Dressings for split thickness skin graft donor sites: A comparison of three options

ABSTRACT
Background: The management of donor sites after harvesting of split thickness skin grafts is a challenge.
Aim: The aim of this study was to compare three different dressings for split thickness skin donor sites.
Methods: This study was designed as a prospective comparative study of 60 patients allocated to one of three donor site dressings groups, following harvesting of split skin. The first and second groups (n=20 for each) were treated with calcium sodium alginate dressings covered with transparent semi-occlusive films*, **, and the third group (n=20) with a hydrofiber dressing covered with a soft silicone foam dressing***. Endpoints were healing, pain, costs, and number of dressing changes.
Results: No difference was found among the three groups with respect to healing and pain. Significantly more unplanned dressing changes were required in the second group (28) compared with the first and third groups (4 for each). Significantly lower total direct dressing costs were found in the first and third groups compared with the second group. The median ratios of total dressing costs were 1.13, 2.15, and 1.00 for the first through third groups, respectively.
Conclusions: This study shows that two dressings, almost identically described by manufacturers, performed significantly differently when used clinically. The dressing with the lower per-dressing cost was the most expensive choice because of its high frequency of dressing changes.

INTRODUCTION
Split thickness skin grafts (STSGs) are used to repair acute and chronic skin defects when direct closure cannot be accomplished, and a STSG is considered preferable to a surgical flap or closure by secondary intention. The wound created by harvesting the STSG – the STSG donor site – is a flat wound. A STSG donor site reepithelialises through the in-growth of keratinocytes originating from the apocrine glands and pilosebaceous units left intact in the preserved deep layer of the dermis. A donor site can be expected to heal within 2 weeks, if complications are avoided1, 2.

A recent systematic review regarding donor site dressing found no clear evidence to support the choice of any particular dressing3. A STSG donor site is painful, so it is important to the patient that the dressing, placed over the site, reduces pain3, 4. Furthermore, it is preferable that the dressing is relatively inexpensive and easy to handle, apply, and remove5, 6. It is also essential that the dressing is comfortable and does not hinder physical activities4, 7, 8. In addition to the abovementioned requirements, it is crucial that the dressing improves, or at least does not impair, healing at the donor site8-10. The combination of providing protection and maintaining a moist surface are the main factors that minimise wound-related discomfort3.

In 2010, it was decided that all hospitals in Region Midt in Denmark should shift from one product to another for STSG dressings. In our department, we used the shift as an opportunity to conduct this clinical trial, to compare three different donor site dressings. The original dressing was a calcium sodium alginate dressing covered with a transparent semi-occlusive polyurethane film*. The new product chosen for all hospitals in the region was also calcium sodium alginate dressing covered with transparent semi-occlusive
polyurethane film*. A hydrofibre dressing covered with soft silicone foam dressing was chosen as a third option for evaluation in this trial***. Therefore, the aim of this study was to compare these three different dressings used on donor sites after STSG harvesting.

METHODS

The study protocol was approved by the Central Region Denmark and by the Danish Data Protection Agency, and the study was conducted in accordance with good clinical practice and ethical principles consistent with the Declaration of Helsinki. This was a prospective comparative study with historic allocation to three groups, based on different products used as dressings for donor sites after harvesting STSGs. Group allocation to the three groups is shown in Figure 1. The first 20 patients were included in Group 1; they were treated with calcium sodium alginate dressings covered with transparent semi-occlusive film. The next 20 patients were included in Group 2; they were also treated with calcium sodium alginate dressings covered with transparent semi-occlusive film. The last 20 patients were included in Group 3; they were treated with a hydrofibre dressing covered with a soft silicone foam dressing.

All adult (>18 years old) patients hospitalised or seen in the Department of Plastic Surgery’s outpatient clinic at the Aarhus University Hospital, Aarhus C, Denmark, between September 2010 and October 2011 were offered inclusion in the study if they required surgery to obtain an STSG from the anterior thigh. Only patients expected to have a donor site with an area <300 cm² were included, to obtain donor sites suitable for comparison. All patients were informed about the study both orally and in writing by the coordinating investigator during a clinical consultation. Patients were excluded if they were not physically or mentally able to cooperate, had a history of allergy to dressings, or refused to provide consent.

In the operating theatre, the STSG was harvested from the anterior aspect of the thigh of the patient using a dermatome or knife, according to standards for best practice. Immediately after split skin harvesting, the donor site was covered with adrenaline-soaked gauze (at a concentration of 1 mg adrenaline in 500 mL saline). After 10 minutes, the donor site was covered with a dressing according to the protocol and group allocation. The patients and staff could not be blinded to the chosen dressing because of the nature of the intervention and allocation in this study.

According to the protocol, the donor site dressing was left unchanged until the first clinic visit, which was planned at 8 to 10 days postoperatively unless leakage occurred (see an example of a dressing without leakage in Figure 2A). The nurses were instructed to act in accordance with the standards of the department and good clinical practice in all instances, and to report all occurrences and actions taken. The entire dressing was removed and replaced with a new dressing identical to the initial dressing (according to the treatment group), if the maximum capacity of the dressing was exceeded, leading to leakage or a high risk of leakage (see an example of a dressing with leakage in Figure 2B). The dressing was left in place and simply reinforced along the edges if there was loosening of the top layer. If infection was suspected, the dressing was changed, and if signs of infection were confirmed, the site was treated with a silver dressing, according to our standard treatment for infected STSG donor sites. At the first planned clinic visit, the percentage of healing at the donor site, as well as patient-reported pain and discomfort, were recorded. All contacts with the patient and abnormalities at the donor

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Figure 1: Patients included and evaluated in the three groups.

Figure 2A: Group 3 dressing on the ninth day, immediately prior to its removal.
site areas were also recorded. Each donor site was photographed at the first clinic visit and weekly thereafter until complete healing occurred (see an example of complete healing in Figure 2C). Any unhealed area was redressed every third day during from first change of dressing until complete healing.

The primary outcome measure was the percentage of healing at the first planned clinic visit, when the initial dressing was changed. Healing was recorded in 5-percentage increments, from 0 to 100% (e.g., 0%, 5%, 10%, etc.). As secondary outcome measures, the time to complete healing, number of dressing changes, and reported discomfort and pain intensity were recorded. The percentage of healing was assessed until 95% healing was obtained. The time to complete healing was recorded as the time (in days) from STSG harvesting until 95-100% healing was achieved. On the first day after surgery, the patients were asked to report their discomfort score, and they were asked to indicate their pain score three times: on the first day after STSG harvesting, and at the first planned clinic visit before and after the dressing was removed or changed. All scores were made using a numerical rating scale (NRS). Other observations, such as signs of infection, excessive wound exudate, leakage, and changing or reinforcement of dressings were also registered until the tenth postoperative day.

Statistical assessments were performed using the Mann-Whitney rank sum test. A p-value of 0.05 was considered as the level of significance.

**RESULTS**

Sixty patients were enrolled in the study (Table 1). Three patients (one in group 1 and two in group 2) were excluded, because they did not return to the hospital for the planned clinic visit (see Consort diagram in Figure 1). There were no statistical differences among the three groups with respect to patient characteristics or size of the donor site (see Table 1).

The median percentage of healing at the first planned clinic visit was 90%, 95%, and 98% in group 1, 2 and 3, respectively. For this primary outcome, there were no statistically significant differences among groups. The median (range) time to complete healing of the donor site was 13 (8-37), 14 (10-67), and 12 (8-35) days in group 1, 2 and 3, respectively (Fig. 3). These times were not significantly different among groups.

![Figure 2B: Donor site in group 2 in which the calcium sodium alginate dressing under the transparent semi-occlusive film has become displaced.](image1)

![Figure 2C: Healed split skin donor site in group 3 immediately after dressing removal.](image2)

**Table 1: Description of patients and donor sites for the three types of dressings**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients evaluated; patients included, (number)</td>
<td>19 (20)</td>
<td>18 (20)</td>
<td>20 (20)</td>
</tr>
<tr>
<td>Patients with comorbidities and/or treatments (number)</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Immunosuppressant treatment</td>
<td>8</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Anticoagulant therapy</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Median (range) patient age (years)</td>
<td>72 (56-90)</td>
<td>72 (47-94)</td>
<td>78 (41-87)</td>
</tr>
<tr>
<td>Median (range) size of donor site (cm²)</td>
<td>45 (25-150)</td>
<td>42 (16-119)</td>
<td>63 (16-200)</td>
</tr>
</tbody>
</table>
In all three groups, at least 70% of patients reported 0 or 1 out of 10 on the NRS scale regarding pain or discomfort at any time, and at no time was the mean score above 1.2 for any group (data not shown). There were no statistically significant differences in pain or discomfort scores among the three groups.

The number of additional, unplanned dressing changes within the first 8 to 10 days after harvesting was higher in group 2 compared with group 1 and 3 (p<0.001 for both comparisons) (Fig. 4). The number of reinforcements performed was similar in the three groups (six, five, and four reinforcements in group 1, 2 and 3 respectively). After the first 10 days, only the number of dressing changes was recorded. The total number of dressing changes was 36, 47, and 24 in group 1, 2 and 3 respectively; these numbers were not statistically different between groups.

Significantly more silver dressings were used for clinically identified infection at the STSG donor site in group 2 compared to group 1 and 3 (seven dressings compared to two [p<0.03] and zero [p=0.001] dressings, respectively) (Fig. 5). No systemic antibiotics were administered for donor site infection. Two patients received systemic antibiotic treatment for other reasons: one in group 1 and one group 2.

The direct cost of dressings used in the first 10 days after STSG harvesting was significantly lower in group 1 and group 3 compared with group 2 (p<0.004 and p<0.003, respectively). The ratios of the median total dressing costs for the three groups were 1.13, 2.15, and 1.00 for group 1, 2 and 3, respectively. The ratios of the costs per dressing for the same three groups were 1.13, 1.00, and 1.28, respectively.

**DISCUSSION**

In our study, we found no statistically significant differences among the three groups with respect to the percentage of healing at the first planned visit, total healing time, or patient-reported pain or discomfort. Yet, significant differences among the three groups were observed in the number of dressing changes required before the first planned dressing change, number of silver dressings used, and direct costs of the dressing used (Table 2).

In a randomised controlled trial, Vaingankar et al. demonstrated that moist wound healing protects the wound from dehydration and contamination, promotes wound healing, and is associated with decreased levels of wound pain7. Only dressings designed to provide moist wound healing were used in this trial. Because the raw surface of the donor site produces a considerable amount of exudate, the ideal donor site dressing must be able to deal with a large volume of exudate initially, yet still provide moist wound healing when the quantity of exudate later decreases7, 10, 11.

Many products are available that potentially or theoretically fulfil the requirements for an optimal donor site dressing. However, none has been definitively shown to be superior to the others, and the choice of dressing currently depends on the clinician's preferences2, 3. The healing effect of the dressing is of primary importance, but discomfort and pain caused by the donor site and dressings are also important. The choice of dressing for the donor site can have a major impact on a patient's satisfaction and recovery12. Other significant considerations when choosing a STSG donor site dressing are the risk of complications, costs related to the dressing products, ease with which the dressing products can be applied and removed, and contentment of the caretakers.

The calcium alginates used in our study seem to be suitable for STSG donor sites according to the information provided by the manufacturers. Calcium sodium alginate interacts with the wound exudate, forming a gel that promotes a moist environment and provides a haemostatic effect. To cover the calcium sodium alginate dressing, we used a semi-occlusive transparent film. These transparent semi-occlusive polyurethane films are appropriate for this purpose, as they allow inspection without being removed and they allow exudate to evaporate through the film. A review concluded that as a primary dressing on small
donor sites, these dressings are the most comfortable for patients and allow reepithelialisation in approximately 10 days\textsuperscript{10}. They have also been demonstrated to be useful when applied on top of calcium sodium alginate dressings\textsuperscript{13, 14}. Transparent semi-occlusive polyurethane films are recommended primarily for small donor sites when used without fillers, because they have difficulty handling excessive exudate\textsuperscript{10, 15}. Another sort of filler and cover was used in group 3. The hydrofibre dressing is made of sodium carboxymethylcellulose. It absorbs and interacts with wound exudate to form a hydrophilic, gas-permeable gel that traps bacteria. To cover the filler, we chose a soft silicone foam dressing. The silicone foam dressing allows evaporation like the transparent semi-occlusive polyurethane films used for the first two groups. It is not as transparent as the aforementioned two films, but as it is a foam cover, it has its own absorbing and retaining capacity, which can supplement the capacity of the filler.

In our study, we found that significantly more dressing changes were performed in group 2 than in group 1, despite the calcium sodium alginate dressing being covered with transparent semi-occlusive film in both groups. According to the information regarding the absorption and evaporation capacity supplied by the manufacturers, the descriptions of the products are almost identical, so no differences were expected. A clinical comparison between these two dressings has not been heretofore performed. There is no obvious explanation why the dressings in group 2 required more changes than those in the other groups. Suggestions might be the lower absorption capacity of the filler, inferior or lesser evaporation or adherence capacity of the dressings in group 2, or a combination of these reasons. The final test of a product is how it performs clinically, regardless of the capacity described by the manufacturers. Higgins et al. have shown in a randomised controlled trial that the time until the first unplanned dressing change was earlier, and the total number of dressing changes was greater in the group randomised to a hydrocellular foam dressing compared with a calcium sodium alginate dressing\textsuperscript{5}.

Infection is the most important complication in the healing of donor sites, and the ideal dressing to a donor site will reduce the risk of wound infection\textsuperscript{2, 6}. As early detection of complications is essential for adequate intervention, it is likewise of importance to caretakers that the dressing does not interfere with inspection of the wound. When choosing a donor site dressing, it is also important to remember that the donor site is caused not by a disease of

Table 2: Results for the three types of dressings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients evaluated; patients included, (number)</td>
<td>19 (20)</td>
<td>18 (20)</td>
<td>20 (20)</td>
</tr>
<tr>
<td>Median percentage healing at first planned dressing change (%)</td>
<td>90</td>
<td>95</td>
<td>98</td>
</tr>
<tr>
<td>Median (range) healing time (days)</td>
<td>13 (8-37)</td>
<td>14 (10-67)</td>
<td>12 (8-35)</td>
</tr>
<tr>
<td>Total non-planned dressing changes before first planned dressing change (number)</td>
<td>4</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>Total unplanned interventions before first planned change (number)a</td>
<td>10</td>
<td>33</td>
<td>8</td>
</tr>
<tr>
<td>Total leaks before first planned change of dressing (number)</td>
<td>5</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Relative cost per dressingb</td>
<td>1.13</td>
<td>1.00</td>
<td>1.28</td>
</tr>
<tr>
<td>Relative total dressing costsb,c</td>
<td>1.13</td>
<td>2.15</td>
<td>1.00</td>
</tr>
</tbody>
</table>

a interventions include dressing changes and reinforcements  
b dressing with the lowest cost is set at 1.00  
c total cost accounts for the cost per dressing and number of dressing changes
the patient but by a treatment of the patient, which may impact how the patient reacts to pain and discomfort at the donor site.

All donor sites clinically diagnosed as infected were covered with silver dressings according to our standard for treatment of infected donor sites. In our trial, we found a significantly larger use of silver dressing in group 2 compared to the two other groups. This means that a significantly larger number of donor sites in group 2 were assessed as being infected. As a consequence it would be less appealing in this group to let less experienced staff perform the changes of dressings, as any shift in treatment has to be based on qualified evaluation. As silver dressings are more expensive than standard dressings the change to silver dressing will on its own increase the cost of the treatment. No patients required systemic antibiotics for infection at the donor site.

In our study, the dressing was left intact for 8-10 days unless unexpected events occurred. We found, in accordance with other studies, that it was possible to leave more than 80% of the dressings in group 1 and group 3 unchanged for 8 to 10 days without problems. In other studies of STSG donor sites, dressing protocols have involved earlier planned dressing changes. Such earlier planned changes may be beneficial, especially in group 2, as some instances of leakage might be avoided. However, a lower percentage healing would be expected at an earlier planned change, which may increase patient pain and discomfort, as well as the time and costs required for the dressing change procedure.

For the first 10 days, the ratios of the median direct total dressing costs were 1.13, 2.15, and 1.00 for group 1, 2 and 3, respectively. However, the ratios among the same groups for the per-dressing costs were 1.13, 1.00, and 1.28, respectively. The exact costs are not stated, as they will vary to silver dressing will on its own increase the cost of the treatment. No patients required systemic antibiotics for infection at the donor site.

In our study, we noted the number of dressing changes after the tenth day until the total healing of the donor site, but we have not been able to obtain information regarding the exact type of dressings used after 10 days. However, the number of changes performed after the tenth day in group 1, 2 and 3 – 36, 47, and 24, respectively – provides some indications about the costs. These findings again suggest that group 2 was more expensive.

CONCLUSION
This study shows that two dressings that appeared to be almost identical according to the manufacturers’ descriptions performed significantly differently in the clinical situation when used to cover a STSG donor site. The least expensive dressing on a per-dressing basis was found to be the most expensive choice because it was associated with a high frequency of dressing changes.

Acknowledgements: The authors wish to thank the patients who volunteered in this study and colleagues who helped in completing it.

References