Original Research Article

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To compare the efficacy of topical negative pressure dressing with that of conventional moist wound dressings, in healing of wounds

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ABSTRACT

Background: Wounds and their management are fundamental to the practice of surgery. In the past 15 years there have been significant advances in complex acute and chronic wound management. One of the most significant discoveries was the improvement in wounds with negative pressure—assisted wound closure. The aim and objective of the study was efficacy of topical negative pressure dressing with that of a control group using conventional moist wound dressings, in healing of wounds, were assessed with quality of wound healing.

Methods: This prospective randomized controlled study 50 patients with acute and traumatic wounds, sub-acute wounds, chronic open wounds, of which 25 patients underwent topical negative pressure dressing. The remaining 25 patients underwent conventional moist wound dressings. The results were compared after second week. Wounds were assessed depending on wound size and percentage of reduction of wound size, wound bed score and increase in wound bed score, percentage of granulation tissue cover, graft take up as the percentage of ulcer surface area.

Results: Our present study shows significant reduction in wound size, in the study group 19.52 cm2 as compare to control group, (6.64 cm^2) found to be statistically significant (p < 0.001). There is significant increase in wound bed score in the study group (mean difference was 9.60 ± 2.16) where as in the control group there was not much increase in wound bed score (mean difference was 5.12 ± 1.99) (p-valve 0.00001) which is statistically significant. The % of granulation tissue formation in the study group was 81.0 ± 8.29 and in the control group was 53.60 ± 19.23 .

Conclusions: Topical negative pressure dressing was better than conventional wound dressings in quality of wound healing.

Keywords: Topical negative pressure dressing, Wound bed score

INTRODUCTION

Wounds and their management are fundamental to the practice of surgery. A wound is a break in the integrity of the skin or tissues often, which may be associated with disruption in the normal anatomical structure and function.¹ Any elective surgical intervention will result in a wound in order to gain access to and deal with the underlying pathology. In the surgery of trauma, the wound is the primary pathology. In both situations, the surgeon's task is to minimise the adverse effects of the

wound, remove or repair damaged structures and harness the processes of wound healing to restore function.²

Wound repair is the effort of injured tissues to restore their normal function and structural integrity after injury. During the effort to restore barriers to fluid loss and infection, re-establish normal blood and lymphatic flow patterns, and restore the mechanical integrity of the injured system, often times flawless repair is sacrificed because of the urgency to return to function.³ Wound healing is a complex cellular and biochemical cascade

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that leads to restitution of integrity and function.⁴ The treatment and healing of wounds are some of the oldest subjects discussed in the medical literature.

In the past 15 years there have been significant advances in complex acute and chronic wound management. One of the most significant discoveries was the improvement in wounds with negative pressure—assisted wound closure. With this technology, the surgeon now has additional options besides immediate closure of wounds (i.e., adjunctive therapy before or after surgery or an alternative to surgery in the extremely ill).

Clinical benefits of negative pressure therapy have been demonstrated in randomized control trails and case-control studies. These benefits include decrease in wound volume or size, accelerated wound bed preparation, accelerated wound healing, improved rate of graft take, decreased drainage time for acute wounds, reduction of complications, enhancement of response to first line treatment, increased patient survival, and decreased cost.

Application of a sub atmospheric pressure in a controlled manner to the wound site has got an important role in assisting wound healing. The present study was conducted to assess the efficacy of topical negative pressure moist wound dressing as compared to conventional moist wound dressings in improving the healing process in chronic wounds and ulcers and to prove that negative pressure dressings can be used as a much better treatment option in the management of acute and chronic wounds.

METHODS

This a prospective randomized controlled study, to test the efficacy of topical negative pressure moist dressing with that of a control group using conventional moist wound dressings, in healing of wounds. The study was conducted in the department of surgery, KIMS, Hubli.

The source of data were patients admitted as inpatients for the management of wounds. 50 patients were studied. 25 cases were randomly chosen for study with topical negative pressure 25 cases received normal saline as dressing for the wounds.

Sample size

The sample size was 50 cases 25 patients received topical negative pressure dressing 25 patients received conventional saline dressings.

Inclusion criteria

- Acute and traumatic wounds
- Sub-acute wounds
- Chronic open wounds (Diabetic ulcers, Pressure ulcers, Venous stasis ulcers)

Exclusion criteria

- Fistulas or organs or body cavities
- Necrotic Tissue in eschar
- Osteomyelitis (Untreated)
- Malignancy in the wound
- Actively bleeding wound

It was prospective, observational randomized study.

RESULTS

The 50 patients admitted for the study were divided into two equal and comparable groups. Patients subjected to topical negative pressure dressing were classified under study and those who underwent conventional wound dressings were classified as control. The patient's characteristics of the two groups were comparable in the Table 1 and Table 2.

Table 1: The patient's characteristics of the two groups.

Characteristics	Study group	Control group
Number of patients	25	25
Age range in years	9-70	24-75
Sex ratio (Male:Female)	18:7	20:5
Range of ulcer surface area in cm ²	16-234	8-363

Table 2: Age distribution in the two groups.

Age	Study group	%	Control group	%
<20 yrs	4	16.00	0	0.00
21-30 yrs	0	0.00	2	8.00
31-40 yrs	5	20.00	7	28.00
41-50 yrs	5	20.00	4	16.00
51-60 yrs	9	36.0	8	32.00
61 ⁺ yrs	2	8.0	4	16.00
Total	25.0	100.0	25.0	100.0
Mean age	43.56		49.60	
SD age	17.94		14.9	

In this study, the age of the patients ranged from 9 years to 75 years. Of this 9-70 years were from study group and 24-75 years were from control group 34% in the age group of 51-60 years of this 36% were in the study group and 32% were in the control group.

Maximum number of cases (64%) belong to the age group of above 41 years. The mean age of study group was 43.56 ± 17.94 years and the mean age of control group was 49.60 ± 14.90 years. All patients included in the study were suffering from ulcers of varied etiology. In this study, 42% of the wounds were of diabetic etiology. The next most common wounds were post infective etiology at 32% (Table 3).

Table 3: Type of ulcer wise distribution in the two groups.

Type of ulcer	Study group	%	Control group	%
Diabetic ulcer	7	28.0	14	56.00
Post infective raw area	7	28.0	9	36.00
Traumatic ulcer	9	36.0	2	8.00
Venous ulcer	2	8.0	0	0.00
Total	25	100.0	25	100.0

The mean duration of no of days of hospital stay in the study group is 42.36 ± 13.78 and 46.76 ± 28.36 in the control group. p value is 0.4887. The wound size in the study group before and after treatment shows statistically significant (p value <0.00001), similarly the wound size in the control group before and after treatment is also statistically significant (p value<0.007), but the study group shows high significance value than the control group (Table 4). The wound size at initial presentation in the study group is 107.07 ± 87.23 and in the control group is 89.19 ± 81.72 , this is found to be statistically

insignificant (p value=0.2514) thus implying the comparability of wound size at initial presentation.

Table 4: Comparison of before and after treatment of the wound size (in cm²) in the study and control groups by paired t test.

Groups	Treatment	Mean	SD	Paired t	P value	
Study	Before	107.07	87.23	8.655	0.0001	
group	After	89.79	81.73	6.033	0.0001	
Control	Before	89.19	81.72	2.943	0.01*	
group	After	82.99	73.71	2.943	0.01	

Similarly, the wound size after the completion of treatment in the study group is 89.79±81.73 and in the control group is 82.99±73.71 which is also found to be statistically insignificant p value. (p value=0.4822).

The mean difference in wound size in the study group is 17.88 ± 9.70 and in control group is 6.79 ± 9.09 , which shows, the difference is statistically significant (p value = 0.0001) (Table 5).

Table 5: Comparison of the study and control groups with respect to wound size (in cm²) before and after treatment and their difference by unpaired t test.

Treatment	Groups	n	Mean	SD	t-value	P value
	Study group	25	107.07	87.23	0.748	0.458
Before	Control group	25	89.19	81.72	0.748	0.438
	Study group	25	89.79	81.73	0.200	0.750
After	Control group	25	82.99	73.71	0.309	0.759
D:cc	Study group	25	17.88	9.70	4 2005	0.0001*
Difference	Control group	25	6.79	9.09	4.2085	0.0001

^{*}p<0.05.

Mean reduction in wound size in centimetre square for the study group is more than that of control group.

The percentage reduction in the study group is 19.52 ± 7.67 and 6.64 ± 7.27 in the control group which is statically significant (0.0001) (Table 6).

Table 6: Comparison of the study and control groups with respect to % reduction in wound size by t test.

Groups	n	Mean	SD	t value	P value	
Study group	25	19.54	7.67	6.0042	0.00001*	
Control group	25	6.64	7.27	0.0943	0.00001*	

The wound bed score at initial presentation in the study group is 5.52±2.42 and in the control group is 5.08±1.44,

this is found to be statistically insignificant (p value=0.4382) thus implying the comparability of wound bed score at initial presentation.

Similarly, the wound bed score after the completion of the treatment in the study group is 15.12±1.54 and in the control group is 10.20±2.69 which is statistically significant.

The mean difference in wound bed score in the study group is 9.60±2.16 and the control group is 5.12±1.99, the difference is statistically significant (p value=0.0001) (Table 7 and Table 8).

The % of granulation tissue formation in the study group is 81.0 ± 8.29 and in the control group is 53.60 ± 19.23 , which is found to be statistically significant (p value=0.00001) (Table 9).

Table 7: Comparison of before and after treatment, wound bed scores in the study and control groups by paired t test.

Groups	Treatment	Mean	SD	Paired t	p value
Study group	Before	5.52	2.42	22 2107	0.00001^*
	After	15.12	1.54	-22.2197	0.00001
Control group	Before	5.08	1.44	12.9016	0.00001*
	After	10.20	2.69	-12.8916	0.00001

Table 8: Comparison of the study and the control groups with respect to wound bed scores, before and after treatment and their difference by unpaired t test.

Treatment	Groups	n	Mean	SD	t value	P value
Before	Study group	25	5.52	2.42	0.7817	0.4382
	Control group	25	5.08	1.44	0.7617	0.4382
After	Study group	25	15.12	1.54	7.9355	0.00001*
	Control group	25	10.20	2.69	1.9555	0.00001
Difference	Study group	25	9.60	2.16	7.6339	0.00001*
	Control group	25	5.12	1.99		0.00001^*

Table 9: Comparison of the study and control groups with respect to % of granulation tissue cover by t test.

Group	n	Mean	SD	t value	P value
Study group	25	81.00%	8.29	65410	0.00001*
Control group	25	53.60 %	19.23	6.5418	0.00001*

Table 10: Comparison of the study and control groups with respect to % of graft uptake.

Group	n	Mean	SD	t value	P value
Study group	19	83.42	4.43	7.0212	0.00001*
Control group	11	63.18	11.24	7.0312	0.00001

The % of graft take up in the study group is 83.42 ± 4.43 and in the control group is 63.18 ± 11.24 , which is found to be statistically significant (p value=0.00001) (Table 10).

DISCUSSION

This study was done as a prospective randomized controlled comparative study to compare the efficacy of topical negative pressure dressing to conventional moist wound dressings in the healing of wounds (Table 11 and 12), shows a comparison of % of granulation tissue cover, present study has comparable granulation tissue cover to Joseph et al, 81.56% in vacuum group (A) and 54.30% in control group (B) Tauro et al has lesser granulation tissue cover (71.43%) compare to present study.

Table 11: Comparison of present study to other studies with respect to sample and mean age in years.

Character	Tauro et al		Joseph et al		Present study	
	A	В	A	В	A	В
Sample	56	56	25	25	18	18
Mean age	47.56	47.42	52.4	53.2	43.5	49.6
in years	₹7.50	77.72	1	33.2	6	₹7.0

Table 12: Comparison of present studies with respect to % of granulation tissue cover and % of graft take up, as the % of ulcer surface area.

Charact	Tauro et al		Joseph et al		Present study	
ers	A	В	A	В	A	В
Rate of granulation tissue formation	71.43	52.8	81.65	54.30	81.00	53.60
	%	5%	%	%	%	%
Graft	79.29	60.45	85.30	56.43	83.42	63.18
take up	%	%	%	%	%	

Present study has comparable % of graft take up with both studies. Tauro et al 79.29% in vaccum group, 60.45% in control group and Joseph et al 85.30% in vaccum group, 56.43% in control group. ^{5,6} In our present study split skin graft was done only in 19 patients in study group and 11 patients in control group. Patients in our present study were suffering from ulcers of varied etiology, most common etiology was diabetic, next most common was infective etiology. In Tauro et al also the main etiology was diabetic ulcer but next most common

cause was pressure ulcer and in our present study there was no ischemic ulcer and pressure ulcer. In Tauro et al, study comparison was not made in terms of wound size reduction andwound bed score between the two dressing groups Prabhdeep. S. N et al, study in 15 diabetic foot ulcers received VAC dressing % of mean reduction of wound is lesser compare to present study, and mean age is higher (61.33 years) compare to present study (43.56 years) (Figure 1).^{7,8}

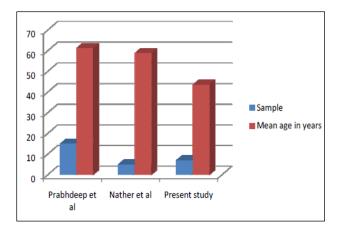


Figure 1: Comparison of present study to various other studies in terms of mean age and reduction of wound size in diabetic foot ulcers in vacuum group.

Nather et al, done study of VAC dressing in 5 diabetic foot ulcers, shows higher % of reduction in wound size (32.8%) compare to present study (25.57%). In present study the wound size at initial presentation in the study group was 107.07±87.23 and in the control group was 89.19±81.72, this is found to be statistically insignificant (p value=0.458) thus implying the comparability of wound size at initial presentation. After treatment also both the groups showed statistically in significant p value (p-value=0.759). But the mean difference in wound size in the study group was 17.88±9.70 and in control group 6.79 ± 9.09 , which shows the difference was statistically significant (p value=0.0001). Present study shows significant % of reduction in wound size, in the study group 19.52 cm² as compare to the control group, (6.64 c m²). p <0.001 which is statistically significant. There is significant increase in wound bed score in the study group (mean difference was 9.60±2.16) where as in the control group there was not much increase in wound bed score (mean difference was 5.12±1.99) (p-valve 0.00001) which is statistically significant. Even the % of granulation tissue formation and the % of graft take up is higher in the study group compared to the control group, which is statistically significant (p value <0.001) in both variables. Though the mean duration of hospital stay is statistically not significant, it is less in study group compare to control group. Number of dressings were less in the topical negative pressure dressing group hence

reducing the cost of dressing when compared to conventional wound dressings group.

CONCLUSION

In our present study it was concluded that the wound bed score, the rate of granulation tissue formation, reduction in wound size, graft take up are better in the topical negative pressure dressing group when compared to the conventional wound dressing group. It was also seen that topical negative pressure dressing is cost effective and overall hospital stay is less in the topical negative pressure therapy. Hence the VAC dressing is proved to be more efficient than the normal saline dressing.

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