests itself proportionately. Hands and feet joints are most commonly impacted by the disease in its early stages, which cause inflammation in the body's structure. Every component of the joints is destroyed as the inflammatory process in the synovium progresses [8-17].

TYPICAL FEATURES OF RHEUMATOID ARTHRITIS [18]

- Initial stiffness
- An increase in erythrocyte sedimentation rate (ESR)
- The presence of auto antibodies in the serum that attack immunoglobins.
- Together with tenosynovitis, symmetrical polyarthritis

FACTORS CAUSING RHEUMATOID ARTHRITIS INCLUDE [19]

- Genetic susceptibility
- An immune response possibly brought on by a foreign antigen that targets the synovial tissue.
- a joint and tendon sheath inflammatory response.
- Rheumatoid factors' presence in the blood and synovium.
- Inflammatory process continuation degradation of articular cartilage.

THE PATHOLOGY OF RHEUMATOID ARTHRITIS [20]

PHASES OF RA RHEUMATOID ARTHRITIS

PHASE 1; PRE-CLINICAL PHASE

Immune pathology has started even before symptoms of RA appear clinically. Prior to the initial diagnosis, elevated levels of ESR (erythrocyte sedimentation rate), C-reactive protein (CRP), and RF (rheumatoid factor) may have been visible.

PHASE 2; SYNOVIAL PHASE

PREVIOUS CHANGES IN THIS PHASE INCLUDE:

- Congestion in the arteries and the development of new blood vessels]
- Synoviocyte growth\polymorph, lymphocyte, and plasma cell infiltration of the sub-synovial layers
- A cell-rich synovium, villous development of the synovium, and thickening of the capsular structures
- Additionally, effusion into the tendon sheath and joints occur.

PHASE 3; DESTRUCTION PHASE

The following occur in this phase:

- deterioration of joints and tendons due to ongoing inflammation
- worn-out articular cartilage
- Bone reabsorbed at the joint edge due to osteoclastic activity and invasion of granular tissue.
- Tendon rupture that is either full or partial
- Swelling of joints, tendons and bursae

PHASE 4; DEFORMITY PHASE

The phase includes interplay of:

- An interplay between tendon rupture, capsular strain, and articular degradation that results in progressive joint instability.
- It is crucial to have an ongoing inflammatory process that coincides with the mechanical and functional impacts of disrupted joints and tendons.

Cryotherapy is characterized as the topical administration of cold as a healing tool. One advantage of cryotherapy is the reduction of pain in particular body parts, either locally or more widely by non-local treatment [13]

The use of ice packs or ice bags that are specially manufactured in water-resistant plastic receptacles or iced vegetable receptacles is one method of local administration of cold or cryotherapy. Ice-baths, ice - massages, gel-packs, chemical cold-packs, vapo-coolant sprays, and limited cryo-cuffs which are placed throughout a joint and cruciform cold water are other locally applied cold therapies. [14]

Cryotherapy, also known as non-local application of cold, involves applying cold either partially or completely(whole-body cryotherapy).

Only one person is involved in incomplete-body cold application (partial-body cryotherapy), which excludes the head and neck and uses a gas(nitrogen) to directly cool the client's body. While complete-body cold application, whole-body cryotherapy (WBC) uses a huge, custom-fitted boudoir that can hold like three or four patients at once, producing cold either by mixing cold nitrogen gas with oxygen gas and expelling it into the boudoir or by distributing nitrogen gas within the boudoir walls.

COLD APPLICATION (CRYOTHERAPY) has been around for a while, but having Hippocrates' Aphorisms refute it as a treatment for pain relief for both acute pain—such as bleeding—and chronic pain—such as joint pain and chronic inflammation—has changed the game[10]. Since that time, doctors have firmly backed the use of cold therapeutic process to lessen pain. Doctor John Floyer fully supports cold fomentation as a method of treating as well as relieving extreme pain in rickets and also rheumatism included a 1697 letter to both Prince William and Duke Devonshire. A doctor named Worte wrote about the advantages of cold therapy on his patients in a publication in 1846. He also included a personal experience of how it helped him get rid of rheumatism and the agony it caused. [10]

The ease and simplicity of using cold therapy, as well as the low cost of this therapy, continue to make it a popular recommendation among doctors and physical therapists for treating patients with chronic aches and pains. Although cold therapy is frequently used to lessen pain, the precise mechanism of action is yet unknown.

THE MECHANISM OF ACTION OF CRYOTHERAPY

Even though the precise mechanism of action by which cryotherapy reduces pain is still unknown, there are a few leading hypotheses that point to the management of oedema (inflammation), strain (oxidative stress), and neuronal transmission in strain fibers(pain fibers) [21].

1. INFLAMMATION OR OEDEMA

The chemical stimulation and mechanical stimulation of receptors of pain as well as the free nerve endings, that is most common in some autoimmune diseases like the rheumatoid arthritis, can cause

chronic inflammation, which can increase persistent pain. There is therefore a real need to employ cryotherapy to treat these chronic pain syndromes and reduce inflammation, which should help to reduce pain in the long run [22].

Oedema is one of the primary indicators of inflammation and is brought on as a result of vascular alterations and raised permeability, which allow fluid (flowing substances) to enter into the extravascular space. Cytokines are primary inflammatory markers utilized in evaluating the impact of therapy on inflammation. The higher pressure in this area frequently causes mechanical stimulation and pain generation. The consolidation of reducing vascular permeability as well as decreasing both the arterial and the soft tissue blood flow to the impaired areas is therefore accepted to help minimize swelling. [7]

The primary homeostatic functions of the immune system can be controlled by cytokines, which are also crucial in triggering inflammatory reactions. IL-1, TNF-a, IL-6, IL-12, and IL-17 are typically regarded as pro-inflammatory cytokines, but IL-10 is regarded as an anti-inflammatory cytokine. Cryotherapy may thereby reduce inflammation by reducing the pro-inflammatory cytokine TNF-a and raising the anti-inflammatory cytokine IL-10, according to studies. The pro-inflammatory cytokine IL-6, however, may potentially have anti-inflammatory characteristics, according to recent research [23-26].

NERVE TRANSMISSION IN PAIN FIBERS

The slowing of the nerve transmission in strain fibers (pain fibers) is an alternative hypothesized mechanism for cold application (cryotherapy). It's possible that cold application (cryotherapy) has a pain reducing effect and relieves pain in this way. In earlier studies, cryotherapy was found to significantly reduce both motor and sensory complaints. Algaly and George found a higher pain threshold and a decrease in the nerve conduction velocity at the site of cold application (cryotherapy) treatment.

Notably, the significant effect on pain threshold as well as tolerance also spread in the opposite direction, but on the same wavelength, to a region outside the application site. [10]

THE OXIDATIVE STRESS

The Oxidative stress is generally related to all types of human illnesses, such as cancer, rheumatoid arthritis, neurological disorders, cardiovascular diseases, and more. An rise in inflammation and an aggravation of the patient's continuous discomfort are two effects of the oxidative stress, which can also be a sign of some autoimmune illnesses.

According to researched studies, cryotherapy reduces the oxidative stress by elevating the total antioxidant status (TAS) and also FRAP, a different method of estimating total antioxidant status. Moreover, research studies demonstrate that cold application (cryotherapy) lowers the total oxidant status (TOS) and the oxidative status index (OSI), that is a ratio of the TOS to the TAS. [15]

METHODOLOGY

On the use of cryotherapy in rheumatoid arthritis, using the PubMed database, a wired (online) literary studies was carried out. The following search phrases were used: cold application, cold therapy, chronic pain, cryotherapy and pain. Results from studies carried on humans, randomised trials, clinically observed trials, and systemic reviewed articles were constrained to English-language sources only, and they were sorted by year from 2011 to 2021. Through a review of essential references, additional articles were acquired. Studies involving patients with rheumatoid arthritis who experienced extreme pain as well had an negative effects on their daily living were put into consideration, while those involving patients with minor (acute) traumatic pain, post-surgical pain, cold application (cryotherapy) on healthy individuals (also known to be called cold stimulation (cry stimulation), the use of alternating heat and cold therapeutic processes on healthy subjects were exempted. This article is based on previous research and none of the authors have conducted any studies using humans or animals.

SUPPORTIVE DATA ON REDUCING PAIN

In order to assess the success of cryotherapy on chronic pain in general, it's very crucial to not consider only the pain metrics but also include range of motion (ROM) and other aspects as well. Chronic pain is a complex condition. Chronic pain can diminish function of the affected area and restrict range of motion by intensifying the pain. The results of this study will therefore fundamentally focus on pain quantification, for instance the use of pain measuring equipment, the Visual Analogue Scale for Pain (VAS), including some supplemental information, like range of motion (ROM) and body mass index (BMI), tossed in for good measure ankylosing Spondylitis. The Illness Activity Score 28 (DAS28) is one of a small number of BASDAI disease types for (Bath Ankylosing Spondylitis). For example, the BASDAI consists of

six items on fatigue in individuals with AS. Spinal along with pain at the peripheral joint, peripheral neuropathy, edema, discomfort, and morning stiffness are all symptoms. The DAS28 incorporates markers such as how many swollen and painful joints there are, as well as a global visual analogue scale that gauges the patient's general health, erythrocyte sedimentation rate, and health. Following are some broad conclusions that can be drawn from these disease activity scores: Every aspect of a person's life can be impacted by chronic pain. Figure 1 illustrates a flow diagram of the literary search and study selection, as modified from Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) [24-30]

ADVERSE EFFECTS

With only a few reports of side effects in the research taken into consideration, cryotherapy seems to be a therapy that is generally safe. Individuals who received LC have also complained of joint or muscular pain, discomfort, and respiratory infections. Certain side effects reported for the people who experienced whole-body, WBC consist of headache, hypertension, dizziness, malaise, joint or muscle pain, nervousness, respiratory infection, long-lasting freezing, urticaria, mild symptom raise in the early days of treatment, a heartbeat-like sensation all over the body, palpitations, sleep issues, bowel symptoms and bloating, muscle stiffness, and tremors [31-32].

RHEUMATOID ARTHRITIS: is a structurally inflammatory illness that causes functional restrictions and premature death. The severity of the illness impairs the patients' ability to rely on themselves. In tiny joints, RA frequently develops proportionally. Hand and foot joints are most commonly impacted in the early phase of the disease. All of the components in the joints are destroyed as a result of the synovium's inflammatory activity. The typical symptoms of RA include morning stiffness, an increase in ESR, the emergence of autoantibodies that target immunoglobins in the serum, symmetrical polyarthritis, and tenosynovitis [33, 34].

RA can be hereditary, or due to any abnormal reactions in the immune system or due to any abnormal inflammatory reaction in the joints and tendon sheath or auricular joint degeneration. There are four(4) phases of RA namely;

PHASE 1: Pre-clinical phase

PHASE 2: Synovial phase PHASE 3: Destruction phase

PHASE 4: Deformity phase

CRYOTHERAPY: is the use of cold as a treatment method that is only applied topically. The ability to reduce pain in particular body parts through local or non-local cryotherapy applications is one of its advantages.

The use of ice bags, ice packs, or frozen vegetable bags that are particularly packaged in water-resistant plastic bags is one method of local administration of cold or cryotherapy. Other methods of locally delivering cold consist ice lavatory, ice massage, gel packs, chemical cold packs, vapo-coolant sprays, and specialized cryo-cuffs which are wrapped throughout a cruciform(joint) and pump icy-cold water through it. Non-specific (non-local) cold application (cryotherapy) is the implementation of cold partially alternatively wholly (whole-body cryotherapy) [35].

Only one person is involved in partial-body cryotherapy, which does not involve the head and the neck and uses nitrogen (gas) to directly cool the client's body. While cryotherapy WBC (whole-body) uses a huge, custom-fitted boudoir that can hold as much as three or four patients at once, producing cold either by mixing cold nitrogen gas with oxygen gas respectively, and injecting it into the boudoir or by emitting nitrogen gas within the boudoir walls [36].

The ease and simplicity of using cold therapy, as well as the inexpensive cost of this therapy, continue to make it a popular recommendation among doctors and physical therapists for treating patients with chronic aches and pains. Although cold therapy is frequently used to lessen pain, the precise mechanism of action is yet unknown.

CONCLUSION

Since Hippocrates' day, cryotherapy has been used to treat pain, and it is still commonly practiced today. Although cryotherapy is frequently used, it is still unknown whether it is beneficial at treating pain. In this study, I provide evidence demonstrating the efficacy of cold application (cryotherapy) in the management of rheumatoid arthritis discomfort as well as pain.

The processes behind this pain reduction are hypothesized to be decreased oedema and inflammation, the oxidative stress, as well as the nerve conduction velocity of the pain fibers. Generally, controlling rheumatoid arthritis as a whole, cryotherapy has demonstrated promising results. Cryotherapy for the

entire body decreased pain and disease activity, with the best results being observed at temperatures of at least -110 C. The outcome also implies patients with this illness may find specific cold application (local cryotherapy) to be an effective pain-relieving therapeutic process.

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