Effectiveness of Ultrasound Versus Low Level Laser Therapy for Diabetic Foot Ulcer

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ABSTRACT

Introduction and Aim: To determine the effectiveness of Ultrasound therapy (UST) versus Low-level laser therapy (LLLT) for a diabetic foot ulcer. To determine the size of the wound with acetate tracing after the application of Ultrasound therapy. To determine the size of the wound with acetate tracing after the application of Low-level laser therapy. To determine the quality of life of patients with diabetes with ADFU after the application of Ultrasound therapy and low-level laser therapy.

Materials and Methods: 40subjects with diabetic foot ulcers based on the inclusion and exclusion criteria were assessed these include subjects above the age of 35, ulcer without infections, ulcers grade 2 based on Waggner grading. They are divided into two groups by Odd and Even method. Group A content of 20 participants, received ultrasound therapy for 4weeks, 6days/week and group B content of 20 participants, received low-level laser therapy for 4weeks, 6days/week. Outcome measures were taken at the baseline and after 4weeks of the treatment protocol.

Results: This research work states that group B which received LLLT (40.65 SD 13.5) showed significant improvement in wound contraction in comparison with the group-A which received UST (44.15 SD 14.5). Hence from the above results, it was proved that LLLT is a more significant and effective method for diabetic wound healing

Conclusion: From the result, it has been concluded that LLLT is more effective than UST in decreasing the healing time and improving the quality of life.

Key Words: Diabetic ulcer, Direct contact method, Ultrasound therapy, Low-level laser therapy, Sterile ultrasound gel.

INTRODUCTION

In twenty-first-century diabetes mellitus is the most common disease outbreak in India with the incidence of 69.2 million (8.7%) among the total population in the year of 2015 (1). But it was estimated to be 62 million in the year of 2014 (2) it seems to be an epidemic proportional increase with the people affected by 2014-15. Diabetes mellitus is caused due to impaired glucose tolerance by the body. One of the major complications of diabetic patients is diabetic foot syndrome otherwise known as diabetic foot ulcer which is often the main cause for non-traumatic foot amputation. This is the most common health issue faced by an enormous number of people worldwide.

Diabetes mellitus is a condition which increases the blood glucose level due to reduced insulin production by the pancreas or it can also be due to reduced absorption of insulin by the body which leads to the damage of the endothelial cells. These cells are responsible for various inflammatory actions of the cells (3). If these cells are damaged the process of

wound healing stops in the inflammatory phase and cell proliferation does not take place which leads to worsening of the wound and also causing delayed wound healing leading to non-healing chronic ulcers. Ultrasound and low-level laser therapy help in the proliferation of these cells thereby helping in healing.

These ulcers are the main cause of morbidity and expense. There have been several surgical and conservational procedures being followed to treat these ulcers. But still healing of ulcers seems to be difficult. Medical management includes, cleaning of the wound, wound debridement, skin grafting, antibiotics, vasodilators, bandaging and pain management.

In physiotherapy, many studies have been conducted and stated that ultrasound and low-level laser therapy can be given to enhance the healing process of the wound. It is also a non-invasive painless technique hence any patient can undergo and it also helps in avoiding surgery. It is of low cost and easily available anywhere hence patient of any status can undergo this technique.

Ultrasound therapy is being used since 90s (3) by physical and other therapists for various purposes like pain control, tissue heating, placebo effect, etc., so many studies have been conducted and concluded that ultrasound therapy also helps in tissue repair (4) by means of increasing the cell proliferation and microcirculation in the affected wounds.

Low-level laser therapy also known as low-intensity laser or soft laser is known to supply direct biostimulative light energy to body cells. The absorbed laser energy causes a stimulatory effect on molecules and atoms of the body cells (5). Hence it increases the cell proliferation process thereby reducing the size of the wound.

MATERIALS AND METHODS

A Quasi-experimental study was conducted at Saveetha Medical College and Hospital. Scientific review board approval and ethical committee approval was obtained prior to the study. Following the ethical clearance, the data collection procedure was initiated. The detailed procedure was clearly explained to the patient by providing an information sheet and written informed consent was taken from all the participants. A Consecutive sampling technique used to allocate the participants equally into two groups by lottery method.

40subjects with diabetic foot ulcers based on the inclusion and exclusion criteria were assessed these include subjects above the age of 35, ulcer without infections, ulcers grade 2 based on Waggner grading.

They are divided into two groups by Odd and Even method. Group A content of 20 participants, received ultrasound therapy for 4weeks, 6days/week and group B content of 20 participants, received low-level laser therapy for 4weeks, 6days/week. Outcome measures were taken at the baseline and after 4weeks of the treatment protocol.

IFT: Frequency -1MHZ, Intensity-1W/cm2, Duration -based on ulcer area (6cm2=6minutes), Sessions -6days/week (1session/day for 4weeks)

Low Level Laser Therapy: Wavelength -632.8Nm, Duration-80secs, Energy -4J/cm2

Frequency- 5000Hz, Height-10cm, Sessions -6days/week (1dsession/day for 4weeks)

RESULTS

From statistically analysis made with quantitative and qualitative data revealed a statistically significant difference between the Group A& Group B and also within the group.

The post mean value of ACETATE TRACING in group A is 37.3 and, in the group, B is 25.9. This shows that the SIZE of the wound has significantly reduced in group B.

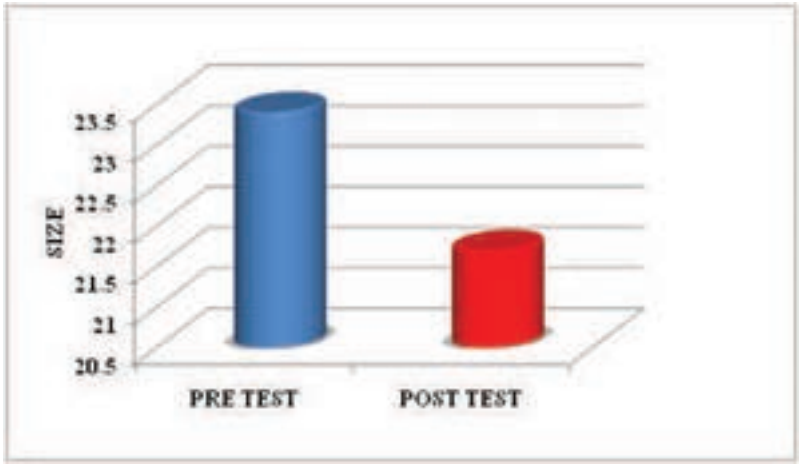
The post mean value of DFS score in group A IS 66.80 and that of group B is 69.95. This shows that the DFS score is comparatively higher in group B than group A.

Hence from the above statistical analysis, it has been proved that LLLT is an effective modality in treating a Diabetic foot ulcer.

Table 1: Pre test –Post test values of group –A

Group A	Test	Mean	Standard deviation(SD)	T value	P value
SIZE(Acetate tracing)	Pre test	23.4	8.3	8.3	< 0.0001
	Post test	21.7	8.7		
DFUS	Pre test	62.9	12.7	11	< 0.000.1
	Post test	66.8	13.1		

Graph 1: Graph showing pre and post test acetate tracing values of group-A



Graph 2: Graph showing pre and post test DFUS values of group A

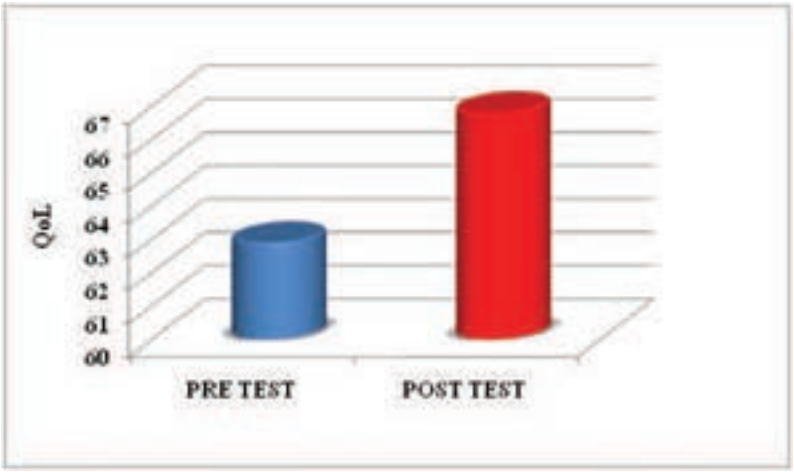
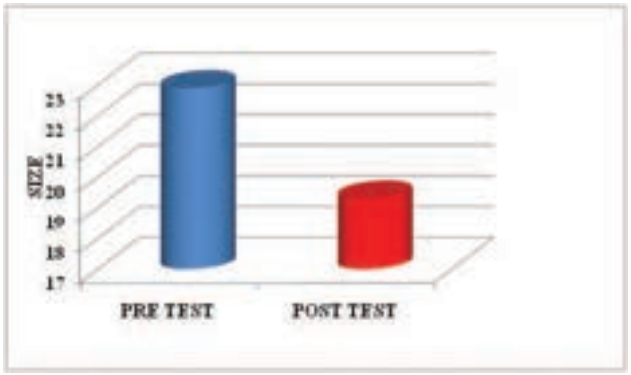


Table 2: Pre test –Post test values of group –B

Group A	Test	Mean	Standard deviation(SD)	T value	P value
Size(Acetate tracing)	Pre test	22.9	7.8	8.3	<0.0001
	Post test	19.3	7.6		
DFUS	Pre test	64.35	12.93	12.05	<0.0001
	Post test	69.95	13.75		

Graph 3: Graph showing pre and post test acetate tracing values of group-B



Graph 4: Graph showing pre and post test DFUS values of group-B

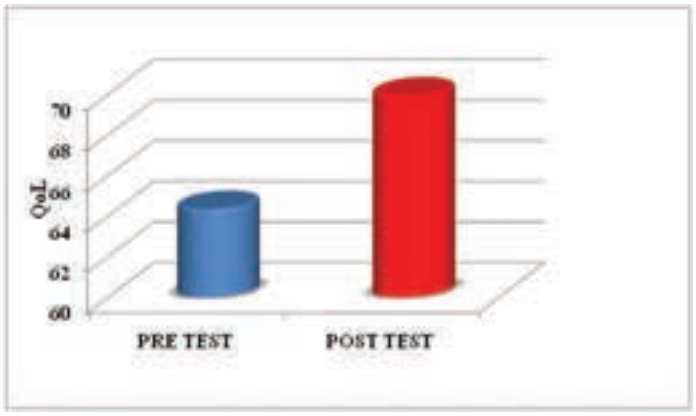
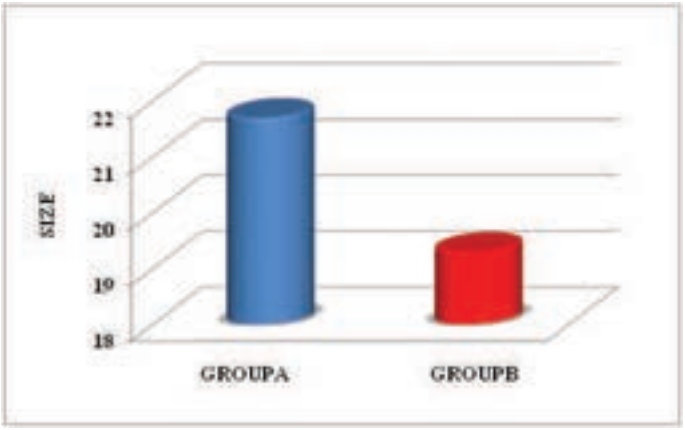


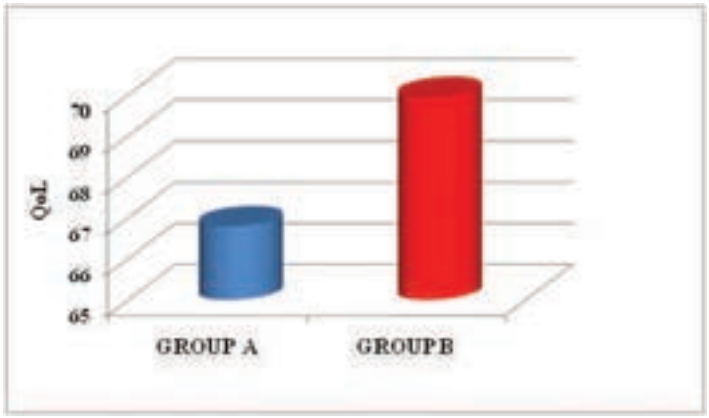
Table 3: Comparison between the post test values group A and group B.

Group A&B	Test	Mean	Standard deviation(SD)	T value	P value
SIZE(acetate tracing)	Post test Group-A	21.7	8.7	8.7	<0.0001
	Post test Group-B	19.3	7.6		
DFUS	Post test Group-A	66.80	12.93	11.06	<0.0001
	Post test Group-B	69.95	13.7		

Graph 5: Graph showing post test-post test Acetate tracing values of group- A and group B



Graph 6: Graph showing post test-post testDFUS values of group- A and group –B



DISCUSSION

A diabetic foot ulcer is a major healthcare problem faced by patients with diabetes. It is the main cause of morbidity expense and non-traumatic foot amputation. The healing process of the wound is arrested in the inflammatory stage itself due to the destruction of epithelium the cell proliferation and granulation stops thus leading to chronic non-healing foot ulcers (6).

Many types of research have been conducted regarding the healing process and stated that UST and LLLT used in the field of physiotherapy helps in increasing the tissue granulation thus helping in wound healing.

Krzysztof goralthczyk et al in 2016 formulated that the damage caused to the endothelium can be corrected by LLLT and they also concluded that LLLT increases the cell proliferation process thereby contracting the size of the wound.

Bakthi et al in 2011 studied the effects of ultrasound delivered at high frequency and low doses for a period of weeks resulted in reduced ulcer area and had a positive healing effect on the wound.

As of now, it has been formulated that both ultrasound and the low-level laser is effective in wound healing. But there have been no comparisons made between these two modalities to show which helps in healing faster and better. In addition, the studies conducted previously have used water bag method in ultrasound therapy as per evidence it has been stated that the water bag method has no much effect (7).

Hence in my study, I have used direct contact method of ultrasound therapy by means of using a sterile ultrasound gel as coupling medial and sterilizing of ultrasound head is also done before and after the treatment session in order to avoid infection of the wound.

It is to be noted that previously the size of the wound is being measured with either inch tape or digital planiometry which is not goal standard and of costlier too. It cannot be affordable and made available in all clinical setups (8).

Hence Joseph E grey et al 2006 concluded that acetate tracing method can be considered as the standard manual method of measuring the wound size. It is important to measure the size of the wound to know about the progression of healing and the effect of treatment.

So, in this study, this standard manual method of wound measuring (ACETATE TRACING) which is affordable to all clinical setup is used.

Linda Abetz et al 2002 came to an end that DFS discriminate between patients with diabetes with healed and non-healed ulcers, is sensitive to changes in wound status and is therefore appropriate for use in clinical trials of patients with a diabetic foot ulcer.

The above scale to measure the quality of life of patients is also used in this study to analyse the progression of treatment thereby how it improves the functional ability of these patients.

By having these two outcomes that are size and quality of life we can able to say that treatment is effective in improving the physical ability by decreasing the size and also it improves functional and psychological ability in patients with a diabetic foot ulcer.

CONCLUSION

From the result, it has been concluded that group B which received low-level laser therapy has shown a significant reduction in the size of the wound. The quality of life of patients in group B has been markedly increased. Hence it can be formulated that low-level laser therapy is an effective modality in the treatment of diabetic foot ulcer thus reducing the expense and morbidity rate of patients

Conflict of Interest: There is no conflict of interest from other author.

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