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COMPARATIVE ANALYSIS OF EXERCISE THERAPY COMBINED WITH THERMOTHERAPY AND CRYOTHERAPY APPLICATIONS IN PATIENTS WITH ANKLE SPRAIN

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Numerical pain rating scale (NPRS), dorsiflexors (DF), foot and ankle outcome score (FAOS)

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ABSTRACT

Background: Ankle sprain is one of the most common causes of pain and disability among individuals and primarily caused by with sudden twisting injury to the ankle and presents as severe pain, swelling, unable to walk with sustained amount of time leads to lack of ROM, reduced muscle strength and even functional disability. The heat therapy and cryotherapy along with conventional therapy is much helpful in regain ankle mobility, improved muscle strength and also minimize disability in early phase of recovery.

Objective: The aim of current study is to determine the effectiveness of cryotherapy therapy and heat therapy along with therapeutic exercise in ankle sprain.

Methodology: The Overall, 34 numbers of subjects with ankle sprain were selected as subjects who come under the inclusion criteria. So, total N-30 subjects were allocated into 2 groups i.e., 15 subjects in (Group A) and 15 subjects in (Group B) through simple random sampling method. Out of 30 subjects there were 12 male patients and 18 female patients. A Written Consent form was obtained from subjects after describe the intervention and its outcomes. A pre intervention assessment was done via Numerical pain rating scale (NPRS) for pain, Foot and Ankle Outcome Score [FAOS].

Group-A received exercise therapy along with heat therapy and group- B received exercise therapy along with cryotherapy. The treatment was given for 4 weeks; 5 sessions per week, 30-45 minutes/session once a day. Post intervention assessment was done after completion of 4 weeks.

Results: The data was evaluated by statistical analysis paired t test and unpaired t test was applied both groups show significant difference but group A i.e. exercise therapy along with heat therapy is associated with higher levels of improvement assessed by NPRS, FAOS. When compared to group-B which was intervened by exercise therapy along with cryotherapy.

Conclusion: There is a significant improvement in calf muscle strain after applying exercise therapy along with heat therapy

INTRODUCTION

An ankle sprain is an injury to one or more of the ligaments of ankle that provides stability. Ankle injury is one of the most common musculoskeletal injuries in athletes as well as in sedentary peoples.[1] It is one of the common acute soft tissue injuries.[1]

Ankle sprains are the second most common sports injury after knee injuries. 85% of them affecting the lateral ligaments due to inward twisting.[2]

Ligaments of ankle joint consists of: 3 main sets

Medial ligaments/deltoid ligament: It is a multifascicular ligament connects medial malleolus to talus, calcaneus, and navicular bone.

Lateral ligaments complex: These ligaments connects lateral malleolus to the talus and calcaneus. The lateral ligaments has 3 parts:

- Anterior talofibular (ATFL)
- Posterior talofibular (PTFL)
- Calcaneofibular (CFL)

Syndesmotic ligaments: These ligaments connects the tibia and fibula.

The ATFL is the most commonly injured ligament in the ankle.[1] These three sets of ligaments work together to provide stability to the ankle joint.

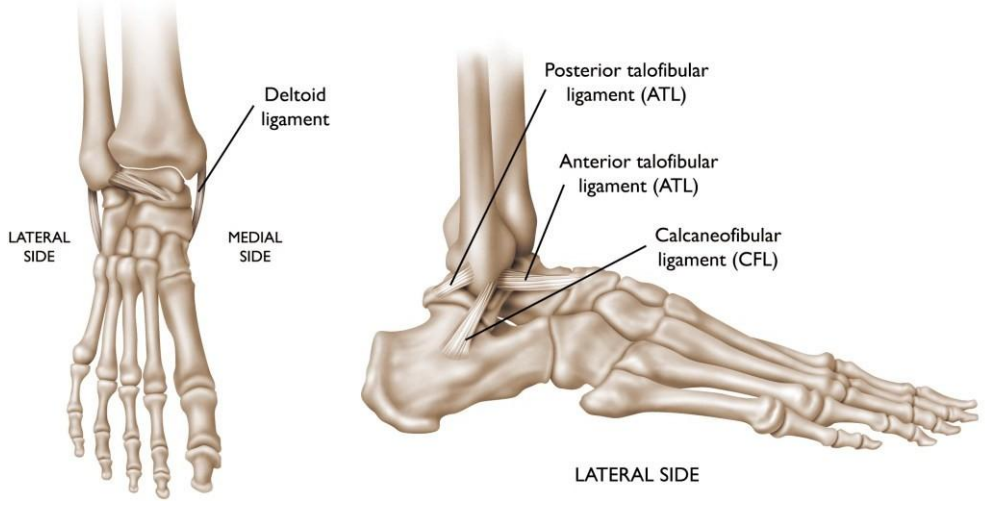

Fig. 1.1 Showing ligaments of ankle

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Ankle sprain is most prevalent among highly active individuals but can also affect less inactive peoples, more frequently affects women, children, and athletes who participate in indoor and field sports.[4] and presents as a recurrent injury in approximately 19% to 31% of cases. Ankle sprain typically occurs suddenly. An acute ankle sprain presents with Pain, Swelling, Bruising, Tenderness and Instability of the ankle etc.

Heat therapy is commonly used immediate analgesic agent include in physiotherapy intereventions. An increase in temperature tends to reduce the stiffness in fascial tissues. However, heat therapy lead to increased metabolism and vasodilation, thus accelerating the healing processes by enhanced supply of nutrients and oxygen and removal of pain-inducing mediators.

Cryotherapy is used as a part of the RICE protocol, in acute phase of musculoskeletal injuries. Cryotherapy induces vasoconstriction via a sympathetic reflex, reduces blood flow to the tissues, Decreasing blood flow implies reduction of edema and slower delivery of inflammatory mediators to the injured area, meaning reduced inflammation. The decreased metabolic demand in the cooled zone also prevents secondary hypoxia-related damage.

In addition, Cryotherapy produces local anesthesia by decreasing the activation threshold of tissue nociceptors and nerve conduction velocity. Finally, decreasing muscle temperature also reduces muscle spasm via inhibition of a spinal cord reflex loop. A cryotherapy provide numbness to the injured area after that the patient can perform weight bearing exercises without pain.

After that, a mechanical defect occurs in the cross bridges as the filaments slip apart resulting in a sudden lengthening of the sarcomere known as sarcomere giving. When the stretching force is released, the individual sarcomere returns to the rest length.

External ankle support, ankle disk training exercises, taping, proprioceptive neuromuscular facilitation exercises or training regimens, proprioceptive balance board training and bracing prevents ankle sprains in high-risk sporting activities.

METHODOLOGY

The population of our study consists of patients with ankle sprain and specified inclusion criteria, such as individuals aged 18-40, both male and female, and those with grade 1 and 2 ankle sprain. Exclusion criteria includechronic cases of ankle sprain, Presence of any other congenital or acquired deformity of foot. The sample size appears to be 30 participants, with an equal distribution between Group A (heat therapy with therapeutic exercise) and Group B (cryotherapy with therapeutic exercise).

INTERVENTION

GROUP A – Heat therapy with therapeutic exercises

The technique of application for heat therapy

- Assess the part to be treated first.
- Tank with hot water at the temperature of 40˚C ± 5˚C was used to apply heat modality in this study.
- The ankle joint of the involved extremity was immersed in the water tank.
- Limit heat application session to 20 mins as a good general rule.
- The skin needs to be checked every few minutes for signs of burns.

GROUP B – Cryotherapy along with therapeutic exercises

The mode of cryotherapy was standardised and consisted of melting iced water (0˚C) in a standard sized pack.[13 14] Plastic ice bags (20 cm*20 cm) were completely filled with water, placed in a freezer, and removed when frozen. Before application, the packs were held under hot water for 30 seconds and wrapped in a single layer of standardised towelling (moistened until just dripping wet).

- This duration of treatment has been recommended in the literature[10 15] and is also commonly used in the clinical setting.[15] The intermittent ice group applied ice for 10 minutes. The pack was then removed, and the ankle was rested at room temperature for 10 minutes. The ice was then reapplied for a further 10 minutes.
- Again intermittent treatments were repeated every two hours. Previous studies[13 14] have shown that the mode and duration of cryotherapy applied in the intermittent protocol reduces skin temperature to 5˚C immediately after treatment. [C M Bleakley et, al]

THERAPEUTIC EXERCISES

Common for both groups group A group B

[Physical therapy rehabilitation program approved by the Clinical Practice Guidelines]

FIRST-WEEK:

- Immobilization by bracing and external support.
- Therapeutic exercises : active ROM (ankle pumps), active assisted eversion/inversion,
- stretching exercises
- Neuromuscular training through towel curls.

SECOND WEEK:

- Resisted ankle ROM through resisted dorsiflexion/planter-flexion, resisted inversion/eversion,
- postural re-education - toe raises and heel walking,
- Balance training - lunging on stable/un-stable surfaces, step-ups/downs, lateral step-ups/downs and Single-leg stance with lower limb.

THIRD AND FOURTH WEEKS

Exercise progressed to:

- Mini squat on an unstable surface,
- Single-leg stance while playing catch,
- Single-leg stance while playing with the coach,
- Single-leg stance with lower limb movement and

- Single leg stance with lower-limb movement on an unstable surface

RESULT AND DATA ANALYSIS

TABLE NO. 1: Descriptive statistics of NPRS and FAOS pre and post treatment (group A)

Group A	ean ±Std. Deviation	ed t test	p-value
NPRS Pre	11.65±1.53	24.278	<0.0001
NPRS Post	6.25±1.29		
FAOS Pre	11.55±3.18	14.694	<0.0001
FAOS Post	4.05±1.57		

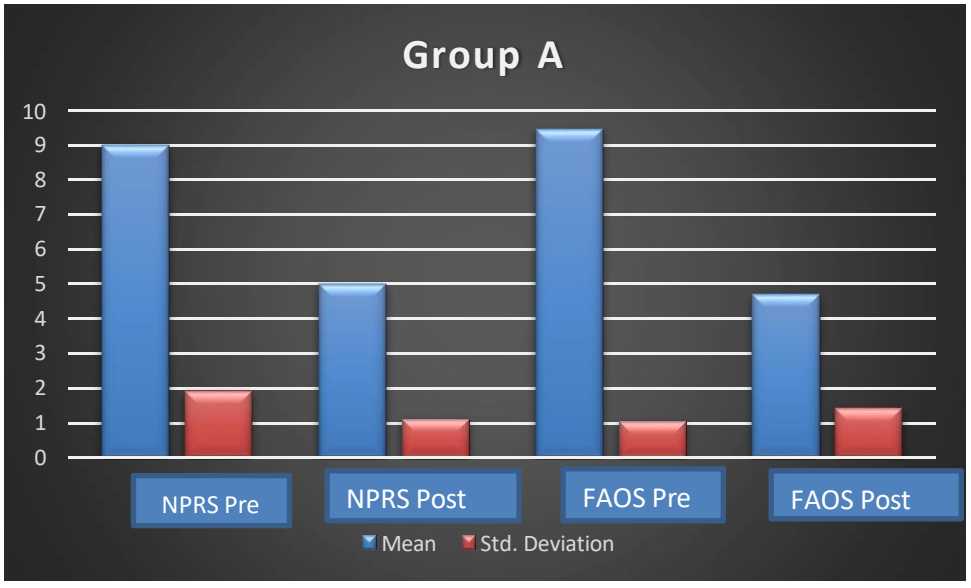

Fig. 2 Graph showing comparison of NPRS and FAOS pre and post intervention scores in group A

TABLE NO.2: Descriptive statistics of NPRS and FAOS pre and post treatment (group B)

Group B	ean ±Std. Deviation	ed t test	p-value
NPRS pre	9.45±1.918	18.379	<0.0001
NPRS post	5.00±1.124		
FAOS pre	10.46±1.050	23.332	<0.0001
FAOS post	4.70±1.418		

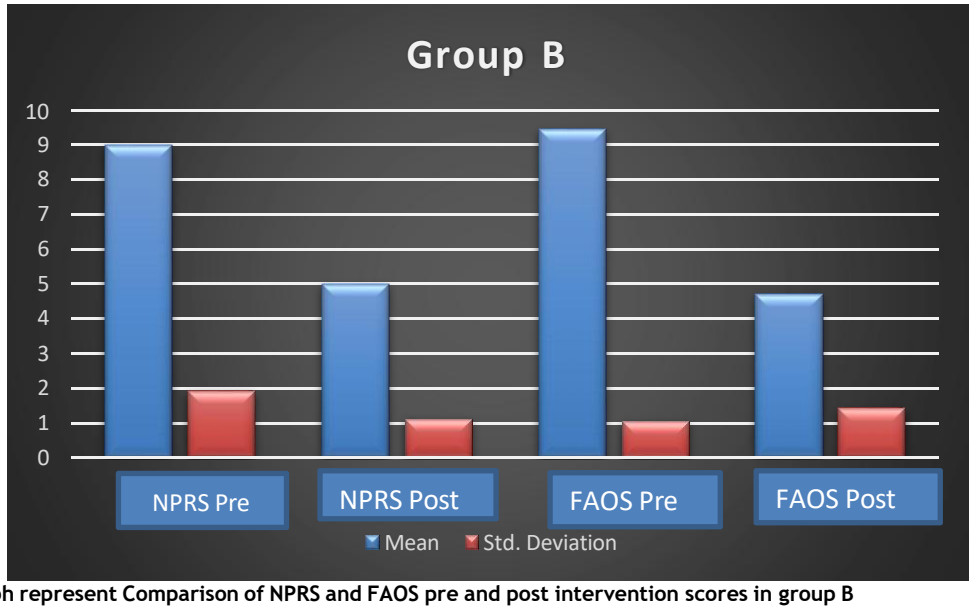

Fig. 3 Graph represent Comparison of NPRS and FAOS pre and post intervention scores in group B

TABLE NO.3: Comparison of pre and post intervention scores of NPRS and FAOS between group A and group B.

Variables	Groupcode	Mean±SD	unpaired t test	p-value
NPRS pre	A	11.65±1.53	0.653	0.518
	B	9.45±1.918		
FAOS pre	A	11.55±3.18	4.134	<0.0001
	B	10.46±1.050		
NPRS post	A	6.25±1.29	0.739	0.464
	B	5.00±1.124		
FAOS post	A	4.05±1.57	4.132	<0.0001
	B	4.70±1.418		

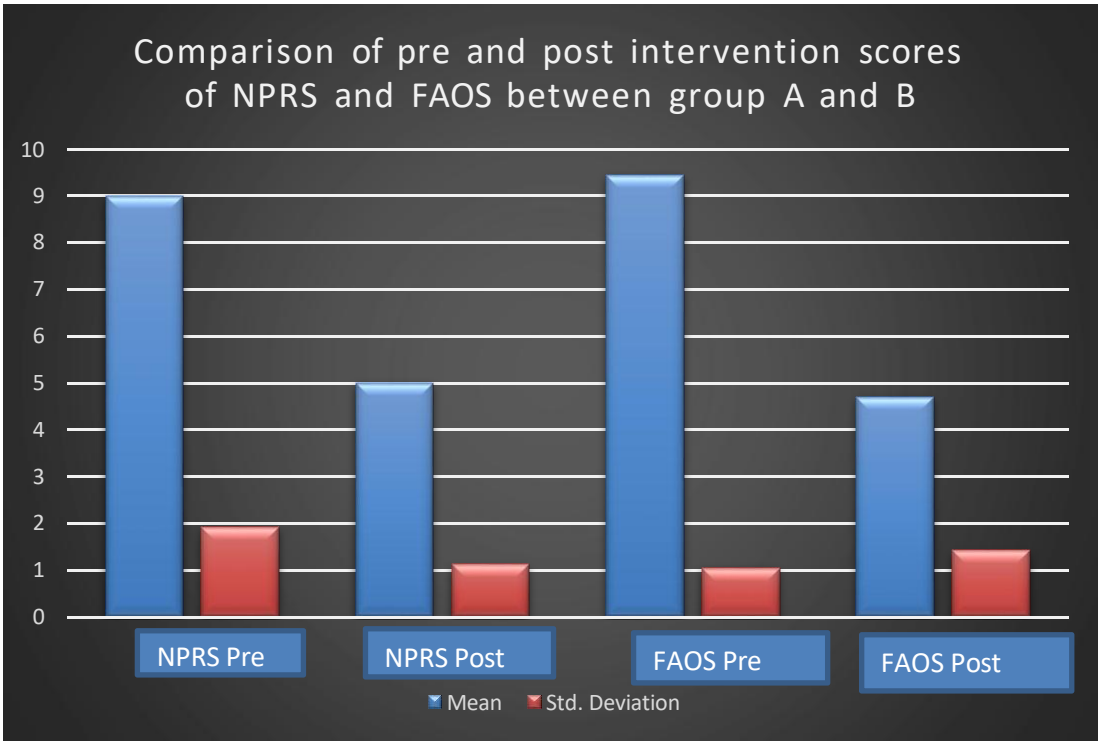

Fig. 4 Graph represent Comparison of NPRS and FAOS pre and post intervention scores in group A and group B

DISCUSSION

The current study confirms the effectiveness of heat therapy in reducing pain intensity and improve muscle strength that may due to the physiological effects of heat therapy includes vasodilation, increases in blood flow and metabolism, and TRP channel activation leads to pain relief and increased mobility. The application of low-level superficial heat activates temperature-sensitive nerve endings (thermoreceptors), which in turn, initiate signals that block the processing of pain signals (nociception) in spinal cord [13]. The analgesic effects of heat are partly mediated by TRPV1 receptors, which facilitate the neural transduction of heat and the processing of nociceptive pain. The activation of TRVP1 receptors in the brain is thought to regulate anti-nociceptive pathways. These mechanisms serve to reduce muscle tonicity and relax muscles, thereby reducing pain and increasing flexibility.

Another explanation for heat therapy is that it is commonly used immediate analgesic agent in physiotherapy intereventions. An increase in temperature tends to reduce the stiffness in fascial tissues. However heat therapy lead to increased metabolism and vasodilation, thus accelerating the healing processes by enhanced supply of nutrients and oxygen and removal of pain-inducing mediators. An elevation in tissue temperature of just 1°C is associated with a 10%–15% increase in the local metabolism. Recent evidence also suggests that localized, repeated HT may promote an angiogenic environment and enhance muscle strength.

Previous studies have shown that Cryotherapy is useful modality to reduce pain and improve the loading on injured leg, helps to minimize functional limitations of patients with sprained ankle. [John E. Hocutt, JR., M.D.et, al] study suggested that the cryotherapy started within 36 hours after the injury was more effective for complete and rapid recovery. Therefore, early use of cryotherapy, continued with adhesive compression, is an effective treatment of ankle sprains yielding earlier complete recovery. Some studies also suggest that, Ice applied to muscles appears to have a local anaesthetic rather than an analgesic action.

It is a cost effecting, easy to apply and noninvasive treatment procedure. Cryotherapy produces quick effect even after first application and completely resolves the pain within a short period. This study was deliberate to find the effectiveness of Cryotherapy in regain ROM and reduce pain intensity in ankle sprain. Following statistical analysis establish increase in post intervention score in NPRS and FAOS. So, both this techniques heat therapy in subacute stage and Cryotherapy in acute stage can be used in clinical practice to lighten pain and improve ROM in patients with ankle sprain for speedy recovery.

CONCLUSION

This study concluded that both Heat therapy and Cryotherapy along with therapeutic exercise showed statistically significant ($p < 0.0001$) improvement in muscle strength, ROM and pain in patients with ankle sprain. But when compared between the groups, group A showed statistically significant ($p<0.0001$) difference on NPRS and FAOS scores after 4 weeks of intervention than group B. Thus, addition of thermal modalities along with therapeutic exercise is more beneficial in increasing muscle strength, reducing pain and minimize disability leading to faster recovery in ankle sprain.

CONFLICT OF INTEREST:

The Authors declares no conflicts of interest

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