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Fixation of split skin graft using cyanoacrylate tissue adhesive versus skin stapling: A comparative study

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Abstract

Introduction: Split thickness skin graft is usually done for soft skin coverage owing to its broad application for use due to ease of harvest. The healing process occurs through three stages of anchorage, inosculation and maturation.

Aim and Objectives: To compare the effectiveness of Cyanoacrylate tissue adhesive in uptake of split thickness skin graft vs skin staplers in resurfacing the surgical wound bed. To study the frequency of dressing, percentage of graft uptake, post-operative pain in the recipient site, duration of post-operative hospital stay, seroma/hematoma, Graft rejection rate and Operating Time.

Materials and Methods: This study was conducted among all patients presenting with chronic extremity ulcers and undergoing resurfacing with skin grafting. Patients were divided into two groups with cases as the Cyanoacrylate tissue adhesive used and controls as the graft fixed with staples and non-adhesive dressing.

Results: Out of total 60 patients, the mean age of all the patients included in the study was 52.03 ± 10.89 yrs. Among the patients included, there was male preponderance (73.3%) and females were 26.7%. Male to female ratio was 2.75:1. On assessment of the post operative pain among the cases and controls, significant higher pain among the controls (36.7%) was seen as compared to cases (6.7%). A significant higher mean of graft uptake was observed in the cases as compared to controls on post operative day 3, 5 and 7, also there was significantly higher rate of complications like seroma, SM and hematoma among the controls as compared to cases. The mean hospital stay in cases was 7.4 ± 1.4 days and among controls it was 9.7 ± 1.0 days.

Conclusion: The adhesive skin glue seems to have better tolerance towards the pain during the post-operative period, lesser wound complication, better graft uptake rate and lesser post-operative stay in the hospital with an overall better outcome.

Keywords: Cyanoacrylate, staples, skin graft, seroma, hematoma, graft uptake

Introduction

Split thickness skin grafts were first introduced in 1872 by Ollier in France and later by Thiersch in Germany in 1874. Brown in England developed the electric dermatome in 1944, to harvest thin homogenous grafts [1]. Cyanoacrylate were accidentally discovered in 1942 by Dr. Harry Coover and were used during Vietnam War and it saved many lives after discovering that praying cyanoacrylate over open wound would stop bleeding [2].

Skin grafts can be classified as split thickness graft for full epidermis and part of dermis, full thickness graft for epidermis and all the layers of dermis, the donor site is either sutured directly or split-thickness skin grafted and composite graft for small grafts containing skin and underlying cartilage or other tissue, donor sites include, for example, ear skin and cartilage to reconstruct nasal alar rim defects [3]. Various factors influence graft uptake like graft nutrition absorption, vascular in-growth from the recipient bed, and postoperative immobility [4].

The split skin grafts are secured conventionally by sutures or staples, painstakingly to the recipient site. Instead, a method of securing the same more easily consuming less time and effort with good cosmetic appearance by using cyanoacrylate has added advantage of obviating the need for post-op suture or staple removal [5].

In quest for trying new methods of graft fixation which are more ideal or towards more ideal it was decided to take up this study.

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Materials and Methods

It was a prospective study conducted in a tertiary care hospital. The study included all patients presenting with chronic extremity ulcers and undergoing resurfacing with skin grafting in the department of general surgery. A total of 60 patients were included in the study. Among whom 30 were cases and 30 in control group. All patients with chronic non healing ulcers, post burn wound and traumatic ulcers were include in the study. Patients with HIV, HBsAg and HCV positive status, those with deranged coagulation profile, patients with raw areas resulting from excision of skin malignancies and those with platelet disorders were excluded from the study.

All the base line assessments along with written and informed consent was taken, wound care was given to all patients and after confirming that the wound is free of any pathogenic microbes patient was taken up for surgery after obtaining PAC fitness. Patients shifted to Operating theatre, under anesthesia, under aseptic precautions, parts painted and draped, donor site prepared, graft harvested and prepared for application. Patients were divided into two groups –the study group and control group. In the study group, Cyanoacrylate tissue adhesive was used to resurfacing with split thickness skin graft followed by placement of non-adhesive dressing topped with cotton wool and secure dressing was applied. 0.5 ml of cyanoacrylate glue used over a surface area of 50cm². In control group the wound were resurfaced by the graft and was fixed with staples and non-adhesive dressing was placed topped with cotton wool and secure dressing was applied.

Once the recipient site wound bed was prepared and lavage given. The Cyanoacrylate tissue adhesive / skin staplers were applied over the wound bed and a dressing was applied with non adhesive mesh and betadine soaked cotton and bandage.

The parameters such as the instant anchorage, dressing soakage, uptake of the graft, operating time, hospital stay and other outcomes included in the study were recorded for analysis.

Statistical analysis: The mean difference between the continuous variables was analysed using independent student’s t-test and the

difference between categorical variables was analysed using chi-square test. For statistical significance, a p-value of <0.05 was considered.

Results

In present study total of 60 patients fulfilling inclusion criteria were included after obtaining the informed consent. The mean age of all the patients included in the study was 52.03±10.89yrs of age as shown in Table 1.

Table 1: Mean age of the patients included in the study

	N	Minimum	Maximum	Mean	SD
Age in years	60	19	80	52.03	10.89

The comparison of mean age of patients between the groups is shown in the figure 1.

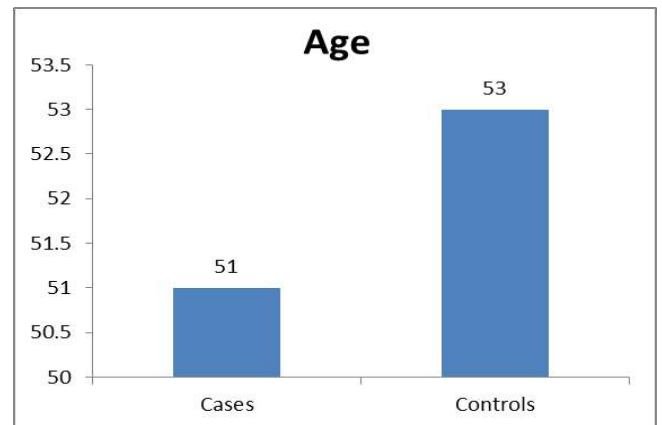


Fig 1: Comparison of the mean of patients between the groups

Following table 2 shows gender distribution among the study participants.

Table 2: Showing the distribution of gender among the study participants

Gender	Frequency	Percent
Female	16	26.7
Male	44	73.3
Total	60	100.0

Figure 2 shows gender distribution between the groups.

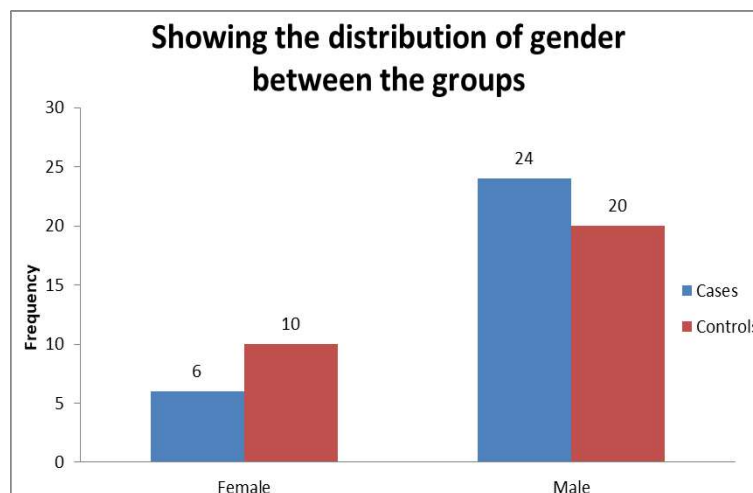


Fig 2: Showing the distribution of gender between the groups

The overall mean operative time is shown in Table 3,

Table 3: Showing overall mean operative time in the study

	N	Minimum	Maximum	Mean	SD
Operating time	60	35.0	90.0	61.33	16.36

Figure 3 shows mean operative time between the two groups.

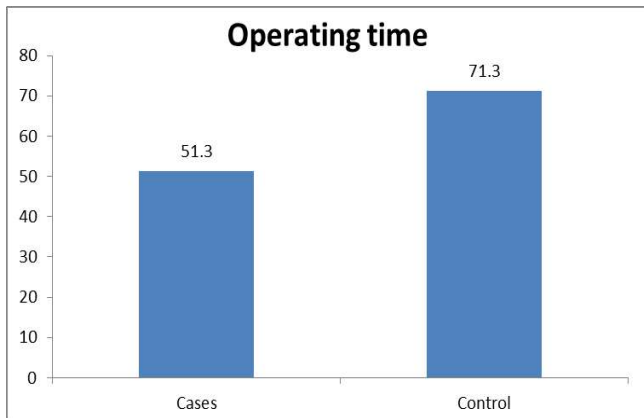


Fig 3: Showing the comparison of mean operative time between the two groups

Figure 4 shows, Comparison of the distribution of patients with post-op pain between the groups

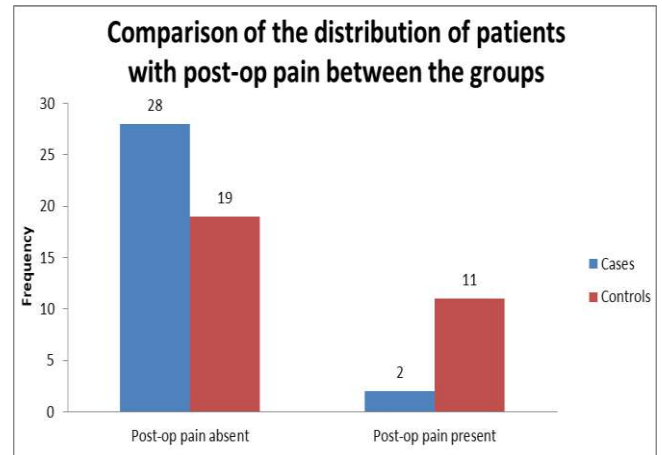


Fig 4: Comparison of the distribution of patients with post-op pain between the groups

Following, Table 4 shows Post-OP pain among the study participants

Table 4: Showing the distribution of overall post-op pain among the study participants

Post-OP pain	Frequency	Percent
Absent	47	78.3
Present	13	21.7
Total	60	100.0

Table 5: shows Comparison of the graft uptake between the two groups

Graft uptake	Cases		Control		t-test (p-value)
	Mean	SD	Mean	SD	
POD3	76.3	8.1	67.3	7.8	0.001**
POD5	87.7	8.6	75.3	7.3	0.001**
POD7	96.9	6.8	84.7	7.8	0.001**
POD9	96.7	8.2	94.4	7.9	0.539
POD11	100.0	.	96.4	6.7	0.617

Table 6: shows Comparison of the complications seen in post-operative days between the groups

		Cases		Control	
		Count	Row N%	Count	Row N%
Complications POD3	Seroma	2	33.3%	4	66.7%
	SM	1	33.3%	2	66.7%
	Hematoma	0	0.0%	1	100.0%
	Seroma+SM	4	25.0%	12	75.0%
	Seroma+Hematoma	2	20.0%	8	80.0%
Complications POD5	Seroma	0	0.0%	2	100.0%
	SM	0	0.0%	14	100.0%
	Hematoma	0	0.0%	1	100.0%
	Seroma+SM	1	20.0%	4	80.0%
	Seroma+Hematoma	0	0.0%	1	100.0%
Complications POD7	Seroma	0	0.0%	1	100.0%
	SM	0	0.0%	2	100.0%
	Hematoma	0	0.0%	0	0.0%
	Seroma+SM	0	0.0%	0	0.0%
	Seroma+Hematoma	0	0.0%	0	0.0%

Figure 5 shows Comparison of the mean duration of hospital stay between two groups.

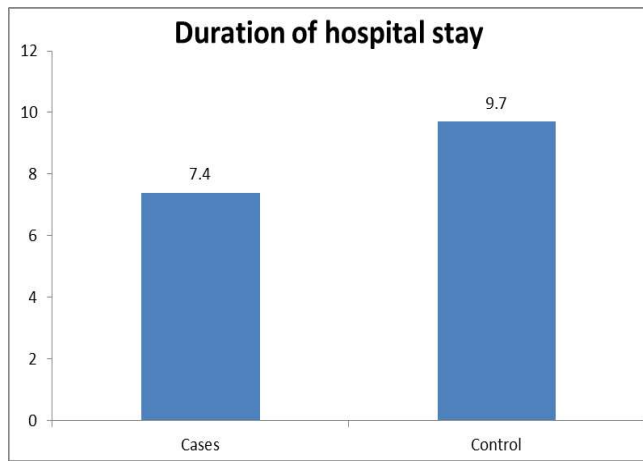


Fig 5: Comparison of the mean duration of hospital stay between two groups.

Discussion

In the present study, out of total 60 patients, the mean age of all the patients was 52.03 ± 10.89 yrs of age. The patients were divided into two group, cases (Cyanoacrylate tissue adhesive was used to resurfacing with split thickness skin graft followed by placement of non-adhesive dressing topped with cotton wool and secure dressing was applied. 0.5 ml of cyanoacrylate glue used over a surface area of 50cm^2) and controls (wound were resurfaced by the graft and was fixed with staples and non-adhesive dressing was placed topped with cotton wool and secure dressing was applied). The mean age between the two groups was not found to be significantly different. The mean age in cases was lower than in the controls. In study by Ananda BB *et al.*, the mean age in the skin glue was 41.20 yrs ± 20.91 , skin staples was 43.30 yrs ± 18.63 [6].

Male preponderance (73.3%) was seen whereas females were 26.7%. Male to female ratio was 2.75:1 which correlated with the findings of Ananda BB *et al* who also documented male preponderance with male to female ratio of 2:1 [6].

The operative time was assessed between the groups. The study found that mean age in cases 51.3 ± 13.7 mins was found to be significantly lower compared to controls (71.3 ± 12.2 min). On assessment of the post-operative pain among the cases and controls, we found significant higher pain among the controls (36.7%) as compared to cases (6.7%). Ananda BB *et al.*, also documented lower pain score among the glue group compared to others, similar to the findings of the present study. 12 hours post operatively the pain score was least in the glue population (mean was 63.13), 24 hours post operatively also pain was minimum in glue population (42.10) and 48 hours also glue had the least pain score (16.97). 72 hours post operatively again glue scored the least among the three population. [6] According to Chibbaro *et al.*, there was no significant difference between surgical adhesive glue and skin staples for closure of neurosurgical scalp incisions [7].

On assessment of the graft uptake in the study, there is a significant higher mean of graft uptake in the cases as compared to controls on post-operative day 3, 5 and 7 day. Complications observed in the present study, on various post-operative days were significantly higher with complications like seroma, SM and hematoma among the controls as compared to cases. Ananda BB *et al.*, found a significant higher asepsis score among the glue group compared to the staple and the sepsis incidence was significantly higher among the staples group. Overall lesser ASEPSIS score was observed among the glue population with statistical significance for POD 3 and suggestive

significance on POD 5 [6]. Study observed the presence of serous exudates, purulent exudates, erythema and wound gaping among the three groups. Only erythema had a statistically significant comparison, which explained that the glue population had lesser chances of erythema when compared with staples and sutures [6]. Blondeel *et al.* concluded that the new tissue adhesive formulation provides epidermal wound closure equivalent to commercially available devices in a series of 209 patients treated with octyl-2-cyanoacrylate and commercially available devices following closure of long surgical incisions, with a trend to decreased incidence of wound infection [8].

The cost-effectiveness was further evaluated in terms of total post-operative hospital stay. On assessment of the total number of days of hospital stay, we found significant lower days of hospital stay among the cases as compared to controls. The mean hospital stay in cases was 7.4 ± 1.4 days and among controls was 9.7 ± 1.0 days.

Conclusion

Adhesive skin glue seems to have better tolerance towards the pain during the post-operative period, lesser wound complication, better graft uptake rate and lesser post-operative stay in the hospital with an overall better outcome.

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