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Original Research Article

Efficacy of Therapeutic Ultrasound versus Low Level Laser Therapy in the Management of Venous Ulcer

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ABSTRACT

Background: Venous ulcers are wounds that are thought to come to pass because of despicable execution of valves in the veins as a leg's rule. They are the premier starting point of unending injuries, blending in 70% to 90% of incessant injury cases. The strict etiology of venous ulcers is not firm, but rather they are thought to emerge when venous valves that exist to avert reverse of blood don't work suitably, bringing about the weight in veins to enlarge. The body craves the weight slope in the middle of supply routes and veins with the end goal heart should pump blood forward through corridors into the veins. At the point when venous hypertension exists, courses no more have radically higher weight than veins, blood is not pumped as effectively into or out of the region, and it pools out. There is scarcity of proof in the writing evidence at the viability of Therapeutic Ultrasound and Low Level Laser Therapy in the administration of venous ulcers, so the present study concentrated on the administration and making utilization of the viable treatment among the two modalities. Objective was to determine whether the Therapeutic Ultrasound or Low Level Laser Therapy increases the healing of venous leg ulcers. And to compare the efficacy of Therapeutic Ultrasound and the Low Level Laser Therapy in the management of venous ulcer. The study design was randomized controlled study design. We recruited 300 subjects into three 3 groups(Low Level Laser Therapy, Therapeutic Ultrasound & Conservative Management Group) by using purposive sampling, which included male and female subjects; subjects were selected from the population group satisfying the inclusion criteria from the patients of the department of general surgery, K S Hegde Charitable Hospital, Derlakkatte, Mangalore. The areas of venous ulcers were traced by sterile transparency paper (cleaned with spirit). The area of venous ulcer will be measured by maximum length and width measurement with ruler, and by digitizer. All the subjects were evaluated for the wound measurement before starting of the treatment. Post outcome measurements were done at the end of 1st, 2nd, 3rd and 4th weeks. The changes in the variables were analyzed statistically and observations and conclusions were made accordingly. The mean deviousness size before the intervention was 32.34 cm^2, at the fourth's end week the size was diminished to 29.24 cm^2, it shows the arrangements are persuading for venous ulcer settling. After the end of fourth week wound size reduction was found in autonomous of treatment along the three interventions, and all are helping in treatment of venous ulcers. We didn't find any significance in wound size decline on each intervention quantifiably however clinically there is essential changes saw (since mean refinement in wound size pre and post intervention is more) in patients treated with Low Level Laser Therapy. From the study's outcome we watched that Low Level Laser Therapy is seen to be for the most part better than anything Therapeutic Ultrasound and the Conservative Treatment in organization of venous ulcer.

Keywords: Low Level Laser Therapy (LLLT), Therapeutic Ultrasound, Conservative, Venous Ulcer, Wound Size.

INTRODUCTION

Venous ulcers are wounds that are thought to transpire due to improper execution of valves in the veins usually of the legs. They are the foremost origin of chronic wounds, stirring in 70% to 90% of chronic wound cases. [(1)] The literal etiology of venous ulcers is not firm, but they are thought to arise when venous valves that exist to prevent backflow of blood do not function suitably, causing the pressure in veins to augment.

The body desires the pressure gradient between arteries and veins in order for heart to pump blood forward through arteries into the veins. When venous hypertension exists, arteries no longer have drastically higher pressure than veins, blood is not pumped as successfully into or out of the area, and it pools out. The disease generally affects people between 60 and 80 years old, with women affected 3 times more habitually than men. [(2)] Chronic venous leg ulcers are a major health dilemma in most countries with patients who suffer from chronic venous insufficiency. Venous ulceration has two main aetiologies. Firstly, ulceration may be coupled with comprehensible varicose veins and secondly, such ulceration may follow thrombosis and phlebitis in deep and perforating veins. The second group in attendance as an ulcerated edematous leg with self-evident superficial varicose in only about 1/3rd of cases. [(3)]

Ulcer healing is a complex process and recently rapid developments in the knowledge of its basic principle have been reported. Natural healing takes time and humans quickly become impatient. As a result, open ulcers have been treated with medicines, physiotherapy and range of natural and synthetic materials in an attempt to speed healing.

Therapeutic Ultrasound refers to sound wave with a frequency greater than that can be alleged by the human ear (20-20,000Hz). Ultrasound is generated by the application of a high frequency current to a crystal. The crystal vibrates due to what is called the reverse piezoelectric effect. [(4)] The piezoelectric effect is produced when pressure is placed on a crystal to produce an electric current. Application of ultrasound may produce a number of biophysical efficacies that are pertinent to healing of wounds. These include undulations in cellular protein synthesis and liberate, blood flow and vascular permeability, angiogenesis, and collagen substances and alignment. [[4]] Such efficacies have been recommended to provide a rationale for use of therapeutic ultrasound at each stage of the wound healing progression. In the treatment of skin or cutaneous wounds, frequencies from 0.5 MHz – 3 MHz have been found to enhance the healing process in incisional lesions and diabetic and venous ulcers. [(5)]

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Low level laser therapy or low intensity laser therapy is generic term that defines the therapeutic application of relative low output lasers and monochromatic super luminous diodes for the treatment of disease and injury at dosages usually <3.5J/cm^2 generally considered to be too low to affect any detectable heating of the irradiated tissues. A low level laser therapy is the one that produces irradiation intensities so low that temperature elevations in tissue are limited to less than 0.1 to 0.5 degree centigrade. Any observed biologic effects are therefore attributed to non thermal events and the direct effect of the laser light on the molecular and cellular levels.

NEED FOR THE STUDY: There is paucity of evidence in the literature comparing the efficacy of ultrasound and low level laser therapy in the management of venous ulcers, so the present study will focus on the management and making use of

the effective therapy among the two modalities.

AIM: To find out the efficacy of therapeutic Ultrasound and Low Level Laser Therapy in the management of venous ulcer.

OBJECTIVES: To determine whether therapeutic ultrasound increases the healing of venous leg ulcers. To determine whether Low level laser therapy increases the healing of venous leg ulcers, and to compare the efficacy of ultrasound therapy and low level laser therapy in the management of venous ulcer.

MATERIALS AND METHODS

MATERIALS USED: Therapeutic Ultrasound (INDOSONIC- HMS), Laser Machine (LASERMED- 2100), Protective goggles , Polyacrylamide agar gel sheet, Trace paper, Tracing pen, Aquasonic gel, Cotton, Crepe bandage, Pillows

Fig 1: Laser Machine (LASERMED- 2100)

Fig 2: Therapeutic Ultrasound

(INDOSONIC- HMS)

STUDY DESIGN: Randomized Controlled Trial

SAMPLING METHOD: A computer generated random number is designed to generate a sequence of numbers that cannot be reasonably predicted better than by a random chance. It is done by SPSS 21.0. Sealed envelope allocation was done in order to reduce bias, producing a balanced comparison and the investigator should not know what the treatment will be assigned until the patient has been determined as eligible.

STUDY CENTER: Department of General surgery and Department of Physiotherapy in K S Hegde Charitable Hospital, Derlakkatte, Mangalore.

SAMPLE SIZE: The sample size was calculated based on the findings of a pilot study conducted among 12 venous ulcer patients. The following formula was used for the calculation;

$$n = \frac{Z^2_{1-\alpha/2}\left[2S_p^2\right]}{d^2}$$

$$S_p^2 = \frac{S_1^2 + S_2^2}{2}$$

S_1^2 - Standard deviation in the Laser therapy group (15 cm^2)

S_2^2 - Standard deviation in the therapeutic ultrasound group (20 cm^2)

α – Level of significance (5%)

d – Precision (3%)

Thus, the calculated sample is 267, Approximately 300.

The sample size was calculated based on the pilot study and was decided to recruit 100 in each group considering the number of subjects reporting to study center and any possible dropouts.

SELECTION CRITERIA: Inclusion Criteria was Subjects of either gender between age group of 20 to 80 years, Subjects suffering from venous ulcer, Subjects suffering from dermatitis, Subject willing to sign the informed consent. Exclusion Criteria was Subjects with tumours, Subjects with deep venous insufficiency, Metal Implants at the area of wound, Photo allergy,Burns, Tuberculous ulcers, History of long steroid therapy and

radiation (more than 6 months), Diabetic patients

PROCEDURE

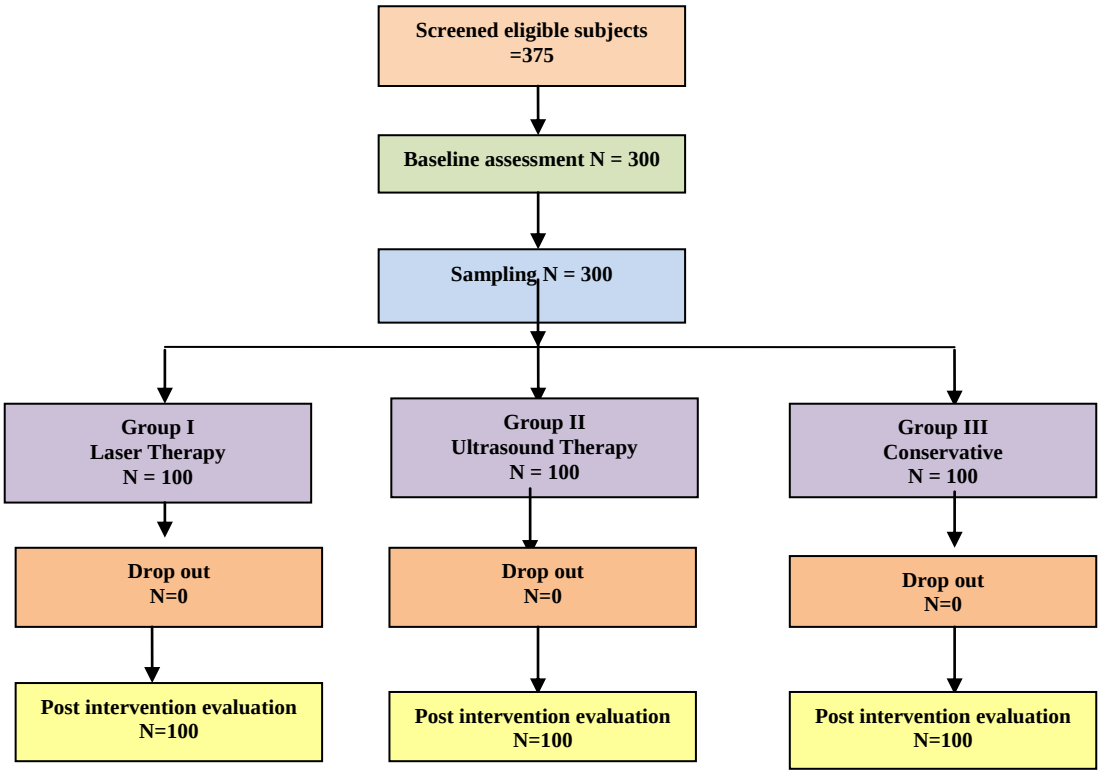


Fig 3: Participant flow chart

PARTICIPANTS: The study design was randomized controlled trial. A total number of 375 subjects were screened initially based on the inclusion and exclusion criteria and 300 subjects randomly divided into three groups of 100 each after obtaining informed consent from the subjects before starting treatment. The wound measurements were taken on the first day before the treatment, end of first week and repeated every week till at the end of the 4th week of treatment. Examination and testing of the equipment and leads were done prior to the treatment. Calibration of the equipments were done preceding the study and in at regular intervals. Patient was placed in a comfortable position depending on the area of venous ulcer. The parts to be treated were exposed while ensuring privacy to the patient. Prior to the study all the patients were seen by a physical therapist who is unaware of the study, who explained the need for physiotherapy in wound management. Preparation of the patients and equipments: Explain to the patient about the effect of therapeutic ultrasound, low level laser therapy and venous ulcer risk factors and preventions, Examination and testing of the equipment and leeds done prior to the treatment, Placed the patient in comfortable position depending on the area of venous ulcers, Ensured the privacy by covering the untreated part and with curtains, Exposed the ulcer part to be treated.

PROCEDURE FOR LOW LEVEL LASER THERAPY: Treatment guidelines are based on the amount of energy density delivered to a square cm of tissue surface. For open wounds with viable tissue, the "grid" technique is used. The base of wound is visually divided into square cm grids. Uses of any opaque substance to the wound area were avoided as this may screen out the laser energy. The Laser probe is held perpendicular to the centre on each square at the distance of 0.5 to 1 cm from the wound surface and is swept in the entire cm square in a circular motion. Each square cm of involved tissue is stimulated for 20 sec equally for effective coverage of entire

tissue surface. Laser therapy dosage: Wound margins were divided into 1 to 2 cm^2 areas and each square area treated. Type of Laser: Gallium arsenide (semiconductor IR Laser), Wavelength: 904nm, Power: 0.8 Joules/cm^2, Duration: 2 - 12 Mins (each grid 20 sec), Treatment protocol: 3 times a week for 4 weeks.

Fig 4: Laser therapy giving to ulcer area

PROCEDURE FOR THERAPEUTIC ULTRASOUND: Ultrasound treatment cannot conveniently be given over open wounds or over injured skin because there is a risk of transmitting infection and moving treatment head may cause further damage. To solve these problems, a polyacrylamide agar gel (solid sterile gel method) in a 3.3 mm sheet was used as a couplant. In a hydrated form, this material is solid in sterile packs and is used for wound dressing and over skin grafts. It is 96% water but impermeable to bacteria and is conveniently transparent. The flexible sheet, cut to an appropriate size, is placed over the open wounds with a little sterile saline water to ensure that there are no air bubbles between the gel sheet and the raw surface. The slightly wetted outside surface of the gel sheet will allow the treatment head to move smoothly over it. The gel has been found to transmit 95% of the applied ultrasound energy (Brueton and Campbell, 1987). Parameters used were Frequency: 3MHz, Mode: pulsed, Pulse ratio: 1:4, Intensity: 0.5 – 0.8 W/cm^2, Duration: 5 mins, Treatment protocol: 3 times a week for 4 weeks.

Fig 5: Therapeutic Ultrasound giving to the ulcer area

PROCEDURE FOR CONVENTIONAL EXERCISES: Conservative treatment and medical management include Elevation of affected limbs, Vertical leg drainage is a simple & valuable method of reducing & eliminating leg edema. The patients were advised to sleep with the legs elevated above the chest level to the horizontal plane by putting a vertical board at the end of the bed or pushing the bed against the wall. Passive movements to maintain the mobility of the foot and ankle for 5 - 10 Minutes thrice in a week for 4 weeks. A firm elastic bandage was applied spirally from the base of the toes up to the knee joint. While walking this bandage will alternatively stretch and relax and thus help in venous pumping. Effectual antibiotic (Pentoxifylline), Fibrinolytics (Stanzolol [6]) an analgesic (NSAIDs, Aspirin [7]), Cleansing and dressing were also given.

Fig 6: Elevation of leg on pillows with crepe bandage application

The areas of venous ulcers were traced by sterile transparency paper (cleaned with spirit). Reliability of wound measurement by using length and width shows ICC 0.962 according to Bryant et al. [8, 9] The area of venous ulcer will be measured by maximum length and width measurement with ruler, and by digitizer. Tracing wounds on clear plastic film provides a valuable option for recording wound surface area. [10, 11] All the subjects were evaluated for the wound measurement before starting of the treatment. Post outcome measurements were done at the end of 1st, 2nd, 3rd and 4th weeks. The changes in the variables were analyzed statistically and observations and conclusions will be made accordingly.

STATISTICAL ANALYSIS

Only the patient ID code was used to identify patients on all data recording forms. The principal investigator kept patients information confidential including his/her name, phone numbers, subject code and consent form in a file,that was separate from the data recording forms. The principal investigator entered the available data and verified the entered data once a week on their own laptop, which has a password not known to anyone other than him. It was the responsibility of the principal investigator keep the data secured at all times. The data were entered into Microsoft Excel and were coded into SPSS software (IBM SPSS Version 21.00).

Using SPSS software, the principal investigator first described the demographic, pre and post measurement values of each group using frequency, percentage, means and standard deviations for all variables. Researcher used parametric and non parametric tests based on the outcome measure used. Researcher tested the homogeneity of variance of the data at baseline and significant differences of pre intervention and post intervention data for the three groups using Analysis of Variance (ANNOVA) test for each continuous variable and Bonferroni test (Bonferroni Correction) for multiple comparison. Repeated Measures of ANOVA and Friedmann ANOVA was used for between and within group comparison. One way ANOVA and Chi-Square was used to study the difference in age and gender with respect to treatment. Mann Whitney U test was used to compare the pain difference between the groups. An overall significance level was maintained at $p<0.05$.

RESULTS

In this study base line assessment was done on 375 subjects and after discounting dropouts, the final outcome was measured from 300 subjects. The mean age of the population ranged from 39.91 – 65.19 (Table 2). There were total 175 males and 125 females (Table 1).The mean wound size before the intervention was 32.34 cm^2, at the end of the 4th week the size was reduced to 29.24 cm^2. It indicates the treatments were effective for venous ulcer healing (Table 3).

In Laser Therapy group initial wound size was 33.81 cm^2 and it reduced to 27.27 cm^2 at the end of 4th week. Thus the mean difference was 6.54 cm^2. In Ultrasound Therapy group initial wound size was 35.11cm^2 and it reduced to 33.04cm^2 at the end of 4th week. Thus the mean difference was 2.07 cm^2. In Conservative treatment group initial wound size was 28.4 cm^2 and it reduced to 27.4cm^2 at the end of 4th week. Thus the mean difference was 1 cm^2. Since the mean difference is high in Laser treatment (6.54 cm^2) and is more effective comparable to other treatments (Table 4).

Intensity of pain before the intervention and at the end of 4th week was measured by using Visual Analogue Scale (VAS). In Laser therapy group initial pain intensity was 8.24 ± 0.75 and it reduced to 3.24 ± 0.75 at the end of 4th week. In Ultrasound therapy group initial pain intensity was 8.41 ± 0.75 and it reduced to 5.56 ± 0.65 at the end of 4th week. In conservative treatment group initial pain intensity was 8.57 ± 0.55 and it reduced to 7.59 ± 0.55 (Table 5).

The mean pain difference in the Laser therapy group was 5.00 ± 0.00 at the end of 4th week. In Ultrasound therapy group pain difference was 2.85 ± 0.43 and in conservative therapy group was 0.98 ± 0.14 (Table 6). Thus the pain difference shows significant difference between each treatment method and Laser therapy was best among that.

Table 1: Gender wise distribution of subjects

Group (n=300)	Gender		Chi-Square	P Value
	Male	Female		
Laser Therapy	58	42	0.027	0.986
Ultrasound Therapy	59	41		
Conservative Management	58	42		

Table 2: Distribution of age with respect to the treatment

Age (n=300)	Mean	Standard Deviation	Standard Error	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
Laser Therapy	51.31	12.76	1.28	48.78	53.84
Ultrasound Therapy	50.34	13.63	1.36	47.64	53.04
Conservative Management	55.99	10.75	1.08	53.86	58.12
Total	52.55	12.64	0.73	51.11	53.98

F Value = 5.899, P Value = 0.003 (Tukey Test). Laser Vs Conservative P Value = 0. 22, Laser Vs Ultrasound P Value = 0. 846, Ultrasound Vs Conservative P Value = 0.004

Table.3: Difference in Wound size at the end of each week (Irrespective of treatment)

Wound Size (cm^2)	Mean	Standard Deviation
Before Treatment	32.44	23.61
1st week	31.50	23.35
2nd week	30.71	23.03
3rd week	29.95	22.82
4th week	29.24	22.67

P Value < 0.05 hence there is an improvement in wound healing.

Table 4: Intra group comparison of wound size

Group (n=300)	Wound Size (cm^2)	before Rx	1st week	2nd week	3rd week	4th week
Laser	Mean	33.81	32.06	30.42	28.67	27.27
	Median	27.75	25.50	23.75	22.00	20.00
	Std. Deviation	18.73	18.28	17.61	17.08	16.73
	Inter Quartile Ratio	13.00	14.00	12.75	10.75	10.00
Ultrasound	Mean	35.10	34.47	33.98	33.64	33.03
	Median	23.50	22.75	22.50	22.00	22.00
	Std. Deviation	25.63	25.26	24.84	24.52	24.32
	Inter Quartile Ratio	17.87	17.88	17.88	16.87	17.06
Conservative	Mean	28.39	27.97	27.71	27.51	27.40
	Median	18.00	17.00	17.00	16.00	16.00
	Std. Deviation	25.48	25.53	25.57	25.65	25.66
	Inter Quartile Ratio	21.75	21.25	20.87	21.25	21.25

Friedmann ANOVA P value <0.001 and Krusal Wallis P value <0.001

Table 5: Between the group comparison of pain (VAS Score)

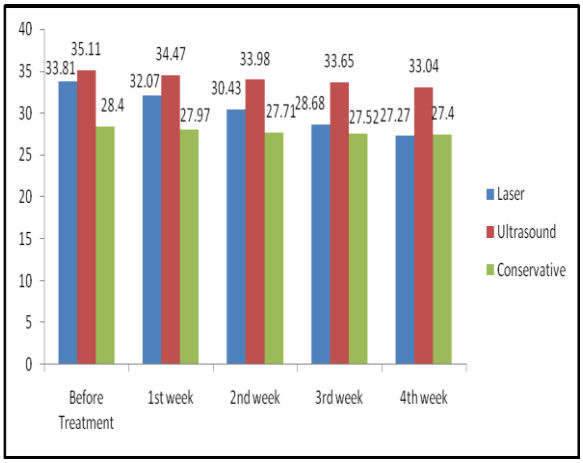
Group (n=300)		VAS_Pre	VAS_Post
Laser	Mean	8.24	3.24
	Median	8.00	3.00
	Std. Deviation	0.75	0.75
	Inter Quartile Ratio	1	1
Ultrasound	Mean	8.41	5.56
	Median	9.00	6.00
	Std. Deviation	0.75	0.65
	Inter Quartile Ratio	1	1
Conservative	Mean	8.57	7.59
	Median	9.00	8.00
	Std. Deviation	0.55	0.55
	Inter Quartile Ratio	1	1

Laser vs Ultrasound P= <0.001, Ultrasound vs Conservative P =<0.001, Laser vs Conservative P=<0.001 (Mann Whitney U test)

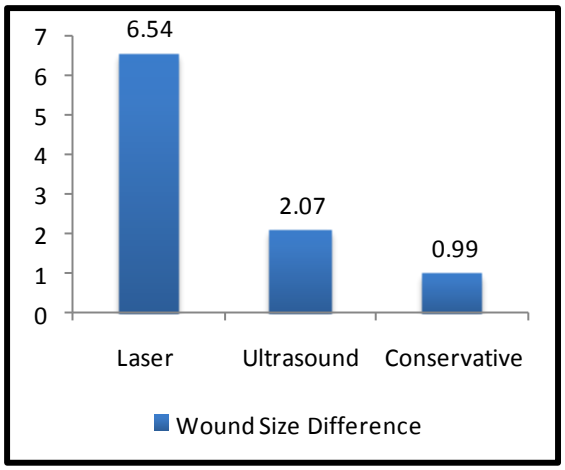
Table 6: Pain Difference (VAS Score) in each group

Group (n=300)	Variable	Mean ± Std. Deviation
Laser	Pain (VAS) Difference [Pre – Post]	5.00 ± 0.00
Ultrasound		2.85 ± 0.43
Conservative		0.98 ± 0.14

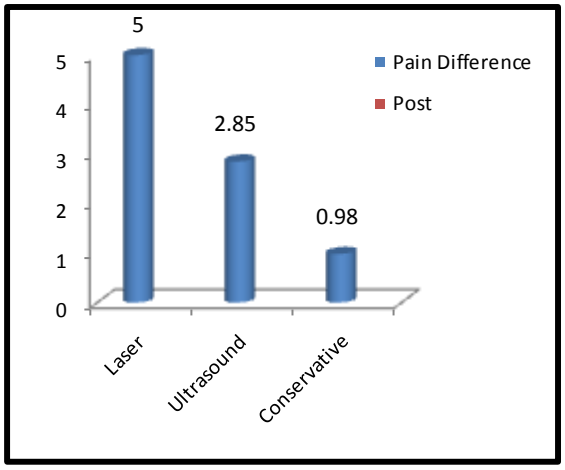
Kruskal Wallis P value <0.001



Graph 1: Pre and post intervention wound size in each group



Graph 2: Pre and post intervention wound size difference in each group



Graph 3: Pre and post intervention pain intensity in each group

DISCUSSION

The aim of this study was to study and compare the effectiveness of Low Level Laser Therapy, Therapeutic Ultrasound and Conservative Management in treating Venous Ulcers. Present study showed a change on wound size in the Laser therapy group from baseline 33.81 ± 18.73 to 4th week 27.27 ± 16.74, in Ultrasound group 35.11 ± 25.63 to 33.04 ± 24.32 and in Conservative treatment group from 28.40 ± 25.49 to 27.40 ± 25.67 respectively.

Intra group comparison of wound size in Laser therapy, Ultrasound therapy and conservative treatment by using repeated measures of ANOVA results suggesting that all three treatment methods are equally effective in reducing venous ulcer size (P < 0.001). The post intervention effects comparison of Laser therapy Vs Ultrasound therapy (P = 0.51), Laser therapy Vs Conservative treatment (P = 0.69) and Ultrasound therapy Vs Conservative treatment (P = 0.13) by using Tukey test evidencing that there is no significant difference between all three treatment methods. Friedmann repeated measures of ANOVA P = <0.001 and hence there was a difference in median of wound size.

The study also showed a difference on pain intensity in the Laser therapy group from 8.24 ± 0.75 to 3.24 ± 0.75, in Ultrasound group 8.41 ± 0.75 to 5.56 ± 0.65 and in Conservative treatment group 8.57 ± 0.55 to 7.55 ± 0.55 respectively.

Intra group comparison of each treatment in reduction of pain by using Kruskal Wallis test suggesting that all the three treatment methods are effective in reducing pain (P <0.001). But the pain difference in Laser group was more than Ultrasound and conservative group (5.00 ± 0.00, 2.85 ± 0.43 and 0.98 ± 0.14)

Physical therapy such as Infrared, Ultrasound, Laser, Active exercises includes in the execution of venous ulcers. However, incompatible verdict have been reported in some studies and some explorations found no treatment effect on an accelerating repair of wounds (Huseyin et al., 2004). Laser therapy has been studied in wound healing: presently Laser is used for open wounds, grafts, incisions, diabetic ulcers, lacerations and burns (Huseyin et al., 2004).

The exact biochemical components hidden the restorative impacts of low level laser therapy are not yet settled. Low level laser therapy can be worthwhile in light of the fact that its restorative window for calming activities covers with its capacity to enhance tissue repair and capacity of low level laser therapy to advance tissue repair in a dosage subordinate manner.

The result of this study correlates with previous study results of Canan Tikoz et al (2009); [(12)] stated that fibroblasts and collagen were found to be augmented in the Laser group on the end of 7th, and angiogenesis was found to be extensively

boost in the Laser group on the 15th day and Franck Marie et al (2010); [13] affirmed that for superior outcome of Laser, increased population size and frequency of treatment may help in reduction of ulcer size.

The result of this study also supports the findings from other studies, John Low and Reed (2000) avowed that LLLT will stimulate collagenogenesis, fibroblast generation and DNA synthesis activity and Aymann Nassief et al (2002) [14] confirmed that LLLT has an Anti inflammatory effect. The evidence from this study also shows that the 4 weeks of treatment duration was not sufficient enough to produce complete healing of venous ulcers.

Yong et al tested the response of macrophage like cells to laser irradiation and non coherent light. [15] They found ulcers that appear to plateau in their healing process respond favorably to a change of pulse repetition rate from 5000 to 16pps until healing is complete or the next plateau occurs. This might was favored in our study to get more effective result in reduction of ulcer size.

Low level laser therapy has an extensive variety of impacts at the atomic, cell, and tissue levels. The three fundamental components by which laser produce pain relieving impacts are accepted to be: animating endogenous opoids discharge, lifting pain limits, and adjusting the arrival of harmful go betweens, for example, bradykinin and histamine. pain reduction might likewise happen because of changes in nerve conduction speed and change in the limit for myelin creation.

Low level laser therapy backs off the transmission of agony signs through the autonomic sensory system, manages serotonin and nor epinephrine, and expansions the torment edge. Inside of the cell, there is solid proof to propose that low level laser therapy follows up on the mitochondria to build adenosine tri phosphate (ATP) creation, adjustment of responsive oxygen species (ROS), and the affectation of interpretation elements. These interpretation variables cause protein union that triggers an expanded cell multiplication and movement, balance in the levels of cytokines, development elements and incendiary middle people, and expanded tissue oxygenation. Low level laser therapy is additionally utilized for irritation, edema, swelling, and tissue healing. Low level laser therapy application is accepted to restrict the arrival of incendiary arbiters, for example, bradykinin and histamine, diminishing the provocative reaction. Notwithstanding, it has been unequivocally conjectured that a lessening in prostaglandin action amid the provocative procedure is the principle mitigating impact of laser incitement. Prostaglandins cause vasodilatation at the site of aggravation, encouraging invasion of incendiary cells to the encompassing tissue. Concentrates on have demonstrated that an abatement in prostaglandin movement because of laser incitement might advance healing.

The issue of significant thermal change is controversial, although some studies concluded that the low level laser does not produce significant tissue temperature changes. A wide variation exists in recommendations for the optimal energy for different conditions; the usual ranges are from 0.5 to 10 J/cm^2. Generally, a laser wavelength of 600 to 984 nm is used in physical medicine and the laser wavelength of 632.8 nm He Ne and 904 nm Ga As are most frequently used in venous ulcer healing. Therefore we have used the semiconductor infrared radiation source with wavelength of 904 nm and power of 0.8 J/cm^2. The result of this study also supports the other studies.

Low level laser therapy causes vasodilatation by setting off the unwinding of smooth muscle connected with endothelium, which is very pertinent to the treatment of joint irritation. This vasodilatation [16] expands the accessibility of oxygen to treated cells, furthermore takes into account more noteworthy activity of safe cells into tissue. These two impacts add to quickened healing.

At the most fundamental level, Low level laser therapy acts by prompting a photochemical response in the cell, a procedure alluded to as biostimulation or photo biomodulation. [17] At the point when a photon of light is consumed by a chromophore in the treated cells, an electron in the chromophore can get to be energized and hop from a low-vitality circle to a higher-vitality circle. [18] This put away vitality can then be utilized by the framework to perform different cell assignments. There are a few bits of proof that indicate a chromophore inside mitochondria being the underlying focus of low level laser therapy. Radiation of tissue with light causes an expansion in mitochondrial items, for example, ATP, NADH, protein, and RNA, and additionally an equal growth in oxygen utilization, and different in vitro tests have affirmed that cell breath is up regulated on treatment with Low level laser therapy. [18]

Erikson et al showed no benefit treating with ultrasound twice weekly at 1 MHz with a continuous spatial average intensity of 1.0 W/cm^2. Whereas Dyson et al showed significant benefit treating ulcers 3 times weekly at 3 MHz with an intensity of 0.20 W/cm^2 (1:4 pulse ratio) and our study is much towards the results of Dyson et al.

Wounds often present a general and, possibly large scale, problem for physical therapists, particularly chronic wounds such as diabetic ulcers. For many chronic wounds, prevention and early intervention can potentially reduce the scale of the problems. [19] Any open wounds, chronic or otherwise, can create a pathway for an antigen, negatively influences ADL, complicate physical rehabilitation, and result in scar formation that influences the ultimate fate and strength of the resolved tissue. [20]

Although physical modality agents are commonly thought of in musculoskeletal and pain management, more recent evidence suggests these modalities can also accelerate wound healing, although guidelines remain unclear to clinical application.

In addition to the diabetic ulceration, clinicians may be presented with a myriad of wounds such as abrasions, blisters, lacerations and post-surgical incisions and both scar formation and the presence of infection can have an impact on treatment and healing. Physical therapists faced with treating patients with open wounds have several treatment options.

Physical therapists are on the front lines of wound management in many healthcare settings, and treat patients during the most critical stages of wound care and healing. They possess in depth knowledge of anatomy and tissue healing as well as mobility and positioning expertise.

All wounds heal at different rates and the duration of therapy will be based on the patient's individual needs. Depending on the type of wound and amount of care needed, the patient may be seen as often as daily in the hospital and one-three times a week in the physical therapy departments. The duration of treatment can vary from one-several months. [21, 22] The physical therapist will work with medical team to adapt treatment to maximize wound healing.

When dealing with the challenge of healing chronic wounds, one can't be a short-term thinker, especially in regard to the cost of different interventions. Many chronic wounds have an increased healing time because the basics of wound healing haven't been addressed, including effectively treating the cause of the wound; managing the bio-burden; managing exudates; promoting appropriate moist wound therapy, efficient removal of the necrotic burden, and appropriate nutritional interventions; and ensuring good tissue perfusion. [23, 24]

The ineffective and inefficient addressing of the basics of wound healing can be attributed to a lack of education and knowledge of current wound care approaches among clinicians. A proactive rehab team can address many of these basic factors and essentially increase the speed at which wounds will heal, thereby lowering the overall costs of wound care, because the

longer the healing time, the higher the cost to the facility.

A thorough evaluation of the patient and all wounds is imperative prior to administering treatment. Assessing patient's musculoskeletal function, mobility, and strength is unique to physical therapist expertise, and findings frequently reveal compromises or losses in one or all areas. Afflictions that often interfere with patient function, mobility, and strength include but are not limited to co-morbid conditions such as diabetes; renal failure; peripheral arterial disease; venous insufficiency; spinal cord injury; as well as aging.

Physical therapists can make a critical difference in wound healing since scar tissue, tendon or bone may often be involved. Deciding whether to mobilize or immobilize the area can make a profound impact in the patient's functional ability long after the wound has been closed.

CONCLUSION

After the end of 4th week wound size and pain reduction was seen in irrespective of treatment along the three groups, and all are helping in treatment of venous ulcers. We didn't find any significance in wound size and pain reduction on each group statistically but clinically there is significant changes observed (since mean difference in wound size and pain pre and post intervention is more) in patients treated with Low Level Laser Therapy. From the result of the study we observed that the Low Level Laser Therapy is found to be relatively better than the Therapeutic Ultrasound and the Conservative management of venous ulcer.

LIMITATIONS: Four weeks of treatment duration was not sufficient enough to produce complete healing of venous ulcers, Influence of pharmacological interventions.

SCOPE FOR THE FURTHER WORK: Standardization of treatment interventions using more parameters of outcome measurement, Usage of other investigations for the knowledge of results like cellular contents, granulation tissue formation and collagen deposition which give better and more significant results, Exclusion of drug and further study needs to complete.

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