Comparison of Three Methods of Dressings for Split Thickness Skin Graft Donor Site - Non Woven Dressing Impregnated with Amorphous Hydrogel, Amorphous Hydrogel with Colloidal Silver and Conventional Paraffin Gauze Dressing

Abha Rani Kujur[1], Nita Trina D'Souza[2]

ABSTRACT

Introduction: Skin grafting is a common reconstructive technique done in plastic surgery. Management of split skin graft donor sites are targeted at promoting faster healing, minimizing pain and complications. A vast number of dressing options for donor sites are available. Search for a better dressing method continues. Aim of this study was to determine the best method of dressing the donor site among three different methods with respect to the rate of healing, pain, exudates and infection.

Material and methods: Institutional ethical clearance and patient consent was obtained prior to start of the study. Based on investigator's previous clinical experience, sample size of 75 was arrived at with a power of 80%. Patients were randomly divided into 3 groups by Graph Pad quick calc computing provided by statistician. Group A- dressings with conventional paraffin gauze. Group B-dressings with non woven dressings impregnated with amorphous hydrogel. Group C- dressings with amorphous hydrogel with colloidal silver and paraffin gauze. Statistical analysis was done by Anova and Kruskal Wallis Test.

Results: Median healing percentage was 98%, 96% and 99% in groups A, B, C respectively on 8th post operative day. This difference was statistically significant (P=0.033). Pain score on post op day 3 was lower in group C (P=0.08). Two patients had infection one in group b and one in group c, which was not statistically significant.

Conclusion: Patients undergoing dressings with amorphous hydrogel with colloidal silver and paraffin gauze had faster healing and experienced lower pain.

Keywords: Skin Graft, Hydrogel, Silver, SSG Donor Site Dressings, Paraffin Gauze

INTRODUCTION

Skin grafting is the most common procedure done in plastic surgery for wound cover. Etiology being raw areas from trauma, diabetic ulcers, deep burns and scar contracture release.[1,2,3] Split skin graft (SSG) involves harvesting epidermis and varying depth of dermis from the donor sites.[4] This results in a second wound which is more painful than the recipient raw area.[5,6] The SSG donor site wound (SSG-DSW) usually heals in 7-14 days.[5] However during this healing time patients experience pain in the DSW, soakage of dressing by exudates from raw area bed and sometimes the DSW gets infected.[7,8,9] This results in increased morbidity for the patient with delayed wound healing and hypertrophy of the donor area.[10] Hence the DSW dressings need to be done precisely and under strict aseptic conditions. An ideal donor site dressing is one which minimizes pain, promotes healing, prevents infection, easy to use, non adherent, cause minimal scarring and is inexpensive.[11,12,13,14] The availability of different types of donor site dressings in the market indicates an ideal dressing is yet to be found.[1,11,15,3,16]

For long paraffin gauze dressing has been the first choice of dressing among plastic surgeons due to ease of application, less pain, low cost and less infection rates.[12,17,18] The standard meshed paraffin gauze dressing is considered nonadherent due to the paraffin component. However it adheres to the wound surface and it doesn't absorb exudates. This results in soakage of dressing and dressing removal is painful.

Amorphous hydrogel has been shown to be able to absorb exudates, maintain a moist environment and facilitate wound healing and prevent secondary infection.[19] Varaprasad et al have demonstrated the antibacterial action of silver by preventing bacterial DNA replication.[20] Thus a dressing with amorphous hydrogel, silver and paraffin gauze would be close to an ideal dressing. However there are no studies in literature assessing the usefulness of this type of dressing combination. Hence the need for such a study is vital.

The aim of our study was to determine the best method of dressing amongst three different methods, A-Conventional paraffin gauze dressings, B-Nonwoven dressings impregnated with amorphous hydrogel, C-Amorphous hydrogel with colloidal silver with paraffin gauze dressings with respect to the rate of healing, pain, exudate and infection.

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MATERIAL AND METHODS

This is a single centre, prospective, comparative randomized study done over a period of 1year. Approval was obtained from the Institutional ethics review board. Informed consent was obtained from each patient who enrolled in the study. Based on the investigator's previous clinical experience, a total sample size of 75 was arrived at with a power of 80%. Patients were randomly divided into three groups by using the software "Quickcalc graphpad". The list was provided by the statistician. All patients requiring SSG were included in the study. Exclusion Criteria was patients less than 18 yrs or above 60 yrs, known diabetes, known allergy to silver, patients on pain modifying drugs and patients who were unable to complete the study.

Donor site for all the patients was either thigh area, unused previously as a donor site. Internal validity was maintained as follows. The grafts were harvested in a standard manner. Thickness of the graft was the same for all patients. All the operating surgeons used the same available instrument - Padget knife for skin harvesting at one and a half calibrations. SSG harvested was approximately 0.36-0.43mm thickness. Immediately after graft harvesting the donor site was dressed with adrenaline saline mops for 7 minutes to achieve hemostasis. Adrenaline saline was prepared by mixing 1ml of 1:1000 adrenaline saline preparations in 500ml of Normal Saline. Surface area of the donor sites was measured using ruler and noted. Then one of the three types of dressing was done for the donor site according to the group the patient belonged to.

Group A – Dressed with a single layer of paraffin impregnated gauze.

Group B – Dressed with nonwoven dressings impregnated with amorphous hydrogel.

Group C– Dressed with amorphous hydrogel with colloidal silver followed by a single layer of paraffin gauze dressings. All groups were then covered with double layer of burns pad dressing and tightly bandaged. Dressing was fixed to skin with dynaplast at the upper border. (Burns pad is absorbent dressing material prepared at the hospital CSSD, size=25cm×44cm×2.5cm with a range of + or _0.5cm.). Post op all patients received the same analgesia as per the department's analgesic protocol. All patients were on strict bed rest till complete graft uptake.

Pain score was recorded daily from day 1 to day 10 post op by using the visual analogue scale from 0 (no pain) to 10 (maximal severe pain). Strike through dressings if any, was also checked for daily. Over-padding was done if strike through was observed. Donor site dressing was opened slowly on day 8, day 10, and day 12 post op and two observations were made. One was to note the healed surface area by direct visual examination. Areas where epithelisation was seen, was considered as healed. Scabs or crusts were considered as unhealed areas.[6] Second observation was to look for any infection of the donor site. Signs of infection included (qualitative methods) erythema, induration, purulent discharge, or malodor. If infection was present swab was sent for culture sensitivity and daily dressing was done with antiseptic ointment and paraffin gauze dressings till complete healing noted. Complete donor site healing was considered when there was complete epithelisation of the area.

Patients were discharged if there was complete uptake of recipient site SSG, complete pain relief and adequate availability of home care. Thus patients were discharged in spite of unhealed study donor sites.[11]

STATISTICAL ANALYSIS

External validity was maintained by using SPSS software. This was used for descriptive and inferential statistics. P value using ANNOVA and Kruskal Wallis Test was calculated and value <0.05 was taken as statistically significant.

RESULTS

A total of 75 patients were enrolled for study and results of 67 patients were studied finally as the rest were lost to follow up. Thus total patients in each group were as follows.

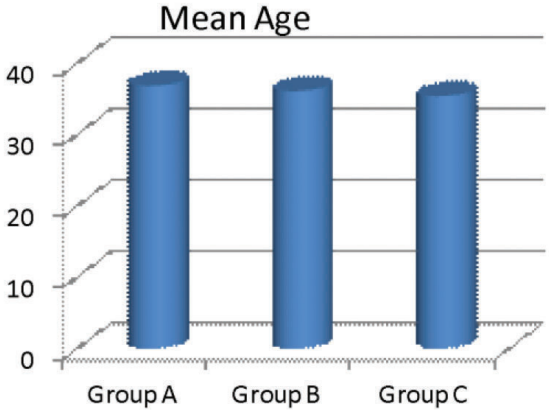
Group a) Conventional paraffin gauze dressings (N=25)

Group b) Nonwoven dressings impregnated with amorphous hydrogel (N=19), 6 patients lost to follow up

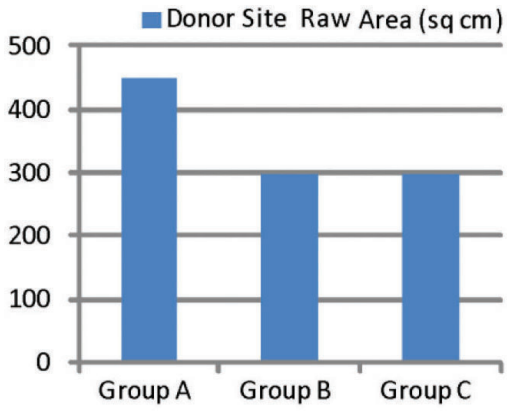
Group c) Amorphous hydrogel with colloidal silver and paraffin gauze dressings (N=23) 2 patient lost to follow up.

Mean age

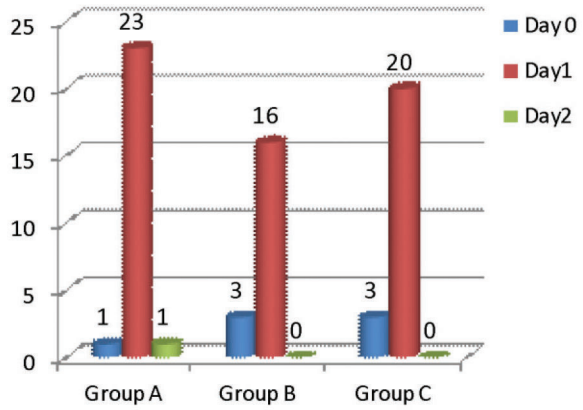
There were 49 men and 18 women. The mean age of the



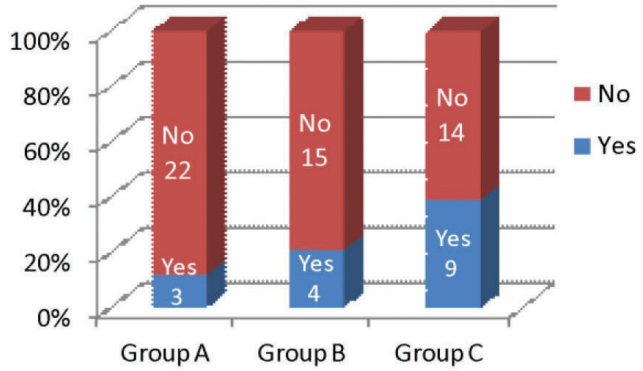
Graph-1: Mean age



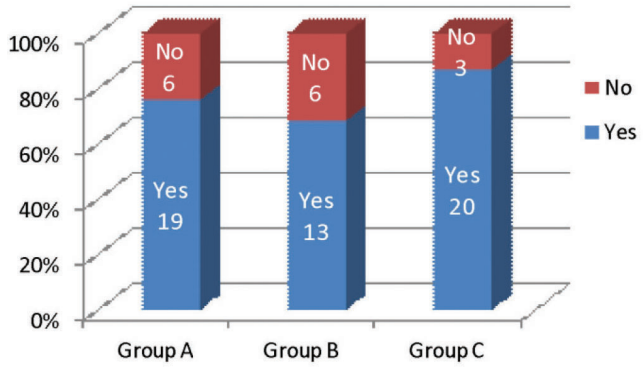
Graph-2: Donor site area



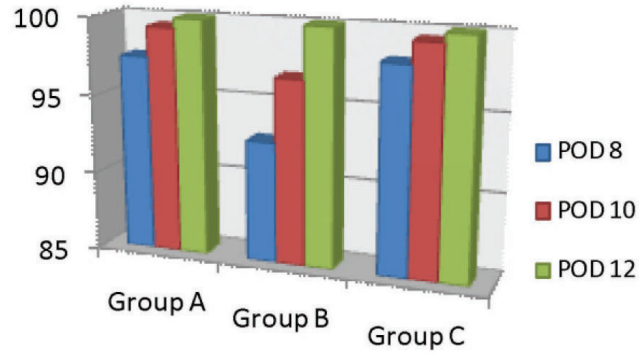
Graph-3: Strike through rate



Graph-4: Shows the proportion of subjects who had complete healing on day 8 was higher in group C.

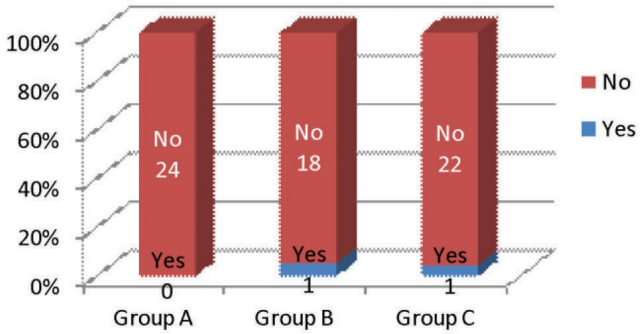


Graph-5: Shows the proportion of subjects who had complete healing on day 10 was higher in group C.

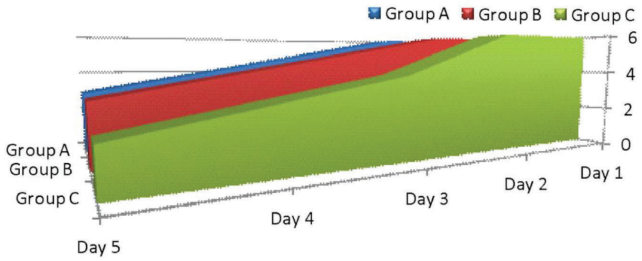


Graph-6: At day 12 the median healing

patients in each group was 35-36yrs. The three groups were comparable in age P=0.88 (graph-1).



Graph-7: Infected DSW in each group



Graph-8: Pain score

Donor site area

The donor site area was comparable between the three groups (P=0.13). The median areas were 450, 300, 300 square cm in the three groups (graph-2).

Strike through

Strike through day was not associated with group. Most patients had strike through on 1st post op day. There were 7 subjects with no strike through at all and only one patient had strike through on 2nd post op day also. No fresh strike through was noticed from day 3 onwards (graph-3).

Healing on post op day 8

At post op day 8 the median percentage healing was 98%, 96% and 99% in groups A, B, C respectively. This is significantly different at *P*=0.03.The proportion of subjects who had complete healing on day 8 was higher in group C (39%) compared to groups A (12%) and B (21%). The chi square *P* value was 0.08 (graph-4).

X-axis shows the study groups and Y-axis shows the number of patients DSW healed and not healed by day 8.

Healing on post op day 10

The proportion of patients having complete healing on post op day 10 is higher in group C (78.6%), compared to group A (72.7%) and group B (60%) (graph-5).

X-axis shows the study groups and Y-axis shows the number of patients with healed and not healed DSW by day 10.

Percentage of raw area healed on post operative day 8, 10 and 12.

At day 12 the median healing was 100% in all three groups (graph-6).

X-axis shows the groups on post op day 8,10,12 and Y axis shows the percentage of DSW healed completely on the respective post op day

Donor Site Infection

Only one subject had infection in groups B and C each.

No side effects like donor site hypertrophy or excess pain were noted. This could be due to breach in sterility at some point in patient care. It was however found to be statistically insignificant (graph-7).

X-axis shows the study group and Y-axis shows number of infected DSW in each group

Pain score

Pain score on post op day 3 was lower in group C (P=0.08)

Visual Analogue Scale (pain score in on right side no 0-6)

X-axis shows post op day and Y-axis shows the groups.

DISCUSSION

Split skin graft surgery has been the workhorse of plastic reconstructive surgery and burns. This results in a second wound (DSW) which is more painful than the recipient raw area.[5,6] The DSW heals spontaneously by 7-14 days.[5] Sometimes there is infection in the DSW and this delays healing and increases morbidity. Thus it is of utmost importance to ensure that the DSW are dressed meticulously. In addition, SSG-DSW are extremely painful. The aim of DSW management is to maintain an environment that promotes optimal healing and prevents morbidity like pain, infection and ultimately delayed healing.

For long paraffin gauge dressing has been the first choice of dressing among plastic surgeons due to ease of application, low cost and less infection rates.[12,17,18] The standard meshed paraffin gauze dressing is considered nonadherent due to the paraffin component. However it adheres to the wound surface and it doesn't absorb exudate. Hence when early removal of the dressing is needed, as in wound infection or to check the epithelization, there can be peeling off of the new epithelium resulting in aggravation of pain and deepening of the wound.[17]

DSW dressings have been undergoing changes from time to time. Surgeons have found various methods for donor site dressings with lot of permutations and combinations to ensure that donor site heal faster with minimal pain and scarring. There have been improvements from then on, but there is no standard dressing. Every surgeon, based on his experience and the probable organisms growing there, arrives at the conclusion of doing a particular kind of DSW dressing.

Hydrogel dressings are hydrophilic gels made of insoluble polymers like carboxymethylcellulose, hemicellulose, agar, glycerol and pectin. They have the capacity to absorb high levels of wound exudate. Since they maintain a moist environment there is faster re epithelization. Hydrogels are available in amorphous form (a loose gel) and in a sheet form where the gel is presented with a fixed three-dimensional macrostructure.[21] Water fills the space between the polymer chains.[22]

Hydro gel has the following properties:

1. Absorbs an excess of wound exudates
2. Protects a wound from secondary infection
3. Promotes re-epithelisation by maintaining a moist environment[19]

Silver is effective in ionic form and in sufficient concentration.[23] Hence one needs to use silver formulation that releases silver over prolonged periods of time to maintain adequate concentration in the wounds. Silver ions cause bacterial cell death by acting on multiple sites in bacterial cells as follows.

1) They bind to bacterial cell membranes, causing disruption of the bacterial cell wall and cell leakage.[24,25]
2) Studies by Varaprasad et al, has shown that the electronic effects of silver produces a change in the local electronic structure on the surfaces of the bacteria. This inactivates the vital bacterial enzymes and prevents replication of DNA.[20]
3) Silver ions transported into the cell disrupt cell function by binding to proteins and interfering with energy production, enzyme function and cell replication.[24,25,26]
4) Silver also binds to proteoglycans in microbial cell walls and denaturing the proteins. Proteoglycans are however not present in mammalian cell wall hence new epithelium and other cellular components of healing are not affected by silver. This allows uninterrupted re–epithelization.
5) Silver reduces metalloproteinase activity in the wound thereby reducing inflammation.[27]
6) Silver ions are active against a broad range of bacteria, fungi and viruses, including many antibioticresistant bacteria, such as meticillin-resistant Staphylococcus aureus (MRSA) and vancomycinresistant Enterococci (VRE).[28]
7) Studies experimental models of biofilms have suggested that silver reduces bacterial adhesion, destabilizes the biofilm matrix and increase susceptibility of bacteria to antibiotics.[29,30,31,32]
8) There is no cross resistance between antibiotics and silver[23]

This study was done on 75 patients, out of which 8 were lost to follow up. Results have been analyzed for the 67 patients who completed the study. The study included 49 men and 18 women. The mean age of the patients was 35-36yrs. All SSG was harvested by the same available Padget's knife to ensure thickness of the graft was the same for all patients. Hemostasis was achieved by dilute adrenaline in all the three groups following which donor SSG area dressing was done based on randomization. Achieving good hemostasis has been shown to achieve faster epithelization and result in an uneventful wound healing of the donor site.[33,34] The groups were assigned as Group A – Dressed with a single layer of paraffin impregnated gauze. Group B – Dressed with nonwoven dressings impregnated with amorphous hydrogel and Group C– Dressed with amorphous hydrogel with colloidal silver followed by a single layer of paraffin gauze dressings. The donor site in group A,B,C was 450, 300, 300 square cm respectively and this was comparable (p=0.137). Post dressing strikethrough was maximum on first post op day with highest number seen in Group A(23). One patient from group A also had strike through on the second day indicating paraffin gauze dressing poorly absorbs exudates.

Strike through rate was lowest in Group B (16) showing that non woven dressing can absorb the exudates better.

Healing of donor area was noted on day 8,10,12 by direct visual examination. This method of assessing and defining healing of donor sites has been described in other studies as well.[13,34,35,36] Complete healing of donor site is determined by complete epithelization of the area. Healing rate, which is the area of epithelization, was higher in group C (39%) compared to groups A (12%) and B (21%) on day 8. This was significantly different at p =0.033. The proportion of patients having complete healing by post op day 10 was also higher in group C (78.6%), compared to group A (72.7%) and group B (60%). This is comparable to other studies which have shown complete re-epithelization with hydrogel by average of 9.4-9.5days.[1,11] This proves hydrogel dressing promotes re-epithelization as shown in numerous other studies[1,19,39,40,41] Epithelial cell proliferation and migration is better in a moist environment.[1,3,11,15,16] This is because keratinocytes migrate more easily over a moist wound surface than underneath a scab.[40] Migration is at a rate of about 0.5 mm/day over a moist wound surface. This is twice as fast as under a scab in dry wounds.[41] This concept has been supported in other skin-graft donor site studies as well which have compared re-epithelisation rates in moist-environment dressings versus traditional dry dressing.[11,39,42,43,44] Complete re epithelisation by hydrocolloid dressings has also been shown in studies by Brolmann et al[4] Only one subject had infection in groups B and C.

Pain was less by day 3 in group C and this was statistically significant (P=0.08). When a single large wound is divided into two small side by side donor wounds, it would be difficult for a patient to tell reliably and accurately, if pain was actually less in a certain part of the larger wound.[11] Hence in our study the division of a single donor site into two different dressings was not done. Pain relief with hydrogel has also been shown in an extensive review of 33 published donor site studies by Rakel et al.[1] Pain is reduced in a moist environment as it protects nerve endings from exposure and drying and this reduces pain especially during dressing changes.[44] Thus our study found hydrogel dressings to be superior for donor site healing as shown in four other systematic reviews.[1,3,15,16] with regard to healing and pain.

Patients were discharged if there was complete uptake of recipient site SSG, complete pain relief, ambulating and adequate availability of home care. Thus patients were discharged inspite of unhealed study donor sites.[11] This however resulted in loss to follow up of 8 patients- 6 in Group B and 2 in Group C. This could have been avoided by discharging all patients only after complete healing of the SSG donor area.

This study doesn't measure the quality of life and cost of each dressing material. For any procedure done patients satisfaction is equally important and this impacts the patient's quality of life. Cost is important in order to utilize our resources optimally. A better way to conduct a study which includes so many variables, to be studied and for analysis, is by randomized controlled trial with a parallel economic evaluation.[3]

The strength of the study is availability of patients requiring SSG, procedure is simple and easily reproducible and short hospitalization.

CONCLUSION

Hydrogel has got good pain relief in partial thickness skin wounds. Silver is a good anti broad spectrum antimicrobial. This combination gives good pain relief and early healing of partial thickness skin wounds. Hence its use in appropriate cases can benefit the patients enormously.

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