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RESEARCH ARTICLE
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TO COMPARE THE EFFECT OF COLD THERAPY AND CONTRAST THERAPY ON PAIN AND SWELLING IN LATERAL ANKLE SPRAIN

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Abstract:
In the present study 30 subjects were selected according to inclusion and exclusion criteria. The purpose of this study was to see the effect of cold therapy and contrast therapy on swelling and pain after grade 1 and 2 lateral ankle sprain. The outcome measure has been taken by figure of 8 method to evaluate ankle swelling and visual analogue scale for pain rating. Pre and post measurement were taken swelling and pain. paired t test was applied within the group and unpaired t test was applied between the groups. The p value was set at $p<0.05$. The result of the study showed that there was a significant difference with in group A and B as p value was less than 0.0001 for swelling and pain. The mean value after the treatment in figure of 8 method also showed significant improvement but the mean value of VAS scale after the treatment did not showed significant difference as p value is 0.8492 Results suggested that cold therapy gave satisfactory result to reduce swelling as compaired to contrast therapy were as statistically pain is insignificant but clinically we found that it is significant.

Keywords: Ankle, Pain, Contrast therapy, cold therapy

1. INTRODUCTION

An ankle sprain is a tear of the ligaments supporting the ankle joint. Ankle sprains are the most common injuries in sports and recreational activity, accounting for 40% of all athletic injuries, especially in basketball, soccer, cross country running, dance, and ballet. Ankle injuries make up 10% of all visits to the emergency room. Ankle sprains account for 53% of injuries in basketball players and 29% of all extremity injuries in soccer players, and account for the most common trauma in modern dance and classical ballet. In football, approximately 12% of all time lost to injuries is secondary to ankle injuries. Three quarters of ankle sprains involve the lateral ligament process. Within specific sporting activities, the incidence is equal for males and females (1).

In contrast therapy, alternating immersion is applied locally or as a total body immersion. This provides a noninvasive and generally safe and cost-saving treatment modality. Studies found in literature from 1988 to 2013 have used various temperatures, duration ratios, and whole time durations in their studies. There was also a noticeable variation in start-up and end-up modality; heat

or cold. (2-8) Contrast therapy has been used in clinical settings for assistance with acute sporting injuries and rehabilitation purposes in sports medicine and physical therapy, but remains insufficiently researched. Cold therapy has been advocated by some researchers as the sole treatment to be used during all phases of soft tissue injury management. Moore et al suggested that the combination of cold therapy and exercise was the key to increasing circulation, resulting in elimination of debris from the injured area and decreased rehabilitation time. (9) Cold therapy has been advocated by some researchers as the sole treatment to be used during all phases of soft tissue injury management. Moore et al suggested that the combination of cold therapy and exercise was the key to increasing circulation, resulting in elimination of debris from the injured area and decreased rehabilitation time. (10)

Proper treatment during sub acute stage will help the player to commence the sports activity without much time loss. As most of our sports centers are lacking of basic physiotherapy facilities and ankle sprain is most common sports injury but cold and contrast both are having very easy availability as well as very cost effective. There are various researches which suggest the physiological effects of cold and contrast therapy which help in reducing pain and swelling individually but our study is comparing which one is more effective cold or contrast hence the need arises to conduct the study. (11-13) To compare the effects of cold therapy and contrast therapy in patient with subacute lateral ankle sprain.

2. METHODOLOGY

30 subjects (both male and female) with sprained ankles, ranging in age from 18 to 25 years, were randomly assigned to two treatment groups. All subjects were examined by a Rajeev Gandhi College, Bhopal and diagnosed as having grade-1 and grade-2 lateral ankle sprain.

2.1 Procedure:

In the study 30 subjects were randomly selected and diagnosed as having grade 1st or 2nd ankle sprain by the sports medicine expert and are divided into 2 groups A and B. 15 subjects in group A were given cold bath and 15 subjects in group B were given contrast bath. Subjects in both the groups were given common treatment of compression and active ROM exercises.

Subjects in group A received the cold therapy treatment once daily for the third to 14th days Post injury. The injured ankle of subjects in the Cold Treatment Group was fully submerged in a cold immersion tub that was maintained in a temperature range of 50° to 60°F for 20 minutes. Subjects were made to sit on a bench adjacent to and level with the rim of the cylinder. Their injured leg was then immersed to midcalf. Subjects were instructed to actively exercise their ankle through a pain-free ROM in all motions.

In group B The injured ankle of subjects was given Contrast Bath Treatment was fully submerged, first in a warm tub maintained in a temperature range of 102° to 106°F for three minutes and then in a cold immersion tub that was maintained in a temperature range of 50° to 60°F for one minute. The sequence was continued until the ankle had been given five heat and five cold treatments beginning with and ending with cold. Subjects sat on a bench connected to the outer rim of the contrast bath. The level of leg immersion and the immersion exercises were identical to those used for the Cold Treatment. (14-16)

2.2 Instrumentation:

The equipment used for water displacement measurement was a handmade volumetric measuring tank. The tank consisted of a Plexiglas container mounted on a platform that contained leveling screws. The interior of the tank was 14 in long, 7 in wide, and 8 in deep. Along the right side wall of the tank, from the subject's perspective, was one small piece of Plexiglas that was used to ensure consistent placement of the ankle in the tank. The piece of Plexiglas was ½-in wide and 2⅜-in long and was adhered to the right side wall l 9/16 in from the back of the tank. At the front end of the tank,

opposite the subject, was a piece of glass tubing that passed through the tank wall with 1 ¼ in protruding from the outside and 1 in on the inside. A rubber tube was attached to the exterior segment of the glass tubing to allow water to drain from the tank into a water collection bucket. A centimeter ruler was attached to the front wall of the tank to accurately determine the depth of the water. A skin thermometer was placed in a posterior corner of the tank to maintain a consistent water temperature of 92°F. Two graduated cylinders calibrated in milliliters were used to measure the volume of the displaced water.

2.3 Data Analysis:

Pre and post values for VAS scale and measurement method was noted. Paired t-test was applied for intra group analysis and unpaired t-test was applied for inter group analysis. The p value was set at $p<0.05$ .The analysis was done using instat software.

3. RESULTS AND OBSERVATION

In the present study 30 subject of ankle sprain were selected according to inclusion and exclusion criteria, 15 subjects in GROUP A were given cold therapy and 15 subjects in GROUP B were given contrast therapy. The subjects were given the treatment in the subacute stage from day 3 to day 14 everyday. All the subjects were given a baseline treatment of compression bandage and range of motion exercises.

Cold therapy and contrast therapy were given for 20 minutes each during which range of motion exercises were performed by the patient. The patient were evaluated for pain and swelling before and after the treatment. The pain was measured on visual analogue scale and swelling was measured by inch tape by figure of 8 method.

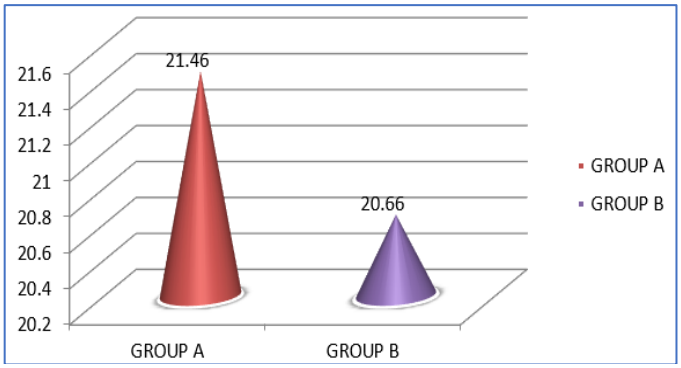

Figure 1: Mean of Age in Group A and B

According to the above figure the mean and SD of age of Group A (cold therapy) is 21.46 and 2.6 respectively and mean and SD of group B (contrast therapy) is 20.66 and 2.6 respectively. This shows that the subjects in group A and B are in same age group of 18 -25 years.

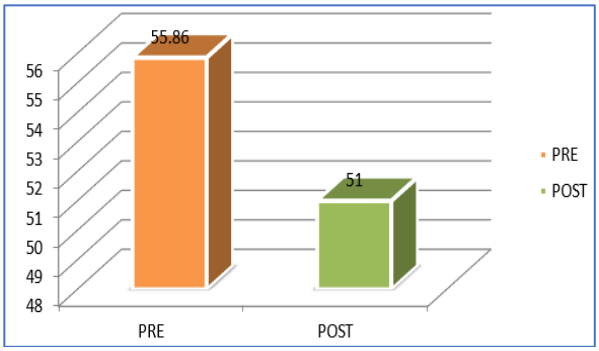

Figure 2: Mean of Group A

According to the above table the mean and SD of Group A(cold therapy) before the treatment is 55.86 and 0.99 respectively and mean and SD of Group A(cold therapy) is 51 and 1.41 respectively. This shows that the subjects in Group A showed improvement after the treatment. After applying unpaired t' test it is found that there is significant difference between Group A and Group B as p <0.0001.

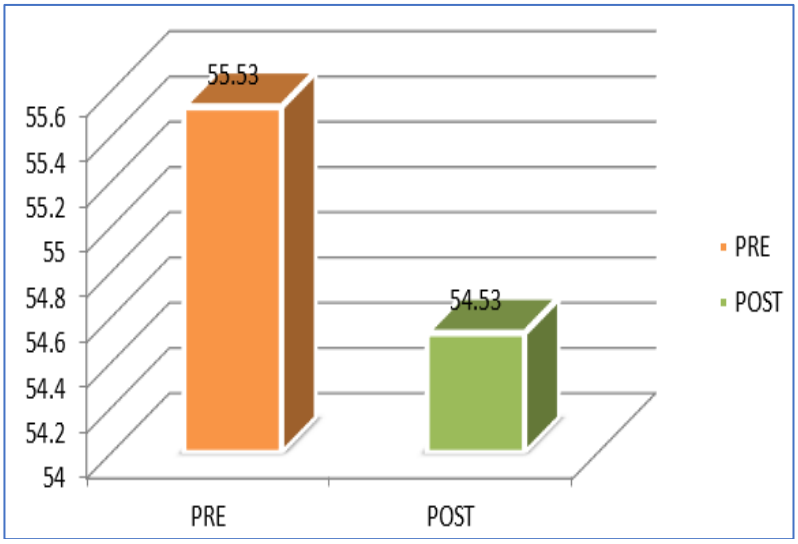

Figure 3: Mean of Group B

According to the above table the mean and SD of Group B (Contrast Therapy) before the treatment is 55.53 and 1.24 respectively and mean and SD of Group A(contrast Therapy) is 54.53 and 0.99 respectively. This shows that the subjects in Group B showed improvement after the treatment. After applying unpaired t' test it is found that there is significant difference between Group A and Group B as p <0.0009.

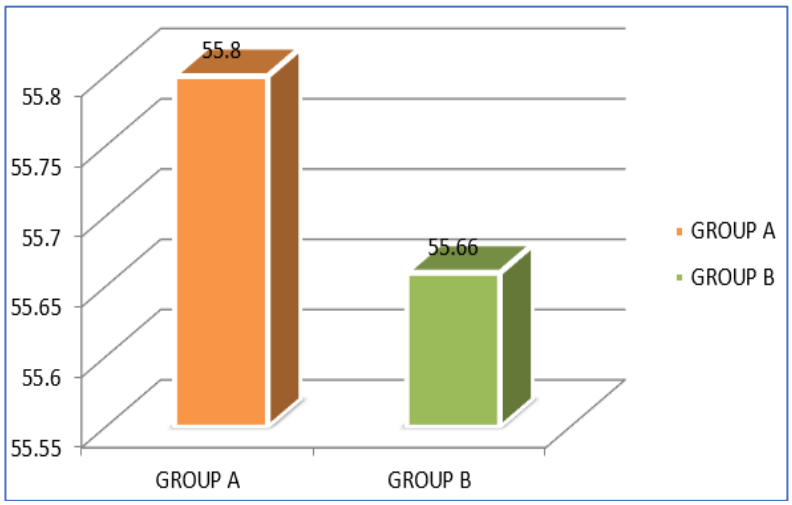

Figure 4: Pre-mean of Group A and B

According to the above table the mean and SD of Group A(cold therapy) before the treatment is 55.8 and 0.99 respectively and mean and SD of Group B(contrast therapy) is 55.66 and 1.04 respectively. This shows that the subjects in group A and B had similar swelling before the treatment. After applying unpaired t' test it is found that there is no significant difference between Group A and GROUP B as p = 0.5951.

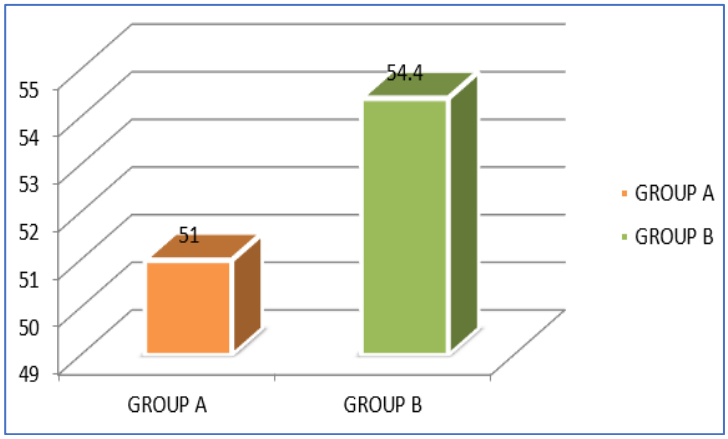

Figure 5: Post-mean of Group A and B

According to the above table the mean and SD of group A (cold therapy) after the treatment is 51 and 1.41 respectively and mean and SD of group B(contrast therapy) is 54.4 and 1.06 respectively. This shows that the subjects in Group A showed reduction in swelling more than Group B. After applying unpaired t' test it is found that there is significant difference between Group A and Group B as p <0.0001.

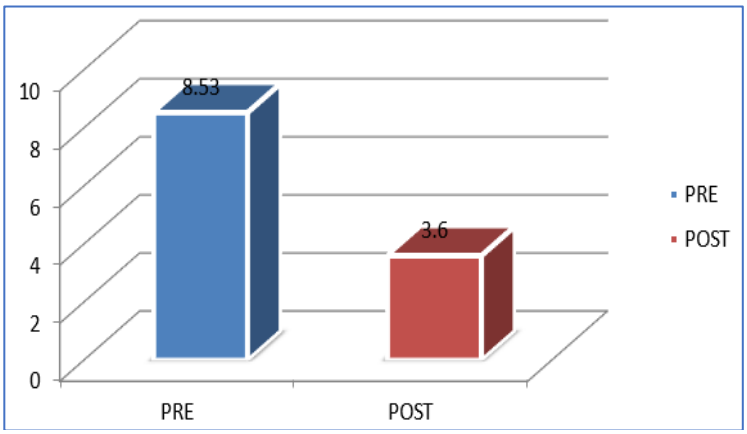

Figure 6: Mean of VAS in Group A

According to the above table the mean and SD For Pain in Group A (cold therapy) before the treatment is 8.53 and 0.91 respectively and mean and SD For Pain in Group A (cold therapy) is 3.6 and 0.98 respectively. This shows that the subjects in Group A showed improvement in pain after the treatment. After applying unpaired t' test it is found that there is significant difference between Group A and Group B as p <0.0001.

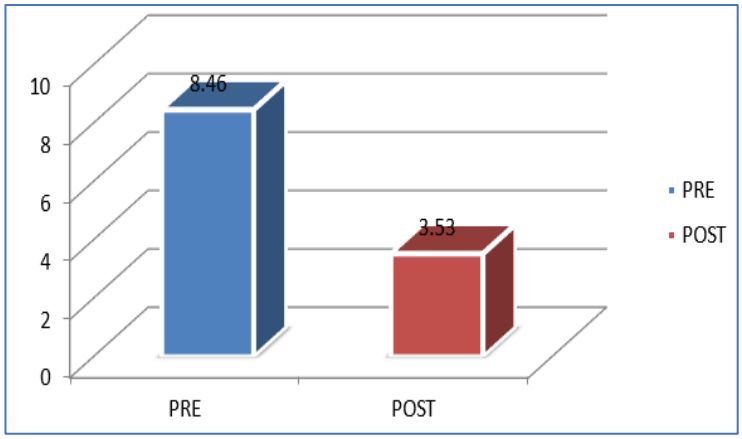

Figure 7: Mean of VAS in Group B

According to the above table the mean and SD For Pain in Group A (cold therapy) before the treatment is 8.46 and 0.99 respectively and mean and SD For Pain in Group A (cold therapy) is 3.53 and 0.91 respectively. This shows that the subjects in Group B showed improvement in pain after the treatment. After applying unpaired t' test it is found that there is significant difference between Group A and Group B as p <0.0001.

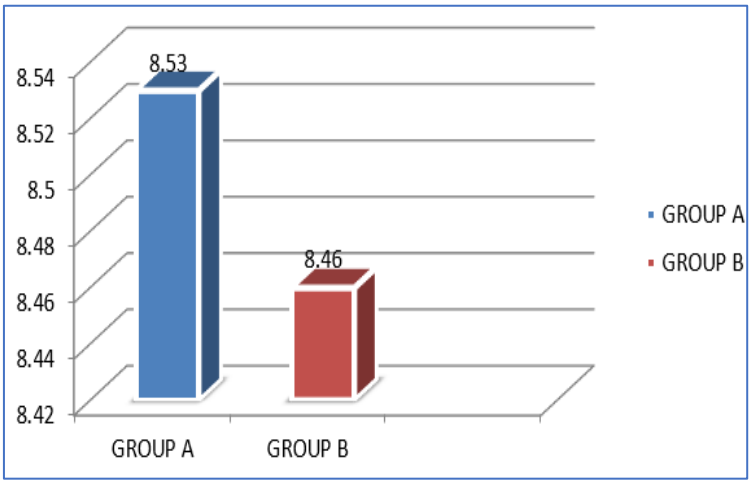

Figure 8: Mean of VAS in Group A and B

According to the above table the mean and SD of group A (cold therapy) before the treatment is 8.53 and 0.91 respectively and mean and SD of group B (contrast therapy) is 8.46 and 0.99 respectively. This shows that the subjects in group A and B had similar pain rating on VAS scale. After applying unpaired t' test it is found that there is no significant difference between Group A and Group B as p = 0.8496.

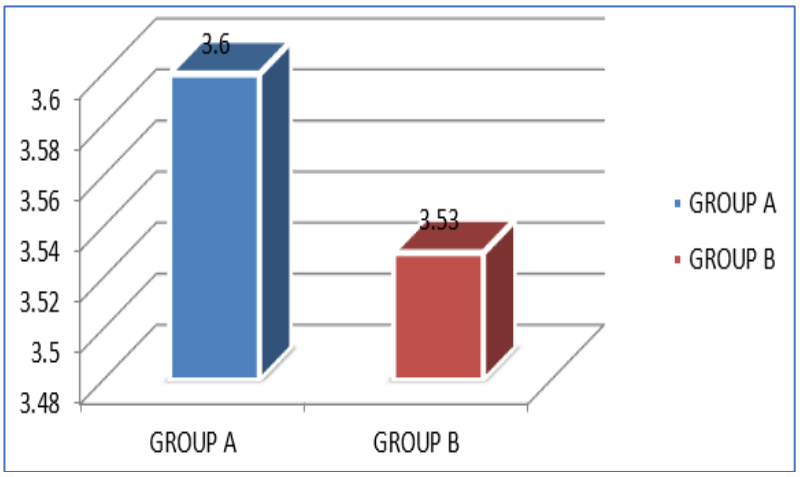

Figure 9: Post Mean of VAS in Group A and Group B

According to the above table the mean and SD of Group A (cold therapy) before the treatment is 3.6 and 0.98 respectively and mean and SD of group B(contrast therapy) is 3.53 and 0.91 respectively. This shows that the subjects in group A and B had similar pain rating on VAS scale after the treatment. After applying unpaired t' test it is found that there is no significant difference between Group A and Group B as p = 0.8492.

4. DISCUSSION

An ankle sprain is a tear of ligaments supporting the ankle joint. This is classified into 3 types a grade 1 sprain is defined as mild damage to a ligament or ligaments without instability of the affected joint. A grade 2 sprain is considered a partial tear to the ligament, in which it is stretched to the point that

it becomes loose. A grade 3 sprain is a complete tear of a ligament, causing instability in the affected joint. (17, 18)

The result of the study showed that there was a significant difference within group A and B as p value was less than 0.0001 for swelling and pain. The mean value after the treatment in figure of 8 method also showed significant improvement but the mean value of VAS scale after the treatment did not showed significant difference as p value is 0.8492.

According to Emin Ergen the ankle sprain occupies about 30% of all sports injuries in which about 80% are anterior talofibular ligament (ATFL) which is caused due to lateral ankle sprain. So, we can conclude that lateral ankle sprains are most common musculoskeletal injuries that occur in athletes. (19)

The major complications created by lateral ankle sprain are pain and swelling. According to Haluk H Oztekin the time lost due to ankle sprain from play for players with grade 2 ankle sprain is about 61 days. If the proper rehabilitation is given in the subacute stage of ankle sprain that is from 3rd to 14th day of injury we can reduce the time lost by the player due to lateral ankle sprain. Further evidence to support the use of ice in acute injury was reported by D.A. McLean (1989) by saying the use of ice, exercise and gait re-education has been shown to be superior to exercise and gait re-education alone in the treatment of ankle sprains. In the sub-acute stage, the role of ice is to reduce pain to allow more vigorous pain-free exercise. Unlike pain killing injections, cold does not abolish sensitivity to pain which remains a protection against over vigorous exercise. Thus it appears that exercise rather than ice aids recovery. So, the main purpose of our study is to reduce the time lost by the player because of lateral ankle sprain so that an effective rehabilitation regime can be commenced soon by avoiding the difficulties created by pain and swelling. (20, 21)

Many studies are conducted on the individual effect of cold therapy and contrast therapy over years as well some physiological findings also indicates that they both are helpful to treat soft tissue injuries but there are less studies directly comparing both of them to interpret their individual effects on pain and swelling.

According to CM Bleakley, ankle sprain resulted in an increase in ankle girth and cold is thought to cause vasoconstriction by decreasing the permeability of local blood vessels, thereby reducing the degree of haemorrhage after injury and in the continuation of the same he concluded that after injury cold therapy creates analgesic effect even upto 1 week.

By cooling the surface of the skin and the underlying tissues, ice causes the narrowing of blood vessels, a process known as vasoconstriction. This vasoconstriction leads to a decrease in the amount of blood being delivered to the area and subsequently lessens the amount of swelling. After a number of minutes, the blood vessels re-open (dilate) allowing blood to return to the area. This phase is followed by another period of vasoconstriction- this process of vasoconstriction followed by dilation is known as the Hunting Response.

Although blood still flows into the area the amount of swelling is significantly less than if ice is not applied. This decreased swelling or edema allows more movement in the muscle and so lessens the functional loss associated with the injury. The swelling associated with the inflammatory response also causes a pressure increase in the tissue and this leads to the area becoming more painful. This pain is intensified by certain chemicals that are released into the blood when the tissue is damaged-hence vasoconstriction from applying ice also decreases pain. (22, 23)

J William Myrer(1994) suggested that in sports medicine, it has been recommended to start with heat and with cold to minimize the possibility of swelling. Debra J. Coté rationally used contrast therapy on soft tissue and stated that the vasoconstriction caused by the cola and vasodilatation caused by the heat result in pumping action that aids in venous and lymphatic return and removes excessive fluid from traumatized tissue. Contrast therapy also creates a gentle warming of the tissues can occur that results in increased circulation hence contrast therapy treatment is believed to aid the healing process by minimizing swelling.

Compression is applied to limit the amount of edema caused by the exudation of fluid from the damaged capillaries in the tissue and helps to decrease swelling. Previous work in a human model of soft-tissue injury has shown that cooling alone does not produce a sustained reduction in swelling and

that the addition of mild pressure (10-30 mmHg) to the cooling (15C) is necessary for any permanent effects to be seen (Sloan et al., 1988). Schmidt et al., (1979), using an experimental rat paw model, also found that cooling alone did not cause a reduction in swelling. (25-26)
The figure of 8 method has been used to measure ankle swelling which is supposed to be very reliable for measuring ankle swelling. This is very rarely used method and can be easily reproduced by using bony landmarks. For pain we are using visual analogue scale (VAS) which is subjective scale for pain perception. Cold and contrast therapy protocols with range of motion exercises and compression suggestive of that cold therapy is helpful to reduce swelling on figure of 8 method but pain is having more or less equal effects of both the treatment protocols. (27)

5. CONCLUSION

Believing that lateral ankle sprain causes pain and swelling on ankle joint, therapist gave cold therapy and contrast therapy with compression and range of motion exercises to patients to reduce pain and swelling. Data suggested that statistically and clinically cold therapy was more effective in reducing swelling than contrast therapy were as statistically pain was insignificant but clinically we found that it was significant.

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