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EFFECT ON HEALING OF SKIN GRAFT DONOR SITE USING CHLORHEXIDINE PARAFFINE DRESSING VERSUS CALCIUM ALGINATE DRESSING

Original Research

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ABSTRACT

Background: Optimal healing of skin graft donor sites is essential to minimize patient discomfort and complications such as infection and delayed recovery. While chlorhexidine paraffin dressings have been widely used for donor site care, calcium alginate dressings—due to their absorbent and hemostatic properties—have emerged as promising alternatives. However, limited regional data exists comparing their clinical effectiveness. This study aims to evaluate the comparative efficacy of these two dressing types in promoting healing and preventing infection at skin graft donor sites.

Objective: To compare the healing outcomes of skin graft donor sites treated with chlorhexidine paraffin dressing versus calcium alginate dressing.

Methods: A randomized controlled trial was conducted at the Department of Plastic Surgery, Lady Reading Hospital, Peshawar, from May 24 to November 24, 2024. A total of 80 patients aged 16 to 75 years were enrolled using consecutive non-probability sampling. Participants were randomly allocated into two equal groups of 40 using blocked randomization. Group A received chlorhexidine paraffin dressings, and Group B received calcium alginate dressings immediately post-grafting. Clinical assessments were performed on day five and subsequent outpatient visits until complete re-epithelialization. Primary outcomes included healing duration and presence of clinical infection. Data were analyzed using SPSS version 22 with significance set at $p \leq 0.05$.

Results: The mean healing time in the calcium alginate group was significantly shorter (8.83 ± 1.551 days) than in the chlorhexidine paraffin group (10.75 ± 1.864 days), with a p-value of 0.0001. Clinical infection was reported in 1 patient (2.5%) in the calcium alginate group compared to 7 patients (17.5%) in the chlorhexidine paraffin group, which was statistically significant ($p = 0.02$).

Conclusion: Calcium alginate dressing demonstrated superior outcomes in reducing healing duration and infection rates at skin graft donor sites, indicating its potential for routine clinical application.

Keywords: Alginate dressings, Chlorhexidine, Clinical infection, Donor site, Healing, Paraffin dressing, Skin grafts.

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INTRODUCTION

Skin grafting has long served as a reliable method for wound closure, particularly when primary closure is not feasible. Although flap techniques have gained popularity in recent years due to their robust vascularity and versatility, skin grafts continue to be a valuable reconstructive tool, especially for achieving cosmetically satisfactory outcomes in well-selected cases. Unlike flaps, skin grafts are completely severed from their blood supply and require a well-vascularized recipient bed for survival (1). The viability of a graft hinges on adequate perfusion at the recipient site and a careful selection of the donor site that closely matches the graft area in terms of thickness, color, texture, and adnexal structures. An ideal donor site should also be free from any cancerous or precancerous lesions and, where applicable, correspond to the degree of actinic damage observed at the recipient site (2,3). Particular attention must be paid to avoid transplanting hair-bearing skin to areas that are naturally hairless, as this may result in aesthetic and functional complications. If unavoidable, post-healing epilation may be used to address unwanted hair growth. Commonly selected donor sites for full-thickness facial skin grafts include the supraclavicular, preauricular, postauricular regions, and the inner arm, with the conchal bowl often utilized for harvesting sebaceous skin suitable for nasal grafts (4,5).

Management of donor site wounds plays a pivotal role in the overall success of grafting procedures. Over the years, a variety of dressings have been employed, with Chlorhexidine Paraffin and Calcium Alginate dressings being among the most commonly used. Chlorhexidine Paraffin dressings combine the antimicrobial action of chlorhexidine with the emollient properties of paraffin, maintaining a moist wound environment conducive to tissue regeneration, while also providing pain relief and reducing infection risk (6,7). In contrast, Calcium Alginate dressings, derived from seaweed, are known for their exceptional absorbency and their ability to conform to the wound bed. These dressings facilitate autolytic debridement and are especially beneficial for wounds with high exudate levels, promoting faster healing and minimizing maceration risk (8,9). Despite promising evidence supporting the superior wound healing outcomes associated with Calcium Alginate dressings, such as reduced healing time and lower infection rates, their adoption in clinical practice remains limited. This discrepancy may be attributed to a lack of localized data supporting their use in donor site management. Consequently, the current study aims to evaluate and compare the outcomes of skin graft donor sites treated with Chlorhexidine Paraffin versus Calcium Alginate dressings. The objective is to generate context-specific evidence that can support the integration of Calcium Alginate dressings into routine practice, potentially improving healing outcomes, reducing patient morbidity, and optimizing resource utilization in skin grafting procedures.

METHODS

This study was designed as a randomized controlled trial to evaluate the effects of chlorhexidine paraffin dressing versus calcium alginate dressing on the healing of skin graft donor sites. The trial was conducted at the Department of Plastic Surgery, Lady Reading Hospital (MTI), Peshawar, over a six-month period from May 24, 2024, to November 24, 2024, following ethical approval from the hospital's Institutional Review Board. The sample size was calculated to be 80 participants, divided equally into two groups of 40 each. This calculation was based on a statistical power of 80%, a significance level of 5%, and expected clinical infection rates of 0% for calcium alginate and 18% for chlorhexidine paraffin dressings, as derived from previous literature (10). Participants were recruited using a non-probability consecutive sampling method from the hospital's plastic surgery wards. The inclusion criteria comprised patients of either gender aged between 16 and 75 years, presenting with a skin graft donor site requiring dressing. Exclusion criteria included patients with diabetes mellitus, confirmed by a random blood sugar level exceeding 200 mg/dl, those on corticosteroid therapy as documented in medical records, and individuals with clinically evident infection at the donor site at the time of recruitment (11).

Prior to enrollment, informed consent was obtained from all participants in their native language, ensuring complete understanding and voluntary participation. Baseline demographic data—including name, age, gender, and graft site and size—were recorded systematically on a structured proforma. Randomization was conducted using a blocked randomization technique to maintain balance between the two groups. One group received chlorhexidine paraffin dressing, while the other was treated with calcium alginate dressing. Both dressings were applied immediately after graft harvesting, adhering to institutional surgical protocols. Postoperatively, patients were followed in the outpatient department. The initial follow-up was scheduled five days after the procedure to evaluate for clinical signs of infection, including redness, swelling, localized pain, or purulent discharge at the donor site. Any cases of infection were managed in accordance

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with standard hospital guidelines. Continued follow-up visits were arranged until complete re-epithelialization of the donor site was observed, which marked the end of the healing period. Dressing changes were performed as needed, and all findings were documented in the proforma. Data analysis was conducted using SPSS version 22. Quantitative variables such as age, graft size, and healing duration were analyzed using mean and standard deviation to depict central tendency and variability. Categorical variables, including gender, graft site, and clinical infection status, were summarized as frequencies and percentages. To compare mean healing durations between the two groups, an independent samples t-test was employed. The chi-square test was used to compare infection rates. A p-value ≤ 0.05 was considered statistically significant. Data were further stratified by age, gender, graft size, and graft site to assess effect modification. Within each stratum, appropriate statistical tests were applied to evaluate subgroup-specific outcomes, maintaining the same significance threshold.

RESULTS

The study included 80 participants, with 40 individuals assigned to each treatment arm. The mean age of patients in the chlorhexidine paraffin group was 50.77 ± 18.60 years, while those in the calcium alginate group had a mean age of 47.08 ± 16.93 years. Across the overall sample, the average age was 48.92 ± 17.77 years. With respect to graft dimensions, the mean graft size in the chlorhexidine paraffin group measured 0.3057 ± 0.02745 mm, compared to 0.2935 ± 0.02527 mm in the calcium alginate group, resulting in a combined average of 0.2996 ± 0.02693 mm. The gender distribution revealed that in the chlorhexidine paraffin group, 23 participants (57.5%) were male and 17 (42.5%) were female. In the calcium alginate group, 21 participants (52.5%) were male and 19 (47.5%) were female. Overall, 55% of the study population were male and 45% were female. Regarding the anatomical location of the donor grafts, the most frequent site was the thigh, utilized in 46.2% of participants. Specifically, thigh grafts were observed in 18 patients (45%) from the chlorhexidine paraffin group and 19 patients (47.5%) in the calcium alginate group. The abdomen was the donor site in 16 patients (40%) from group A and 17 patients (42.5%) from group B. Grafts harvested from the back accounted for 6 cases (15%) in group A and 4 cases (10%) in group B, contributing to a total of 12.5% across both groups.

The mean duration of healing differed significantly between the two dressings. Participants in the chlorhexidine paraffin group experienced an average healing time of 10.75 ± 1.86 days, whereas those in the calcium alginate group demonstrated a shorter healing duration of 8.83 ± 1.55 days. This difference was statistically significant ($p = 0.0001$), indicating a more rapid re-epithelialization process with calcium alginate dressings. Clinical infection at the donor site was identified in 7 participants (17.5%) within the chlorhexidine paraffin group, while only 1 case (2.5%) was observed in the calcium alginate group. The remaining 33 patients (82.5%) in group A and 39 patients (97.5%) in group B showed no signs of infection. This reduction in infection rate with calcium alginate was statistically significant ($p = 0.02$). Upon stratification by age, gender, graft site, and graft size, no statistically significant differences were observed in infection rates between the two groups ($p > 0.05$), suggesting these variables did not modify the relationship between dressing type and infection occurrence.

Table 1: Descriptive statistics

Groups		Age (Years)	Size of the graft (mm)	Duration of healing (Days)
Group A (Chlorhexidine paraffin)	Mean	50.77	.3057	10.75
	N	40	40	40
	Std. Deviation	18.603	.02745	1.864
Group B (Calcium alginate)	Mean	47.08	.2935	8.83
	N	40	40	40
	Std. Deviation	16.929	.02527	1.551
Total	Mean	48.92	.2996	9.79
	N	80	80	80
	Std. Deviation	17.771	.02693	1.960

Table 2: Site of graft

		Site of graft			Total
		Thighs	Abdomen	Back	
Groups	Group A (Chlorhexidine paraffin)	18	16	6	40
		45.0%	40.0%	15.0%	100.0%
	Group B (Calcium alginate)	19	17	4	40
		47.5%	42.5%	10.0%	100.0%
Total		37	33	10	80
		46.2%	41.2%	12.5%	100.0%

Table 3: Comparison of clinical infection between both groups

		Clinical infection		Total	P value
		Yes	No		
Groups	Group A (Chlorhexidine paraffin)	7	33	40	0.02
		17.5%	82.5%	100.0%	
	Group B (Calcium alginate)	1	39	40	
		2.5%	97.5%	100.0%	
Total		8	72	80	
		10.0%	90.0%	100.0%	

Table 4: Comparison of duration of healing between both groups

	Groups	N	Mean	Std. Deviation	P value
Duration of healing (Days)	Group A (Chlorhexidine paraffin)	40	10.75	1.864	0.0001
	Group B (Calcium alginate)	40	8.83	1.551	

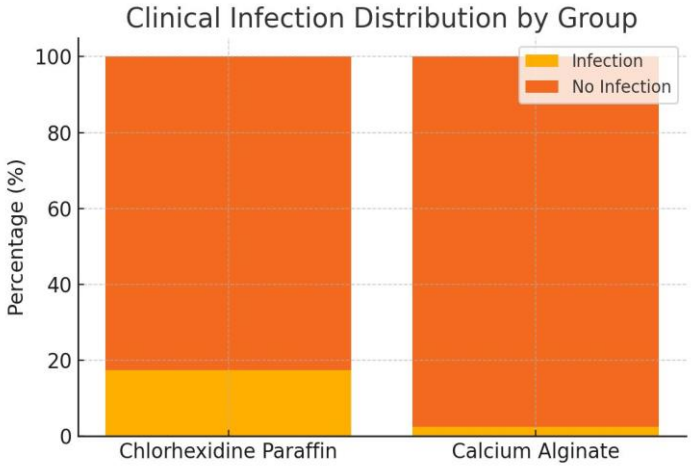


Figure 2 Clinical Infection Distribution by Group

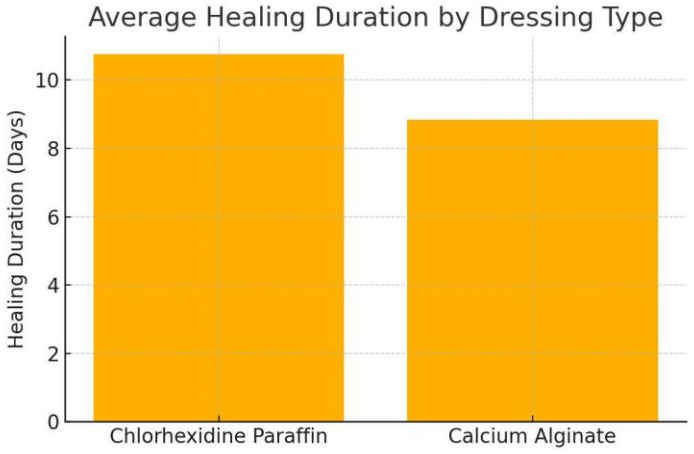
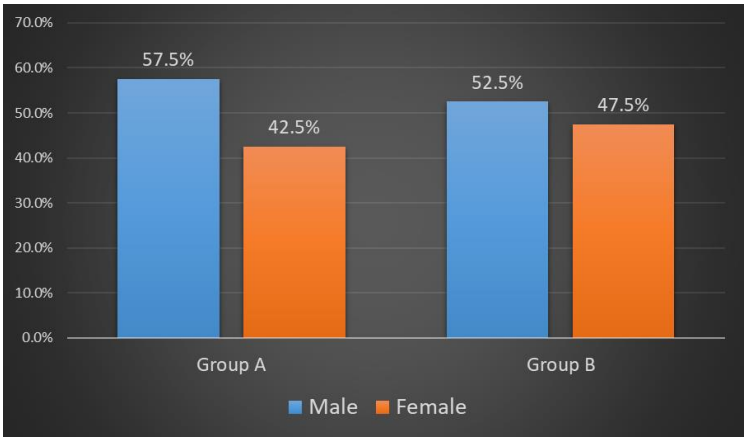


Figure 1 Average Healing Duration by Dressing Type



DISCUSSION

The findings of this study highlighted a statistically significant difference in healing time between the two dressing types, with donor sites managed with calcium alginate exhibiting a faster re-epithelialization period compared to those treated with chlorhexidine paraffin. This trend aligns with previous literature where calcium alginate was consistently associated with accelerated wound closure and enhanced epithelial regeneration (12). Reported reductions in healing time across comparative studies reinforce the premise that calcium alginate's ability to maintain a moist wound environment, support autolytic debridement, and promote hemostasis plays a central role in facilitating tissue repair and recovery (13). These observations substantiate the functional advantage of alginate-based dressings in managing donor site wounds, especially in clinical settings where minimizing recovery time is critical (14). In terms of infection control, the current study revealed a significantly lower rate of clinical infection among participants treated with calcium alginate. This observation mirrors earlier studies where alginate dressings were associated with reduced infection incidence, although not always reaching statistical significance. The hemostatic effect of alginate, through calcium ion release, likely contributes to improved clot stability and reduced hematoma formation, both of which are known risk factors for secondary infection (15,16). Conversely, the antiseptic benefit expected from the chlorhexidine component did not translate into reduced infection rates, suggesting limitations related to its delivery, retention, or the dressing's inability to adequately manage exudate. These findings suggest that the biological properties of the dressing material may be more critical to infection prevention than the incorporation of antiseptics alone (17,18).

The demographic distribution in this study, including a balanced gender ratio and a wide age range, contributed to the generalizability of the findings, especially in adult populations. Unlike prior studies that either lacked demographic detail or included pediatric cohorts, the age uniformity in this cohort strengthens the applicability of results to routine adult surgical practice (19,20). However, the absence of pediatric data restricts extrapolation of outcomes to younger patients, and future studies should consider including pediatric and geriatric populations to expand the clinical relevance across age groups. While this investigation focused primarily on healing duration and infection incidence—both clinically pertinent endpoints—it did not include direct assessment of patient-reported outcomes such as pain intensity, comfort, or satisfaction. These are increasingly recognized as essential components of wound care evaluation. Prior comparative research has shown that calcium alginate dressings result in reduced pain, both at rest and during dressing changes, likely due to their non-adherent properties and the moist healing environment they maintain. Although pain was not measured in this study, the observed differences in healing speed and infection rates indirectly suggest an advantage in patient comfort and morbidity reduction. Incorporating validated pain scoring systems and patient feedback tools in future studies would enrich the evidence base and inform patient-centered care practices.

Among the strengths of this study were its randomized design, balanced baseline characteristics, and clear primary outcome definitions, all of which support the internal validity of the findings. The blocked randomization ensured group comparability, and objective assessment criteria reduced bias. The study's setting in a high-volume tertiary care center further contributes to the external validity of its conclusions. Nevertheless, limitations included the non-probability sampling technique, which could limit representation, and the single-center design, which may not reflect variability in care practices across different institutions. Additionally, the follow-up period was confined to the wound healing phase, without long-term surveillance for complications such as hypertrophic scarring or hyperpigmentation, which can influence overall cosmetic and functional outcomes. In summary, the study demonstrated that calcium alginate dressings significantly reduced healing time and infection rates compared to chlorhexidine paraffin in the management of skin

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graft donor sites. These findings support the incorporation of alginate-based dressings into routine clinical protocols. Future investigations should consider multicenter collaboration, inclusion of patient-reported outcomes, economic evaluations, and long-term cosmetic results to provide a comprehensive understanding of the advantages and limitations associated with each dressing modality.

CONCLUSION

This study concludes that calcium alginate dressing offers clear advantages over chlorhexidine paraffin dressing in promoting faster healing and reducing the risk of clinical infection at skin graft donor sites. These findings support the integration of calcium alginate into routine postoperative wound care protocols for graft management. To build on these results, future studies should explore the impact of dressing types on patient comfort, pain levels, and scarring, allowing for a more comprehensive understanding of their patient-centered outcomes and long-term effectiveness.

Author Contribution

Author	**Contribution**
Shabab Hussain*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Riaz Ahmed Afridi	Substantial Contribution to study design, and interpretation of Data Critical Review Has given Final Approval of the version to be published
Zara Ibrar	Literature Review
Sami Ul Haq	Literature Review
Khalid Abbas	Literature Review
Asghar Khan	Literature Review

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