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**EFFECT OF CRYOTHERAPY ON PAIN AND WOUND HEALING IN THE FORM  
OF STANDARDISED ICE MASSAGE AROUND THE SURFACE OF WOUNDS IN  
DIABETIC PATIENTS: A RANDOMIZED CONTROL TRIAL**

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**ABSTRACT**

One of the most common complications associated with type -I and type -II diabetes patients is delayed wound healing. There are many techniques in physiotherapy for wound care like ultrasound, ENMS and LASERS. Cryotherapy was found not only to be the most effective, cheap and safest way of reducing pain and inflammation without causing hindrance to the wound healing but also improves wound healing. In this study, a total of twenty subjects with lower limb superficial diabetic wounds were selected based on the selection criteria and randomly divided into two groups by coin flip method .Group -A subjects received standardized Ice massage around the wound surface area along with the routine medical wound care. Group -B subjects received only routine medical wound care. Both groups were treated for 3 weeks every day. All the values were tabulated and statistically analysed by means of paired 't' test and Independent 't' test. Data analysis revealed significant difference between the two groups in parameters pain, wound size and percentage of wound contraction. Cryotherapy in the form of standardized Ice massage along with routine medical wound care is found effective than the routine medical wound care alone in reducing pain and speeding up the wound healing.

**Keywords: Diabetic Wound, Cryotherapy, Wound Circumference, Ice Lollies, Medical  
Wound Care, VAS**

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## INTRODUCTION

One of the most common complications associated with both type-I and type-II diabetes is delayed wound healing [1]. If left untreated, wounds can lead to infection, amputation and even death. Diabetes is the leading cause of non-traumatic lower limb amputations. Despite a clear need, there are very few treatment options available that are consistently effective in accelerating wound closure in people with diabetes. Wounds and their symptoms like pain, Muscle spasm has delirious effects on the physical, emotional and well-being on the patients with diabetes.

There are many techniques in physiotherapy for wound care like Ultrasound therapy, electric stimulation, and LASER light therapy. Cryotherapy in the form of Ice massage is a cheap, easily accessible, and more acceptable, with less side effects on the wound healing is found in many studies. Studies found that Ice massage will not decrease the circulation of blood by any means [2]. Cryotherapy was found to be the most effective way of reducing pain and inflammation without causing hindrance to wound healing in Post-surgical wounds [3, 4, 5]. Cryotherapy was in practice in medical and nursing care for wound healing in post surgical wounds [6-9]

Present study was designed with an aim to study the effectiveness of Cryotherapy in

the form of Ice massage around the surface of wound in respect to pain and healing in Diabetic patients over the lower limb wounds with following objectives:

- To study the effect of Cryotherapy in the form of Ice massage over the wound healing in Diabetic patients in lower limb wounds
- To study the effect of Cryotherapy in the form of ice massage over the pain due to wounds in diabetic patients.
- To compare the effectiveness of Cryotherapy in the form of Ice massage in wound healing in diabetic patients over the routine medical wound care on wound healing.
- To study the role of Cryotherapy in the form of Ice massage over the wound healing in Diabetic patients with lower limb wounds

## MATERIAL AND METHODS

The study was conducted at Anisha Multispecialty Hospital, Guntur and SIMER college of Physiotherapy OPD c/o Satya Hospital, Guntur .Total duration of the study was 6 months. The treatment for each subject is 3 weeks, with a 20 min session including the assessment and treatment every day.

**Inclusion Criteria**

- Patients with Diabetes with normal Blood glucose levels
- Diabetic Patients with lower limb superficial wounds
- Both sex
- Willing to participate
- Age from 45-65 years
- Uninfected diabetic wounds
- Patients having good lower limb circulation
- Conscious and oriented

**Exclusion Criteria**

- Peripheral vascular disease
- Mentally challenged
- Unconscious patients
- Sensory impairments
- Cryophobia
- Uncooperative patients

**Materials**

Consent forms, Evaluation format, Tracing papers and pencils, Inch tape and ruler, Ice lollies and refrigerator, Calculator, Supporting pads and pillows

**Treatment and Assessment of Healing Process**

20 patients with diabetic lower limb superficial wounds were selected and are divided into two groups by coin flip method.

**Group A:** Group A were given Cryotherapy in the form of Ice massage around the surface of the wound near to the edges

without touching the wound edges for a period of 15 min, with a protocol of 2 min massage and 1 min rest intervals along with the routine medical care. A Styrofoam cup filled with water and a wooden stick was placed and refrigerated to make ice lollies [10], care was taken that the surface is smooth and edges are not sharp. Along with the Ice massage, general wound care is done in the form of cleaning the wound with Hydrogen peroxide, sterile bandaging and oral antibiotics. The technique was given every day for 3 weeks, the wound size was traced by placing a tracing paper over the wound and another tracing paper over it, a pencil was used to trace the circumference of the wound, after the tracing, the paper over the wound was discarded to prevent the infections and the second was preserved for further action. The wound surface area was calculated by using the following formula [11, 12, 13].

Area = length X breadth of the wound.

Later the wound is traced for every 7 days (1 week) to calculate the percentage of wound contraction by using the following equation:

Percentage of wound contraction = [(Initial wound size-specific day wound size)/Initial wound size] X 100 (Srivastava and Durga Prasad, 2008) [14]. The pain was assessed by means of Pain visual analog scale (VAS)

### Measurements of Wounds

Length: the length is measured in 12° clock to 6° clock.

Breadth: the breadth is measured 3° clock and 9° clock at the widest part perpendicular to the length

**Group B:** Group B were given routine medical care alone in the form of cleaning the wound with Hydrogen peroxide, sterile dressings and oral antibiotics .The wound size was traced by placing a tracing paper over the wound and another tracing paper over it, a pencil was used to trace the circumference of the wound ,after the tracing the paper over the wound was discarded to prevent the infections ,and the calculation was done same as Group A

### RESULTS

In this study to analyse the effects on the outcome measures before and after Cryotherapy in the form of ice massage with general wound care in Group A (experimental group) and only general wound care in group B (control group), all data was expressed as Mean (+/-) Standard deviation (SD) and was statistically analysed using paired and t-test and Independent t- test to determine the statistical difference among the parameters at 0.5% level of significance.

Paired t test was used to examine the changes in dependent variables from base-line to after completion of intervention in

each group. The pre test mean value of VAS in Group A is 8.2, (S.D=0.7888) and post test mean value of Group A is 2.2 (S.D=1.038) with P value <0.005 which shows there is a significant difference between pre-test and post test mean value in Group A

The Pre test mean value of VAS in group B is 8.4 (S.D=0.5164), and the Post test mean value of VAS in Group B is 6.7 (S.D=0.483), with P value 0.005

The Independent t test is done to calculate the significance of difference in VAS scores between the Group A and Group B .The mean of differences in VAS scores between Pre test and Post test in Group A is 5.8 and in Group B is 1.9 with t value is 7.47 . (P<0.005)

This indicates the results are statistically significant, and hence we reject the null hypothesis The Group A (experimental Group) showed a better and higher reduction in Pain than the control group.

The pre test mean value of wound area in Group A is 8.036 (S.D =3.3972) and Post – test mean value of wound area in group A is 2.81 (S.D=0.5301) with P value <0.005. The pre test mean value of wound size in Group B is 7.301 (S.D=3.3046) post test mean value of Group B wound area is 5.845 cm<sup>2</sup> (S.D=2.45), with P value is 0.005

The independent t test is done to calculate the significance of difference in area of

wound sizes between the Group A and Group B. The mean of differences between the area of wound sizes between Pre-test and post test in Group A is 3.39 and in Group B is 1.456 with  $P=0.005$

This indicates the results are statistically significant and hence we reject the null hypothesis. The Group A (experimental group) showed higher decrease in the wound sizes promoting faster healing.

The post mean value of percentage of wound contraction in Group A is 43.17% (S.D=6.666) and Post test mean value of Group B value of percentage of wound

contraction is 20.06 % (S.D=5.53), this shows the wound contraction is higher in Group A (Experimental group) than Group B (Control group) with P value 0.005.

The statistical data obtained from post test VAS (Visual analog scale), wound area and percentage of wound contraction reveals that there is high statistical significant difference between Group A and Group B, and hence we reject the null hypothesis. It suggests that the improvements in outcome measures are more in Group A than Group B.

**Table 1: Comparison of Pre and Post Values of Wound Sizes in Group A and Group B**

Wound sizes	Group A			Group B		
	Mean	SD	P value	Mean	SD	P value
Pretest	8.04cm <sup>2</sup>	3.40	<0.005	7.30cm <sup>2</sup>	3.30	<0.005
Post test	4.65cm <sup>2</sup>	2.22	<0.005	5.84cm <sup>2</sup>	2.45	<0.005

**Table 2: Comparison of Post Values of Percentage of Wound Contraction in Group A and Group B**

% of Wound contraction	Group A			Group B		
	Mean	SD	P value	Mean	SD	P value
Post test	43.17%	6.666	0.005	20.06%	5.53	0.005

**Table 3: Comparison table of Pre and Post values of Pain VAS in Group A and Group B**

VAS	Group A			Group B		
	Mean	SD	P value	Mean	SD	P value
Pretest	8.2	0.789	<0.005	8	0.6	P<0.005
Post test	2.40	0.9666	<0.005	3.40	0.96	P<0.005

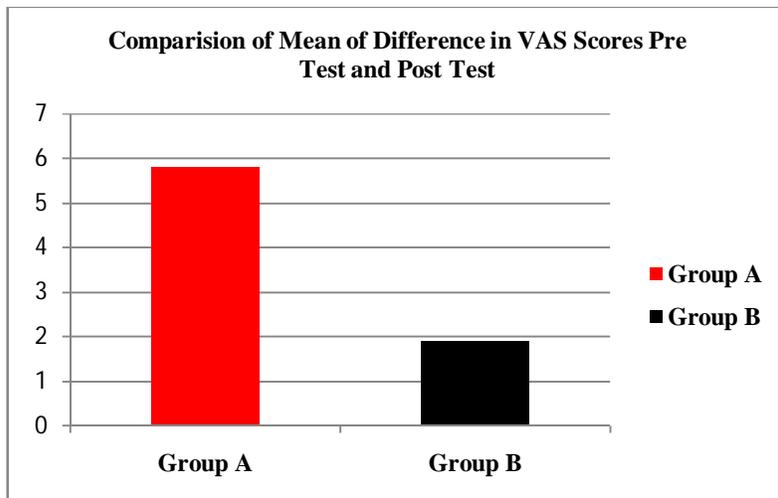


Figure 1: Comparison of Mean of Difference in VAS Scores Pre Test and Post Test

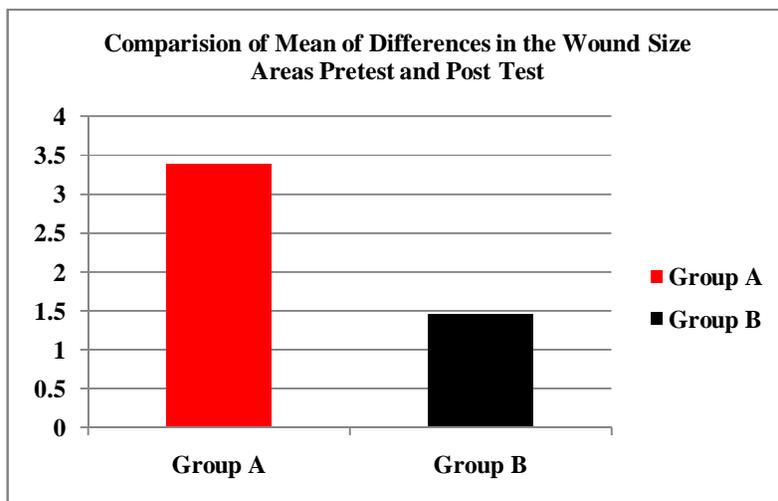


Figure 2: Comparison of Mean of Differences in the Wound Size Areas Pretest and Post Test

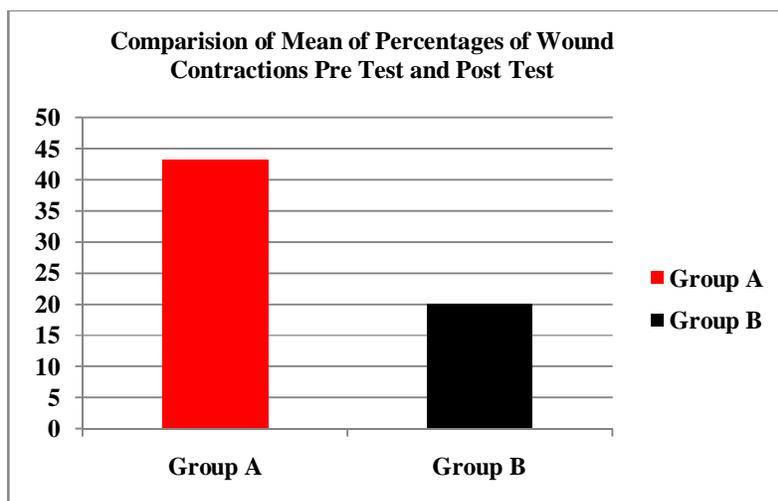


Figure 3: Comparison of Mean of Percentages of Wound Contractions Pre Test and Post Test

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**DISCUSSION**

In this study Cryotherapy in the form of ICE massage around the surface of the wound promoted pain relief and wound contraction faster in experimental group than in control group reduces pain and speeds up the wound healing when compared to the normal .hence thereby we reject the null hypothesis.

The cryotherapy in the form of wound healing around the surface of the wound played a significant role on pain relief and wound healing in the form of wound contraction.

The randomized single blinded controlled trail evaluated the efficiency of cryotherapy in the form of ice massage around the surface of the wound over the pain and wound healing in diabetic patients over a three week trail has found significant differences favouring the experimental group in the form of reduction in pain and maximized percentage of wound contraction. The phenomenon that leads to decrease in the pain is believed to be due to decrease in the acute inflammatory response and decreased nerve conduction velocity by ice. Many studies have shown that Ice heals the wound and wound pain without causing hindrance to the site of healing, the Lewis Hunting response that is ice induced vasodilatation and angiogenesis by ice would have enhanced or speeded up the

process of healing, though some authors believe that Ice can delay the wound healing, there are many experimental studies that have proven that ice reduces pain and increases the recovery by speeding up wound contraction.

There are no much studies done in diabetic patients with cryotherapy. This study certainly is a baseline for the further studies to be carried upon cryotherapy on wound healing.

Cryotherapy is a simple, economical analgesic measure for wound healing without causing delay in wound healing. The following studies suggest that Cryotherapy has been beneficial in promoting wound healing. [6] reported that cold reduces pain in post operative wounds and speed up the wound healing. [2] concluded that neither Ice massage nor ice packs treatments would decrease the blood flow. [3] found that topical cold has clear efficacy in reducing pain without delaying wound healing. [7] reported that cooling a wound would maintain and improve microcirculation which promote better wound contraction. [8] found that cold have a beneficial effect by inhibiting inflammation through delay of the late inflammatory phase of healing and thus promote wound healing. [9] reported that ice applied on post abdominal surgical wounds have a beneficial effect by reducing

the pain and promoting the healing process. [17] mentioned, Ice promotes wound healing. [18] mentioned the vasodilatation followed by vasoconstriction created by ice believed to increase the rate of wound healing.

### CONCLUSION

The following conclusions are drawn from the present study:

1. Cryotherapy in the form of Ice massage around the surface of the wound will reduce pain in diabetic wounds
2. Cryotherapy along with routine wound care is found to be beneficial in the form of speeding up the rate of wound healing when compared to wound care alone.

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