



RESEARCH ARTICLE

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A COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF INFRA RED RADIATION AND INSULIN DRESSING IN HEALING OF DIABETIC ULCER FOOT IN A SELECTED HEALTH CARE SETTING-TAMILNADU

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ABSTRACT

Diabetes is the common health problem in worldwide, diabetes may begin at the early ages and it affects both the gender. Undetected or untreated diabetes leads to multisystem complications. One among the major visible complication is diabetic ulcer foot. This study assessed compared and evaluated the effect of infra-red radiation application and insulin dressing in the healing of diabetic foot ulcer and also studied the influence of extraneous variables. The study was conducted at selected medical college hospital, Kanchipuram district, Tamil Nadu-India. In a pre-experimental pre test post test design 150 diabetic clients with foot ulcer were included as samples. 75 ulcer feet were treated with Infra-red radiation and 75 were treated with insulin dressing for 10 days. Modified Bates-Jensen wound assessment tool was used to assess the wound size and depth. The pre test wound mean scores were 51.50 and 50.24 respectively in the infra-red radiation and insulin dressing groups. The post test mean scores were 20.32 and 24.25 respectively in the infra-red radiation and insulin dressing groups. The paired t values were 68.3 in the infra-red radiation group and 45.3 in the insulin dressing group. The F value was 60.7, the study concluded that both the interventions had significant role in the healing of diabetic ulcer foot but infra-red radiation was more effective than insulin dressing.

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INTRODUCTION

Diabetes is a common medical condition that affect worldwide. It may begins around twenty years of age and become more prevalent when age get advances. Diabetes has been detected more in urban population but undiagnosed diabetes is most common in the rural people. In India, one in two people has diabetes; approximately ninety two million of Indian may get diabetes in the year 2035. International Diabetic Federation 2013 statistics revealed that, more than 387 million people had diabetes, the number of people with diabetes was increasing in every country, half of people with diabetes are undiagnosed, 4.8 million people died due to diabetes. Indian diabetes foundation said that India is the home to the second highest number of people living with diabetes in the world after China. Today there are over 45 million people grappling with this disease and the numbers showed no signs

of reduction in the incidence. India will be the capital of diabetics in the year 2025. It will jump 25 million to 57 million in 2025. "World Health Organization" says that diabetic foot syndrome is ulceration of the foot distally from the ankle and including ankle associated with neuropathy and different grades of ischemia and infection. Neuropathy is a major complication of diabetes, it tend to develop in stages. In the final stage client does not perceive pain this leads to exposure to major foot ulcer, infection and compromised blood supply further reduces the wound healing. Statistics shows that twenty five percent diabetic people develop diabetic ulcer foot in the later stage. Fifty percent diabetic population develops infection and need hospitalization in their lifetime. One out of five diabetic people is prone to get amputation. In India roughly 40000 limbs are amputated every year. There are many experimental trials to treat and heal the diabetic ulcer foot.

This study tried to compare two different treatments to repair the diabetic ulcer foot.

Statement of the Problem: A comparative study to assess the effectiveness of Infra Red Radiation and Insulin Dressing in healing of diabetic ulcer foot in a selected health care setting-TamilNadu.

Objectives

- To assess the pre-test condition of diabetic ulcer foot among patients with diabetes mellitus
- To evaluate the effectiveness of infra red radiation application and insulin dressing in healing diabetic ulcer foot among patients with diabetes mellitus.
- To compare the effectiveness of infra red radiation with insulin dressing in healing of diabetic ulcer foot among patients with Diabetes mellitus.
- To associate the effectiveness of intervention in healing of diabetic ulcer foot with the selected demographic variables.

Assumption

- Application of infra red radiation and insulin dressing may improve healing the diabetic ulcer foot.
- Infra-red radiation and insulin dressing may have different impacts in healing of diabetic ulcer foot.

Hypotheses

- H₁ -There will be significant improvement in healing of diabetic ulcer foot with the interventions.
- H₂ - There will be significant difference between healing of diabetic ulcer foot with infrared radiation and insulin dressing.
- H₃ - There will be significant association of post test score of diabetic ulcer foot among clients with diabetes mellitus.

RESEARCH METHODOLOGY

Research Approach and Design: In this study evaluative approach, quasi-experimental pretest-post test design was utilized.

Group	O ₁	×	O ₂
Diabetic foot ulcer clients 25years age and above were divided in to two groups.	Diabetic ulcer foot assessed by Bates Jensen wound assessment tool	Group-I, Infrared radiation application Group-II, Insulin dressing	Post test assessment by Bates Jensen wound assessment tool

O₁- Observation before the treatment

×- Treatment

O₂ – Observation after the treatment

VARIABLES

Independent Variable: In this study independent variables are Infrared radiation and Insulin dressing.

Dependent Variable: In this study dependent variable was healing of Diabetic ulcer foot.

Demographic Variables: Age, sex, religion, education, occupation, monthly income of the family, marital status, sources of information on diabetes, duration of Illness, dietary pattern, residential area, family history of diabetes mellitus and foot ulcer duration.

Setting of the Study: The study was conducted in Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research Hospital (MAPIMS), Melmaruvathur, Kanchiipuram district, Tamilnadu.

Population

Target Population: In this study target population comprises of all the clients with diabetic foot ulcer in Tamil Nadu.

Accessible population: In this study accessible population comprises of all the diabetic clients with foot ulcer attended in outpatient department and admitted in surgery ward at MAPIMS.

Sample: In this study samples are the clients who fulfilled the sampling criteria.

Sample Size: The researcher had included 150 samples for the study. 75 samples were allocated for Insulin dressing and 75 samples for Infrared radiation group. Sample size was calculated by using power analysis.

Sampling Technique: Non probability consecutive sampling technique was used to select the samples.

Criteria for Sample Selection

Inclusion Criteria

1. Client should had diabetic foot ulcer and ulceration in subcutaneous tissue
2. Client who was willing to participate in the study.
3. Client who was able to speak or understand Tamil
4. Client who had attended in surgical outpatient department and admitted in surgical ward with foot ulcer.

Exclusion Criteria

1. Client with mental disturbances
2. Client with allergic history and other complications.
3. Client having diabetic foot ulcer with involvement of bone and arteries

Development and Description of the Tool: The structured questionnaire and modified wound assessment tool was used for this study.

Section A: Demographic Variables

It consists of age, sex, religion, education, occupation, monthly income of the family, marital status, sources of information on diabetes, duration of Illness, dietary pattern, residential area, family history of diabetes mellitus and foot ulcer duration.

Section B: Modified Bates-Jensen wound assessment tool

It consists of size, Depth, Edges, undermining, necrotic tissue type, necrotic tissue amount, exudates type, exudates amount,

skin color surrounding wound, peripheral tissue edema, peripheral tissue induration, granulation tissue and epithelization.

Score 60-15 wound degeneration
< 14 wound regeneration

The wound healing score was 13 out of 65

Score Interpretation

The obtained data were interrelated by the following procedure
Score Interpretation = Obtained score \times 100 / total score

<50% good
51%-75% fair
>75% poor

Content validity of Tool: The tool was validated by various experts from Nursing, Diabetology, General Surgery and General medicine. Modified Bates-Jensen wound assessment tool to assess the wound.

Reliability: The reliability of the tool was determined by using split half technique and the "r" value was 0.88 the tool was considered highly reliable.

Procedure for data Collection: Considering all the ethical aspects of the study informed consent was obtained from the study participants. Total of 150 diabetic ulcer foot clients were utilized by using consecutive sampling technique those fulfilled the sampling criteria. Pre test was done by using Bates-Jensen wound assessment tool. Each assessment took around 30 minutes; Intervention was started on the same day.

Infra red Radiation Application: After wound assessment, wound was cleansed and exudates were removed Clients were kept in comfortable position and infra red lamp was placed 18 inches away from the foot ulcer, foot ulcer was exposed by infrared radiation for the 15 minutes then saline dressing was done. Infra red radiation was done for the period of ten days. Post assessment was done on tenth day by using the same tool.

Insulin Dressing: After wound assessment, wound was cleansed and exudates were removed. 10 units of regular insulin diluted in 10 ml of normal saline solution were soaked with sterile gauze applied over the wound then dressing was done. Insulin dressing was done for ten days. Post assessment was done by using same tool on tenth day.

Plan for Data Analysis: Both descriptive and inferential statistics were used to analysis the data.

Descriptive Statistics: Frequency and percentage distribution was used to analyze the demographic variables and mean and standard deviation, used analysis of wound size.

Inferential Statistics: Chi-square test used to find the association of demographic variables on wound healing. ANOVA used to compare the wound size before and after the intervention.

RESULTS

Demographic characteristics of clients with diabetic foot ulcer in the infra-red radiation group: The demography of

the diabetic ulcer foot clients showed that Pertaining to age majority 34.7% clients were aged between 36 and 45, 34.7% were aged between 46 and 55 years in age, 58.7% were male and 41.3% were females and almost 54.7% clients were belongs to Hindus religion. With regard to educational qualification most of 26.7% were educated up to higher secondary level, 24. % were completed high school and 24 % were graduate. Considering employment status 29.3% were private employees, 24% were professionals, 24 % were unemployed. Pertaining to the income almost 46.7% clients had monthly income between 5000 and 10000 and most of 34% were widowed. Out of 75 clients 40% of the clients obtained diabetes related information from health care personnel, 28% were obtained information from friends 24% from obtained mass media, and 8% from relatives. Considering the duration of illness 29.3% had been suffering from diabetes around 1-2 years, 28% were suffering 3-4 years and 25.3% were diabetic around 5-6 years. Considering the family history of diabetes 38.7% were having family history of diabetes and 69.3% of the clients had foot ulcer less than one year duration.

Demographic characteristics of clients with diabetic foot ulcer in the insulin dressing group:

The demography of the diabetic ulcer foot clients in this group showed that majority 30.7% clients were aged between 36 and 45, 29.3% were aged between 46 and 55 years in age, most 58.7% were male, 70% foot ulcer clients were Hindus, almost 42% were uneducated and 57% were government employees. Almost 38.7% clients had monthly income between 10001 and 20000, most of 36% were widowed, 26.7% were widowers and almost 46.7% clients were having diabetic less than one year duration. 36% clients had family history of diabetes, 75 clients 45.3% were from rural area and 76% of the clients had foot ulcer less than one year duration.

Pre Test Score of Diabetic Foot Ulcer Clients N=150

Sl. No.	Groups	Number	Mean	Standard Deviation	F-value
1	Infrared Radiation	75	51.5067	4.21828	1.678 N S
2	Insulin Dressing	75	50.2400	5.74419	
Total		150	50.8733	4.98123	

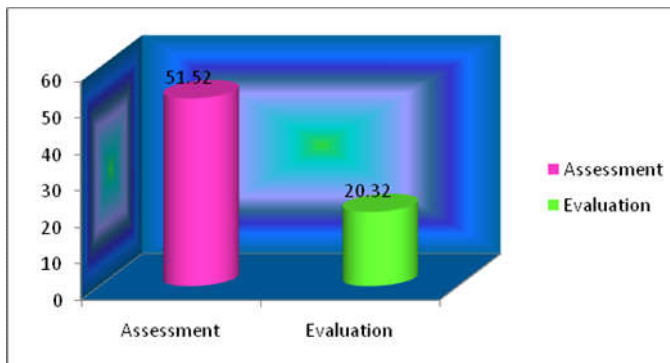
The above table depicts that pre test mean score of diabetic ulcer foot both in the infra-red radiation and insulin dressing groups. The mean score of infra-red radiation group was 51.5(4.21) and the same way in insulin dressing group was 50.2(5.74) the F value was 1.7.

Post-test Score of Diabetic Foot Ulcer Clients N=150

Sl. No.	Groups	Number	Mean	Standard Deviation	F-value
1	Infrared Radiation	75	20.320	3.673	60.7 S****
2	Insulin Dressing	75	24.253	4.027	
Total		150	22.286	3.850	

The above table shows that post test mean score of diabetic ulcer foot both in the infra-red radiation and insulin dressing groups. The mean score of infra-red radiation group was 20.32(3.67) and the same way in insulin dressing group was 24.25(4.02) the F value was 60.7, this shows that there was significant differences in the size of the wound before and after intervention.

Comparison between pre and post test mean score of diabetic ulcer foot in the infra-red radiation group.



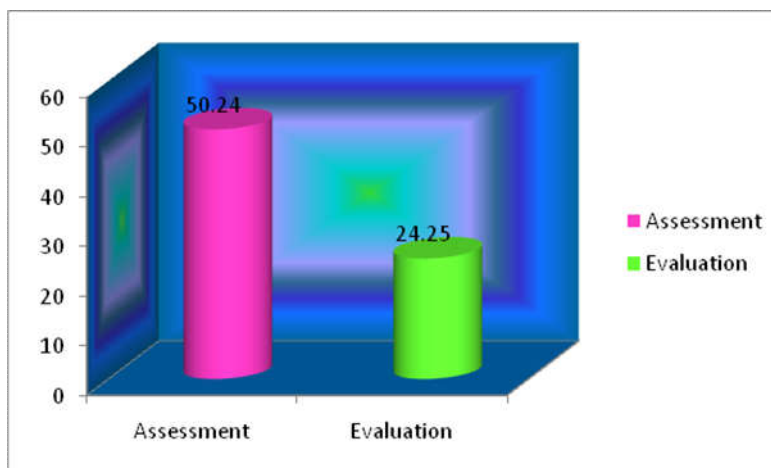
P < 0.00001

Comparison of mean score between pre test and post-test in the infrared Radiation group n=75

Infrared group assessment and evaluation		Paired Differences				t	df	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower			Upper
Pair 1	Assessment - Evaluation	31.187	3.951	.456	30.278	32.096	68.352*	74

*P < 0.00001

Comparison between pre and post test score of diabetic ulcer foot in the insulin dressing group n=75



***P < 0.00001

Comparison of pre test and Post-test score of Insulin dressing in healing of diabetic foot ulcer. n=75

Insulin dressing group assessment and evaluation		Paired Differences				t	df	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower			Upper
Pair 1	Assessment - Evaluation	25.987	4.972	.574	24.843	27.131	45.268*	74

*P < 0.00001

Comparison of pre test and post test score of diabetic foot ulcer in both the groups N=150

Sl.No.	Domain	No	Pretest			Post test		
			Mean	S D	F- Value	Mean	S D	F - Value
1	Infrared radiation	75	51.5	4.2	1.67	20.3	3.6	60.7
2	Insulin Dressing	75	50.2	5.7	N S	24.5	4.0	S****
4	Total	150	50.85	4.95		22.4	3.8	

P < 0.00001

The above table shows the mean difference in the insulin dressing group before and after the intervention. The above tables compare the pre and post test mean scores between infra-red radiation and insulin dressing groups.

Association of post test score of infrared radiation and insulin dressing in healing of diabetic foot ulcer with the selected demographic variables: In the infra-red radiation group diabetic ulcer foot clients' education and occupation had significant influences in the same way insulin dressing group, client's gender, area of residence and family history of diabetes had statistically significant association in the healing of diabetic ulcer foot at $P < 0.05$ level.

DISCUSSION

The study compared the effect of infra-red radiation and insulin dressing in the healing of diabetic ulcer food among diabetic clients. Sum of 150 clients with diabetic ulcer foot were included as samples. 75 ulcer feet were treated with infra red radiation and 75 were treated with insulin dressing. Modified Bates-Jensen wound assessment tool was used to assess the wound size and depth before and after intervention and the result of the study was drawn. The first objective of the study was to assess the pretest condition of diabetic ulcer foot among clients with diabetes mellitus. Infra red radiation group pre test mean score was 51.5067(4.21) and Insulin dressing group pre test mean 50.240(5.7) The overall "F" value was 1.678. This finding is supported by the study conducted by Sinharay. K *et al* (2012) in their cross section survey studied the recently diagnosed diabetic people regarding diabetic ulcer. With one year duration total of 1674 subjects were utilized for this study. They found that 4.54 percentages were having diabetic foot ulcer. The second objective was to evaluate the effectiveness of infra red radiation application and insulin dressing in healing diabetic ulcer foot among patients with diabetes mellitus. At the pre test clients in the infrared radiation group mean was 51.5067(4.218) and the post test mean 20.32 (3.67). The "t" value was 68.35 it was more than table value. It shows a high level of significance statistically at $p < 0.00001$ level in the healing of diabetic foot ulcer. Based on the "t" test result the hypothesis H_1 , which stated earlier that "there will be significant improvement in healing of diabetic ulcer foot at the post test was retained". This finding is supported by the study conducted by Lupart R *et al* (2011) in their randomized double blind study evaluated the effectiveness of broad band light device on healing of diabetes foot ulcer. In the Insulin dressing group the pre-test mean score of foot ulcer was 50.24(5.74) and post test mean score was 24.25(4.02), the "t" value 45.268 which was greater than table value. It shows a high level of significance statistically at $p < 0.00001$ level. The calculated value was greater than the table value depict that insulin dressing was effective on healing of diabetic foot ulcer. This finding is supported by the study conducted by Martinez *et al* (2013) in their interventional study evaluated the effectiveness topical insulin therapy on healing of diabetic foot ulcer. The third objective was to compare the effectiveness of infra red radiation with insulin dressing in healing of diabetic ulcer foot among clients with diabetes mellitus.

This objective compared effectiveness of infra red radiation with insulin dressing in healing of diabetic ulcer foot among clients. At the post test mean score of infrared radiation group was 20.32(4.04) and insulin dressing group mean was 24.25(3.58). The infrared radiation group's wound mean score was less than the insulin dressing. This shows that infrared radiation was more effective in healing of diabetic foot ulcer than insulin dressing groups. The hypothesis H_2 stated earlier that "there will be significant differences between infrared radiation and insulin dressing in healing of diabetic ulcer foot among diabetic ulcer foot clients" was retained. The fourth objective was to associate the effectiveness of intervention in healing of diabetic ulcer foot among diabetes mellitus clients with the selected demographic variables. This objective associated the post test score of infrared radiation in healing of diabetic foot ulcer with the demographic variables of diabetic foot ulcer clients. In the infra-red radiation group only education and occupation and in the insulin dressing group clients' gender, area of residence and family history of diabetes had statistically significant association in healing of diabetic ulcer foot at $P < 0.05$ level.

Conclusion

In India the prevalence of diabetes is very high. Many diabetic clients develop diabetic ulcer foot. There are many treatment modalities tries to treat the diabetic foot ulcer. This study compared infra-red radiation and insulin dressing in healing of diabetic ulcer foot. Both the interventions were effective in the healing of diabetic ulcer foot but infra-red radiation was more effective than insulin dressing.

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