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Original research article

A Study of description and comparison of wounds in topical insulin and normal saline dressing in healing of diabetic foot ulcers

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Abstract

Diabetic foot ulcer is one of the commonest sequelae following trauma or infection in patients with diabetes mellitus, mainly involving the distal ends of limbs where the vascularity is relatively decreased due to effects of diabetes. Despite insulin treatment and a meticulously-controlled diet, approximately 15% of all patients with diabetes will, at some time, have non-healing wounds and this is the leading cause of lower extremity amputation. The present study aims to compare the outcome of insulin dressing over normal saline dressing in diabetic foot ulcer.

Keywords: Description, Wounds, Topical, Insulin, Normal Saline, Dressing.

Introduction

The term diabetes mellitus refers to a metabolic disorder that is associated with abnormality of insulin production or resistance to with action at the peripheral tissues [1]. Though, this is one of the commonest metabolic disorder that is known it is not the metabolic profile but the complications that it causes which are more worrisome to the clinician [2].

This disease has been known since time immemorial. It has been well known even in ancient Indian texts where it is referred to by various names like madhumeha that is sweet honey it is gaining popularity recently not only because of its increasing incidence but ,also because of the fact that the complications associated with it [3].

Complications that are known very well as a consequence of long-term diabetes are diabetic retinopathy, diabetic neuropathy, diabetic microangiopathy [4]. All these three factors have contributed to the increase in the cardiovascular disorders, the cerebrovascular disorders ,and the diabetic foot complications that occur in diabetes mellitus [4].

Diabetic foot is one of the well known surgical problems that a diabetic patient presents to the consultation room. The predisposing factor for development of diabetic foot is the peripheral neuropathy that is associated with diabetes mellitus that causes the patient to lose sensation in the foot making him an aware of minor trauma until it becomes very severe [5, 6].

The diabetic foot ulcer is the precursor for diabetic foot and it is the most common sequel that occurs following any trauma or infection in a diabetic individual. The diabetic foot ulcers most commonly occur at the distal ends of the extremities because this is the area with the vascularity is the least as a result of microangiopathy that has occurs in in diabetes mellitus [7]. It is very important to note that ,even though the management of sugars will be very good, it is common to see that at least 15% of individuals at some point in their life will have a non healing ulcer in the lower extremity which will progress to require and amputation if nor cared for at the right time [8].

The other contributory factors that cause chroncity the ulcer in diabetic mellitus to heal are abnormal wound healing process [9, 10, 11].

The factors that impair wound healing in patients who have diabetes are: Impairment of the cell adhesion Process [9-14].

Reduced migration of the required cell proliferation of the vessels [9-14], Abnormal differentiation and [9-14], Apoptosis [9-14].

Hence, the pathology is at the molecular and the cellular level.

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It is also noted that in diabetics there is a reduction in the production of growth factors that is required for abnormal wound healing to occur.
Also because of the abnormality of accumulation of collagen, defective epidermal barrier abnormality of the macrophage function and the angiogenic response the wounds often tend to not follow the normal orderly process of wound healing.
Also, the most important factor that is associated with impairment of wound healing it is the abnormality in the signalling pathways especially, the production of fibroblasts and the cells that are responsible for forming the extracellular matrix and collagen [9-14]. Various treatments having tried in Diabetic foot in order to improve and accelerate the process. Even topical insulin has been used for this purpose and it is shown in various studies that when and cream of topical insulin is applied topically it can help to activate the various pathways that signal production of collagen. Also, so it has a stimulatory effect on the production of collagen within the fibroblast that are present inside the skin. It will also activate the proliferation of myofibroblasts thus enhancing the extra cellular matrix production and collagen synthesis. It also has an action that activates the and stimulates differentiation of the keratinocytes migration and the proliferation of cell. The insulin is known to act on each and every stage of wound healing especially the ones that are impaired in diabetic patients. Keeping this in mind we at the medical college teaching centre decided to study the role of topical insulin in patients who have diabetic foot ulcers. This study puts in an effort to describe and compare the wounds in topical insulin and normal saline dressing in healing of diabetic foot ulcers.

Aims and Objectives
To describe and compare the wounds in topical insulin and normal saline dressing in healing of diabetic foot ulcers.

Materials and Methods
The study was conducted in the Department of General Surgery in A. J. Institute of Medical Sciences and Research Centre, Mangalore.

Method of collection of data
a. Study Design - Hospital based Comparative Observational study.
b. Period of study – 1 year ,6 months from September 2019 to March 2021
c. Place of study: A. J. Institute of Medical Science and research Centre ,Mangalore Sample size- 60
d. Sampling Technique: Convenience sampling was adopted to select the individuals for the study

Inclusion criteria
1. Diabetic patients of age 18 years and above.
2. Patients having ulcers measuring more than one cm.
3. Patients with controlled blood glucose levels.
4. Patients with grade 1 and grade 2 Wegener's classification were selected for the study.

Exclusion Criteria
1. Patients with absent peripheral pulses in dorsal pedis arttery, posterior tibial artery and anterior tibial artery.
2. Known ccase off hypersensitivity or allergic reaction to the drug used in study.
3. X-rays showing features of osteomyelitis.
4. Malnutrition and uncontrolled diabetes. .
5. Patients receivving immunosuppressive therapy.
6. Patiennts not giving consent for the dressing.

Methodology: Two groups with 60 people each were taken.

Group A includes normal saline dressing to ulcer and Group B includes insulin dressing to ulcer. The daily dressing is done mean area of ulcer is noted before dressing. After 14days of dressing areas of ulcers are taken in mm square measurements using callipers, compared between the two groups.
Results

Table 1: Group * di1charge day 14 cross tabulation

			Di1charge Day 14			Total
			No	Serous	Serousanguinous	
Group		Count	30	30	0	60

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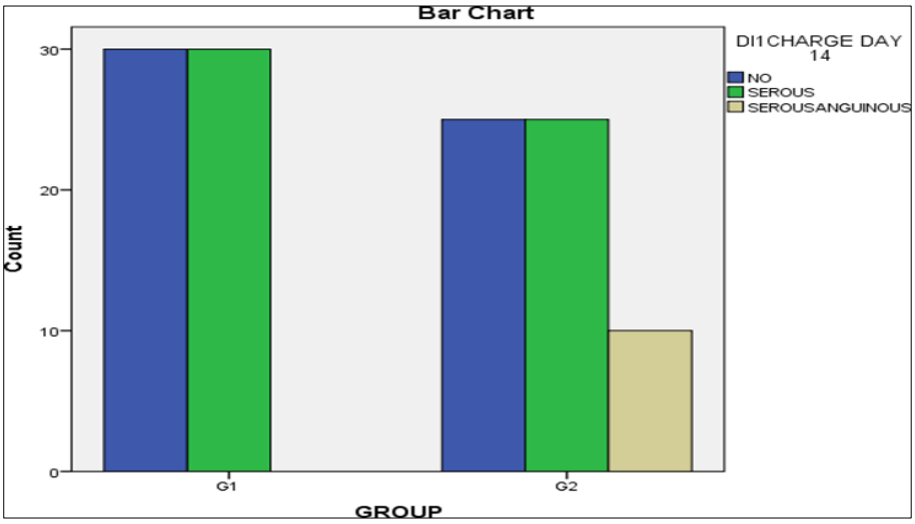
	G1	Expected Count	27.5	27.5	5.0	60.0
		% within Group	50.0%	50.0%	0.0%	100.0%
		Count	25	25	10	60
	G2	Expected Count	27.5	27.5	5.0	60.0
		% within GROUP	41.7%	41.7%	16.7%	100.0%
		Count	55	55	10	120
Total		Expected Count	55.0	55.0	10.0	120.0
		% within GROUP	45.8%	45.8%	8.3%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	10.909[a]	2	.004
Likelihood Ratio	14.773	2	.001
N of Valid Cases	120		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.00.



Graph 1

Table 2: Group * di1charge day 07 crosstabulation

			DI1CHARGE DAY07				Total
			No	Pus	Serous	Serousanguinous	
Group		Count	5	4	51	0	60
	G1	Expected Count	3.0	4.0	44.5	8.5	60.0
		% within GROUP	8.3%	6.7%	85.0%	0.0%	100.0%
		Count	1	4	38	17	60
	G2	Expected Count	3.0	4.0	44.5	8.5	60.0
		% within GROUP	1.7%	6.7%	63.3%	28.3%	100.0%
		Count	6	8	89	17	120
Total		Expected Count	6.0	8.0	89.0	17.0	120.0
		% within GROUP	5.0%	6.7%	74.2%	14.2%	100.0%

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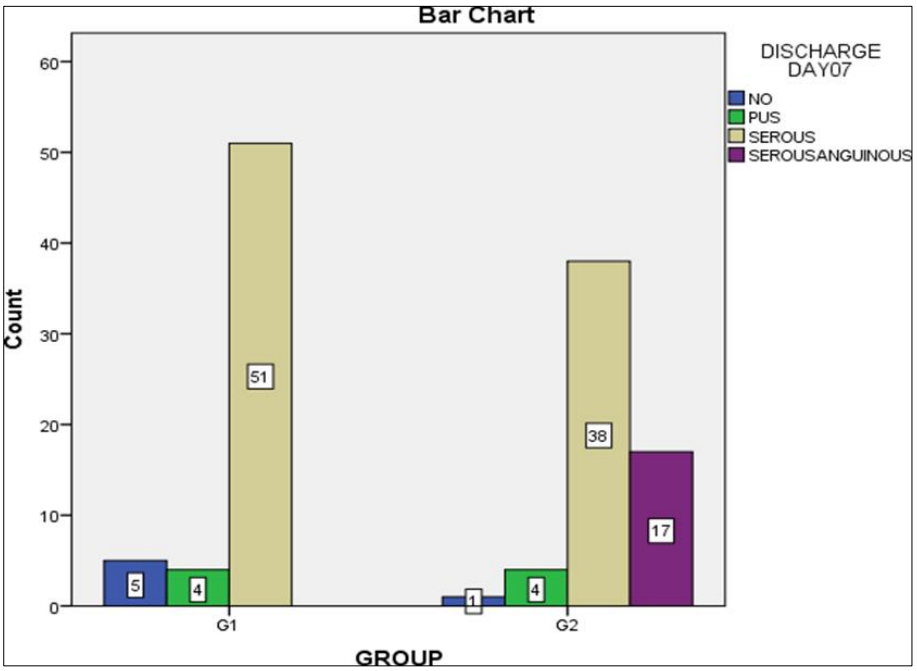
Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	21.566[a]	3	.000
Likelihood Ratio	28.384	3	.000
N of Valid Cases	120		



Graph 2

Table 3: group * di1charge day 14 crosstabulation

			Di1charge Day 14			Total
			No	Serous	Serousanguinous	
GROUP	G1	Count	30	30	0	60
		Expected Count	27.5	27.5	5.0	60.0
		% within GROUP	50.0%	50.0%	0.0%	100.0%
	G2	Count	25	25	10	60
		Expected Count	27.5	27.5	5.0	60.0
		% within GROUP	41.7%	41.7%	16.7%	100.0%
Total		Count	55	55	10	120
		Expected Count	55.0	55.0	10.0	120.0
		% within GROUP	45.8%	45.8%	8.3%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.909[a]	2	.004
Likelihood Ratio	14.773	2	.001
N of Valid Cases	120		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.00.

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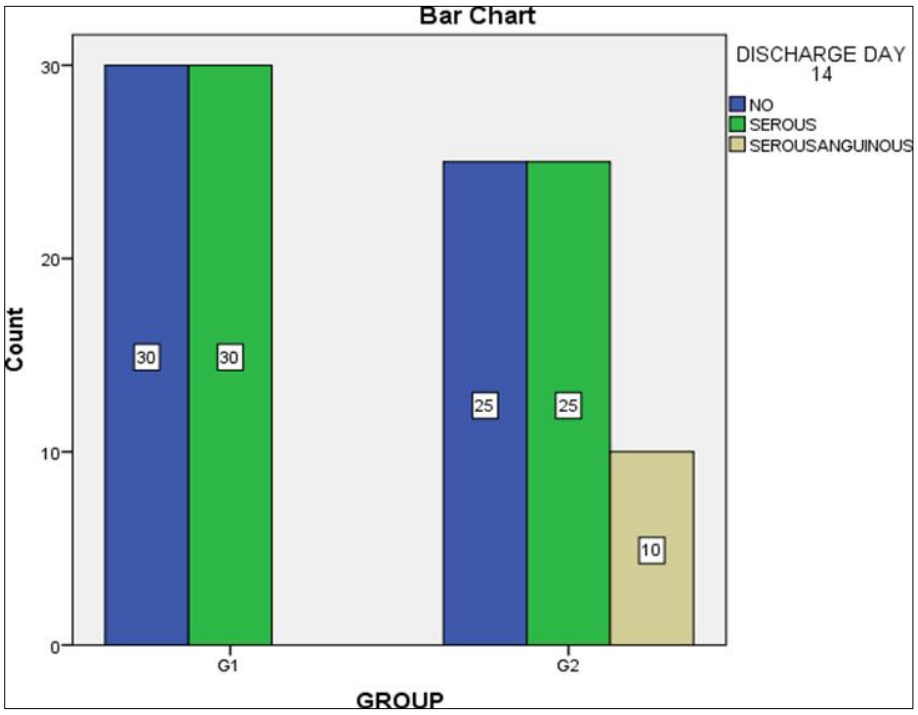
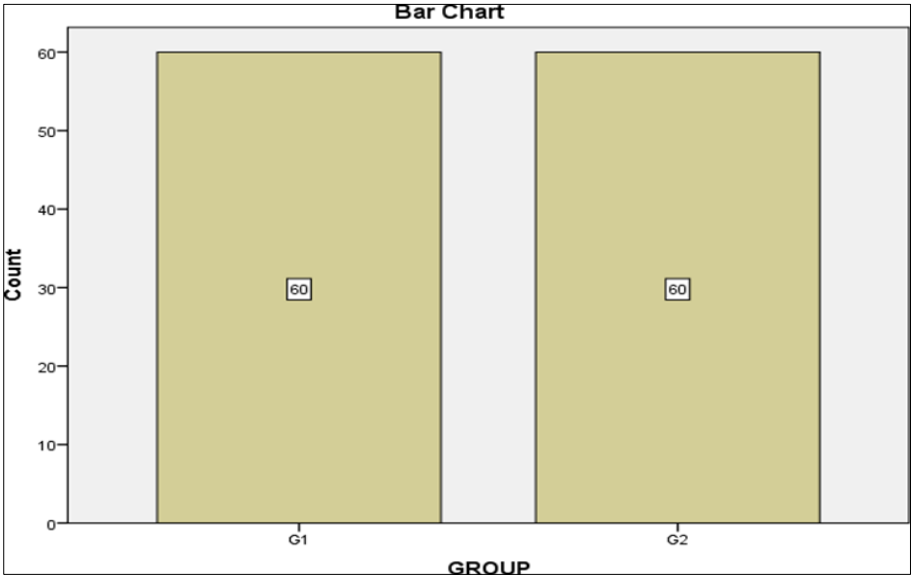


Graph 3

Table 4: Group * slough day 0 crosstabulation

			Slough Day 0	Total
			2	
GROUP		Count	60	60
	G1	Expected Count	60.0	60.0
		% within GROUP	100.0%	100.0%
		Count	60	60
	G2	Expected Count	60.0	60.0
		% within GROUP	100.0%	100.0%
		Count	120	120
Total		Expected Count	120.0	120.0
		% within GROUP	100.0%	100.0%



Graph 4

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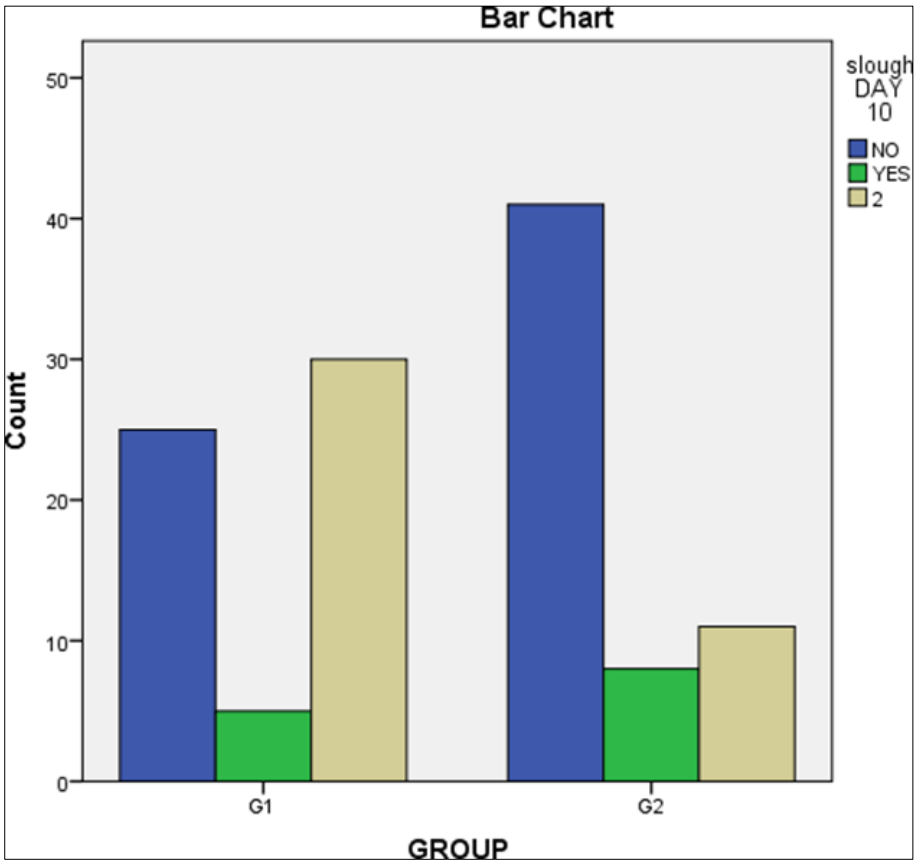
Table 5: Group * slough day 10 crosstabulation

			slough Day 10			Total
			No	Yes	2	
Group		Count	25	5	30	60
	G1	Expected Count	33.0	6.5	20.5	60.0
		% within GROUP	41.7%	8.3%	50.0%	100.0%
		Count	41	8	11	60
	G2	Expected Count	33.0	6.5	20.5	60.0
		% within GROUP	68.3%	13.3%	18.3%	100.0%
		Count	66	13	41	120
Total		Expected Count	66.0	13.0	41.0	120.0
		% within GROUP	55.0%	10.8%	34.2%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	13.376[a]	2	.001
Likelihood Ratio	13.767	2	.001
N of Valid Cases	120		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.50.



Graph 5

Table 6: Group * granulation day 0 crosstabulation

			Granulation Day 0	Total
			Pale	
Group		Count	60	60
	G1	Expected Count	60.0	60.0
		% within GROUP	100.0%	100.0%

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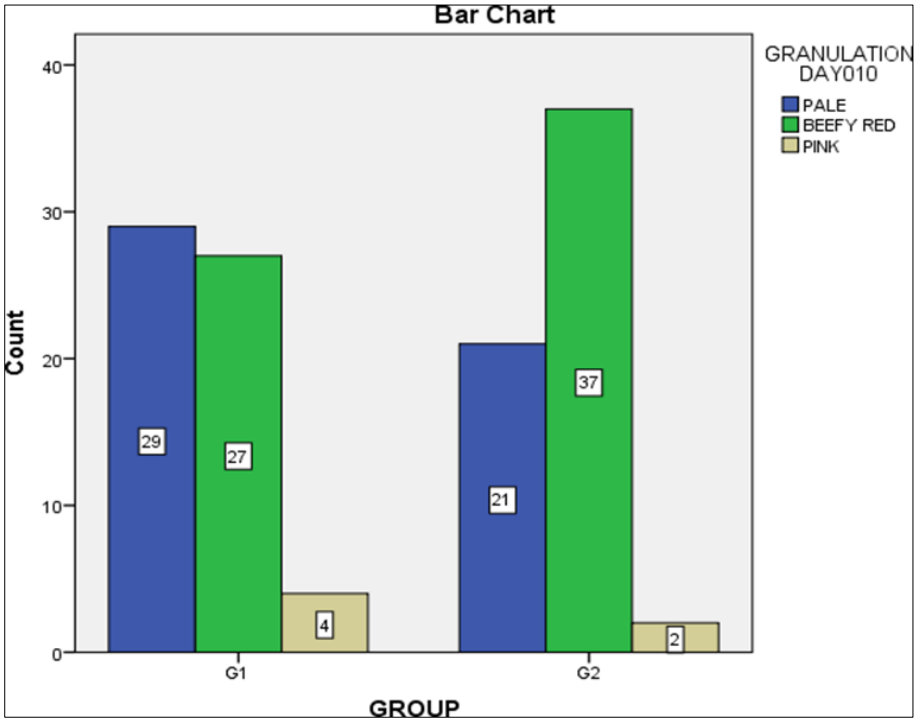
		Count	60	60
	G2	Expected Count	60.0	60.0
		% within GROUP	100.0%	100.0%
		Count	120	120
Total		Expected Count	120.0	120.0
		% within GROUP	100.0%	100.0%

Chi-Square Tests	
	Value
Pearson Chi-Square	.a
N of Valid Cases	120
a. No statistics are computed because GRANULATION DAY 0 is a constant.	



Graph 6

Table 7: Group * granulation day 0 crosstabulation

			Granulation Day 0	Total
			Pale	
Group		Count	60	60
	G1	Expected Count	60.0	60.0
		% within Group	100.0%	100.0%
		Count	60	60
	G2	Expected Count	60.0	60.0
		% within Group	100.0%	100.0%
		Count	120	120
Total		Expected Count	120.0	120.0
		% within Group	100.0%	100.0%

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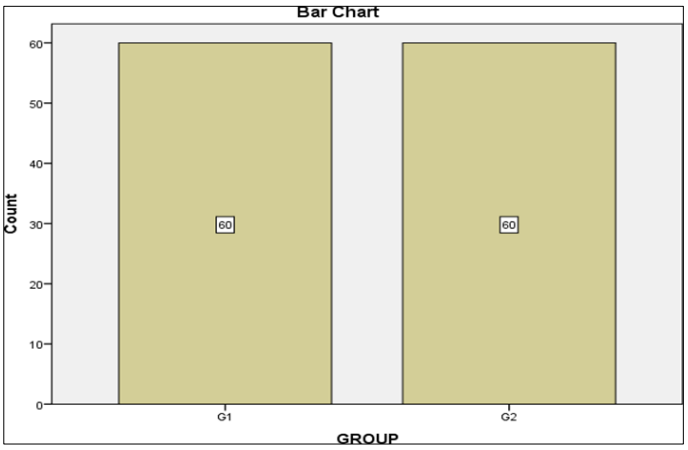


Graph 7

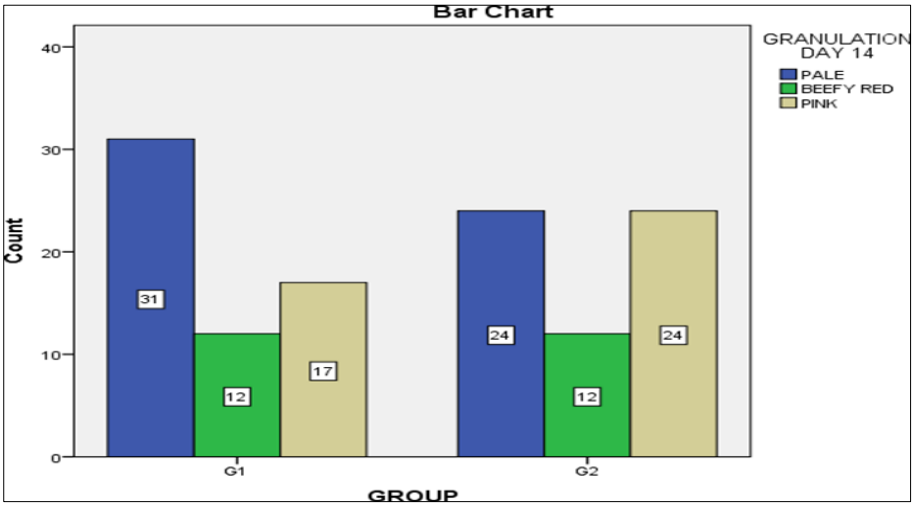
Table 8: Group * granulation day 14 crosstabulation

			Granulation Day 14			Total
			Pale	Beefy Red	Pink	
Group	G1	Count	31	12	17	60
		Expected Count	27.5	12.0	20.5	60.0
		% within Group	51.7%	20.0%	28.3%	100.0%
	G2	Count	24	12	24	60
		Expected Count	27.5	12.0	20.5	60.0
		% within Group	40.0%	20.0%	40.0%	100.0%
Total		Count	55	24	41	120
		Expected Count	55.0	24.0	41.0	120.0
		% within Group	45.8%	20.0%	34.2%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	2.086[a]	2	.035
Likelihood Ratio	2.094	2	.035
N of Valid Cases	120		

0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.00.



Graph 8

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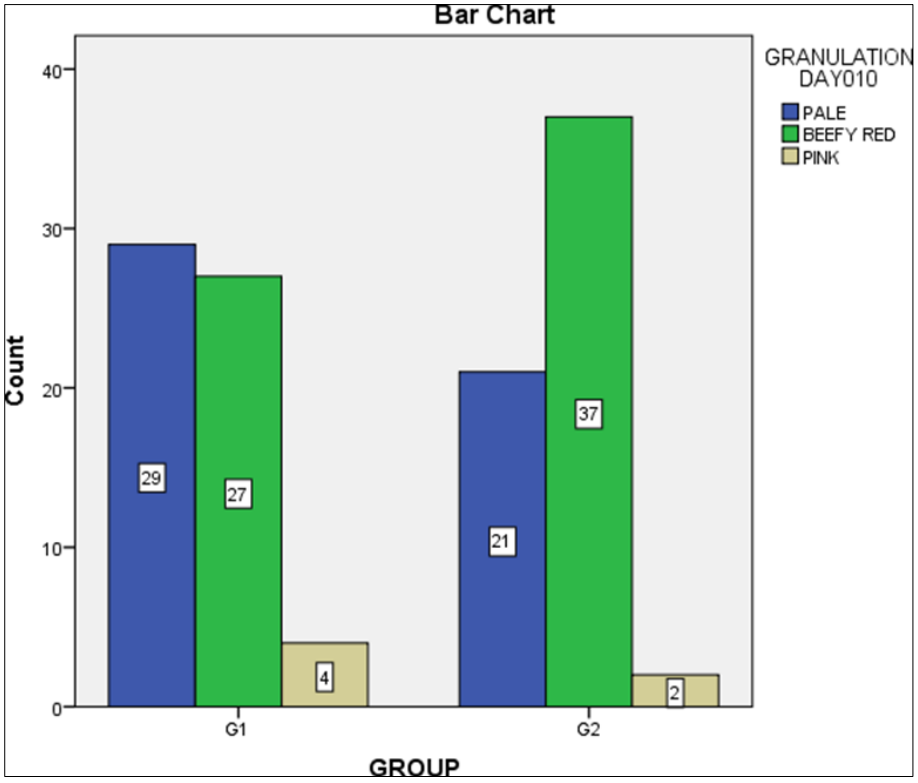
Table 9: Group * Granulation Day 010 Cross tabulation

			Granulation Day 010			Total
			Pale	Beefy Red	Pink	
Group	G1	Count	29	27	4	60
		Expected Count	25.0	32.0	3.0	60.0
		% within GROUP	48.3%	45.0%	6.7%	100.0%
	G2	Count	21	37	2	60
		Expected Count	25.0	32.0	3.0	60.0
		% within group	35.0%	61.7%	3.3%	100.0%
Total		Count	50	64	6	120
		Expected Count	50.0	64.0	6.0	120.0
		% within group	41.7%	53.3%	5.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.509[a]	2	.017
Likelihood Ratio	3.534	2	.017
N of Valid Cases	120		

2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.00.



Graph 9

Discussion

Wounds that results in limited tissue loss, such as surgical wounds, have a tendency to heal rapidly on the surface as opposing edges of the wound are in close proximity for cellular and structural repair. The wound is healed in about a week, but will continue to mature for a year or more. During this time the structural architecture of the wound changes, the scar usually flattens, and the skin regains most of its pre-wound tensile strength. In wounds where significant tissue loss occurs the damaged edges are usually unsuitable for primary closure. In this case, the tissue defect must be made up before the wound can heal. To facilitate healing, dressings are applied to try to

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protect the wound from contamination and keep the wound surface moist to maintain the integrity of the cells present in the defect. Where healing is protracted as a result of significant tissue loss (as in deep pressure sores) or due to underlying pathology (venous leg ulcers) chronic wounds occur.

Principles of surgical management in diabetic ulcer

1. Early recognition and prompt intervention.
2. Control of blood glucose.
3. Complete rest of injured area.
4. Careful but complete debridement and drainage of all involved areas.
5. Appropriate antibiotic coverage.
6. Wound care and dressings.
7. Appropriate vascular reconstruction.
8. Careful follow-up including podiatric appliances and modified footwear.

Woost and colleagues have demonstrated an increase in the tensile strength of wounds following 3 daily applications of insulin. The use of topical insulin strongly suggests accelerated wound healing in chronic ulcer, found to be safe and effective without any systemic side effects.
Dressing is one of the important parts of the treatment of the diabetic ulcer. The types of wound dressing used in diabetic foot ulcer are:

1. Traditional dressing – Gauze dressing.
2. Modern wound dressing (Occlusive/moist wound dressing)

a. Alginate dressings
b. Amorphous hydrogels
c. Hydrogel dressings
d. Hydrocolloid dressings
e. Composite dressings
f. Transparent films

Conclusion

We noted that when insulin was used it reduced the size of the wound at a faster rate as compared to the conventional normal saline dressings . Also the quality of granulation tissue and the percent reduction of the ulcer size was far better in the insulin group .

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