Choice of dressing has a major impact on blistering and healing outcomes in orthopaedic patients

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- **Objective:** To investigate the effect of three postoperative dressings on orthopaedic wound healing.
- **Method:** Three hundred orthopaedic patients were divided into three treatment groups and allocated to management with one of three dressings: Primapore, Tegaderm with pad, and OpSite Post-Op. Staff completed a questionnaire to evaluate the wound progression. Outcome measures were the presence of infection, blistering and the number of dressing changes required.
- **Results:** There was a significantly lower incidence of blistering with OpSite Post-Op (6%) than Tegaderm with pad (16%) and Primapore (24%) ($p<0.001$). Patients in the OpSite Post-Op group had the lowest exudate levels.
- **Conclusion:** Dressings that employ a clear film and have a high moisture vapour transmission rate have been shown to reduce both the rate of blistering and wound discharge. The additional expense inherent in using such dressings may, in reality, prove cost-effective because of the reduced need for dressing changes and the subsequent earlier discharge of these patients from hospital with an uncomplicated wound.
- **Declaration of interest:** All dressings were supplied by the manufacturers. However, they had no contact with the wards or the authors once the study started.

**wound dressing; postoperative dressing; orthopaedic wound; wound outcome**

Normal wound healing is a controlled balance of destructive processes necessary to remove damaged tissue and repair processes that lead to the formation of new tissue. While studies have demonstrated that it is vital that a correct environment is created to facilitate wound healing, this is an area that may have been previously neglected by some surgeons.

One potential postoperative complication is blistering, which occurs when the dermis becomes separated from the epidermis, and is invariably the result of continued abrasion. The deep, finger-like projections of epidermal tissue holding the epidermis and dermis together are weakened, allowing the two skin layers to separate. Blistering leads to increased pain, delayed healing and increased susceptibility to wound infection as the integrity of the skin has been breached.

Blistering can also occur during injuries associated with a closed fracture, burns, epidermal dis orders and immunocompromised states. Blister fluid concentrations of total protein, albumin and gamma globulin make up about 25% of those in serum. Moreover, macrophage inhibitory factor, isolated from blister fluid, has a strong correlation with inflammatory activity. Clinical teaching advocates the drainage of transudate from blisters to decrease inflammatory activity and thus enable the wound to progress to proliferation.

Many wound dressings are available in surgical practice, ranging from the inexpensive to the costly. This study aimed to establish the impact of dressing choice on the postoperative surgical wound outcome and observe any significant difference between them.

**Method**
This prospective study involved 300 patients undergoing hip or knee surgery as trauma and elective cases. The procedures included:
- Total knee replacement
- Total hip replacement
- Hip hemi-arthroplasty
- Dynamic hip screws
- Femoral nailing
- Tibial nailing

Full ethical approval for the study was obtained from the appropriate ethics committee.

Patients were randomised into three groups of 100 and received one of three dressings:
- Primapore
- Tegaderm with pad
- OpSite Post-Op (Table 1).

Randomisation was effected by indicating the dressing in an envelope, which was opened by the theatre sister at the end of the operation.

Exclusion criteria included:
- Patients who failed to give consent (n=3)
- Patients with known dressing allergies (n=8)
Table 1. Dressings used in the study

<table>
<thead>
<tr>
<th>Product</th>
<th>Manufacturer's specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primapore (Smith &amp; Nephew)</td>
<td>An absorbent pad with a conformable fixative. Polyester wound-contact layer. Non-transparent</td>
</tr>
<tr>
<td></td>
<td>Marketed as highly absorbent and low-adherent pad, minimises strikethrough</td>
</tr>
<tr>
<td>Tegaderm with pad (3M)</td>
<td>Transparent film island dressing with absorbent pad</td>
</tr>
<tr>
<td></td>
<td>Marketed as a ‘breathable’ film cover that provides a waterproof and bacterial barrier. Patients can shower or bath without having to remove the dressing</td>
</tr>
<tr>
<td>OpSite Post-Op (Smith &amp; Nephew)</td>
<td>Film dressing</td>
</tr>
<tr>
<td></td>
<td>Marketed as ‘bacteria proof’ and waterproof; has a high moisture vapour transmission rate; transparent, with rounded corners; has the capacity to rapidly absorb serious exudate and has low adherence</td>
</tr>
</tbody>
</table>

All three dressings are claimed to be conformable and to have low allergy adhesives.

- Patients with a closed fracture with existing blisters.
  
  Fourteen forms were lost, damaged or incompletely filled in and were therefore excluded. Subsequently, 300 patients were entered into the study. No wound biopsies were undertaken. The OpSite Post-Op group were found to be significantly older than the Tegaderm with pad and Primapore groups, which occurred by chance. In terms of gender and concomitant disease, the groups were similar.

  The three wound dressings were applied and removed according to the manufacturers’ instructions. All patients were cared for in the same orthopaedic unit, and nine orthopaedic surgical teams were involved.

  A variety of dressings, usually Primapore or Mepore (Mölnlycke), had been used before the trial, unless the consultant specified otherwise.

  Wound data were collected on a standard form, filled in by the surgeons responsible for the care of each patient, the nurses and junior medical staff.

  Fifty random patients were selected to be double-reviewed by the authors to ensure that the wounds were being graded similarly. Wound grades were similar between groups.

  The first dressing was applied in theatre. Coloured recording forms, kept at the foot of the patients’ beds, were used to ensure the same dressing was used throughout the investigation.

  When the dressing required changing, the number of postoperative days and the reason for the change were recorded, along with any other skin problems, such as blistering (although not in absolute terms) and persistent exudate.

  The volume of wound exudate was assessed by the amount of seepage through the dressing and the apparent volume found on the wound after the dressing removal.

  Analysis of variance was used to compare the data relating to the three dressings.

Results

Blistering

Most blistering occurred on the fifth or sixth postoperative days. There was a significantly lower incidence of blistering with the application of OpSite Post-Op (p<0.001) (Fig 1).

It is worth noting that patients in the OpSite Post-Op group were significantly older than those in the other groups, but had the lowest incidence of blistering. Although this has not been definitively assessed in the literature, one assumes that older people may have more friable skin, so are more susceptible to blistering than younger patients.
**Dressing changes**

There was no significant difference in the number of dressing changes between the groups, with each requiring an average of two to three dressing changes during the patients’ hospital stay (mean: 10 days).

Fig 2 illustrates the incidence of serous discharge and shows the significant differences between the three dressings.

There was no correlation between the type of procedure and the rate of blistering.

While acknowledging the difference between a non-infected serous discharge and overt infection, we found that persistent discharge required more frequent dressing changes, incurring greater costs and leading to more frequent exposure of the wound, thus potentially predisposing it to infection.

It should be stated, however, that the number of patients in each group who progressed to overt wound infection and required antimicrobial therapy was broadly similar:

- Primapore (five patients)
- Tegaderm (five patients)
- OpSite Post-Op (four patients).

**Discussion**

The properties of an ideal dressing include:

- Permeability — to control the rate of air exposure and the gaseous exchange between the wound and the outside environment
- The ability to remain *in situ* during bathing
- Transparency — to allow the monitoring of any fluid accumulation and other complications
- Low adherence — to facilitate removal from susceptible thin skin
- The ability to act as a complete barrier to bacteria and water, but not to moisture vapour.\(^7\)

OpSite Post-Op may have performed better owing to its high moisture vapour transmission rate (MVTR) which is calculated as follows:

\[
\text{MVTR (g/m²/24 hr)} = \frac{\text{moisture loss (g)}}{\text{Open area (cm²)}} \times \frac{10,000 \times 24 (hr)}{\text{test length (hr)}}
\]

OpSite Post-Op has an moisture vapour transmission rate of 4959g/m²/24 hours (11,000g/m²/24 hour for the latest extruded film dressing).

For Tegaderm with pad, the moisture vapour transmission rate was 1005g/m²/24 hours.

The figure for Primapore was 2088g/m²/24 hours.\(^11\)

Effective vapour transmission prevents the accumulation of fluid at the skin surface and hence reduces the potential for maceration.\(^12\) Furthermore, as fluid is absorbed into the dressing, transpiration through the film can increase the dressing’s fluid-handling capacity.

However, moisture is essential for good wound healing,\(^13\) although confusion remains regarding the precise amount of exudate required.

It is possible that OpSite Post-Op may provide an optimal balance between excess wound exudate and the amount of fluid required for moist wound healing, which may explain the improved healing rate observed with this dressing.

Another reason for the lower blistering rate in the OpSite Post-Op group could be that it is more elastic than the other two products — 0.04kgfcm\(^{-2}\) for OpSite Post-Op compared with 0.09kgfcm\(^{-2}\) (Tegaderm with pad).\(^13\)

Lack of elasticity in the dressings, coupled with postoperative wound oedema, has been shown to be a contributory factor in wound blistering.\(^14\) This is the result of greater shear forces being applied at the epidermis/dermis interface.

While this study did not specifically examine cost-effectiveness as an outcome measure, the cost of dressings and the frequency with which they require changing has to be a consideration. Cost-effectiveness is the comparative measure of costs to achieve a given clinical outcome.\(^15\) There may be a tension between the quality of care provided and the cost-effectiveness of treatment.

Although OpSite Post-Op is more expensive, it was found to cause less blistering and was therefore associated with fewer wound complications, potenti-ally leading to a shorter hospital stay. Long-term financial studies of wound care are needed to compare accurately the quality and cost-effectiveness of such dressings.

Potential weaknesses of our study included the mix of trauma and elective patients — it could be postulated that trauma patients have a greater tendency to experience wound problems as they face a greater systemic challenge, although this is not well documented. We hope, however, that by excluding patients who had evidence of skin abrasion/blistering following the direct impact, we were able to minimise this effect and focus purely on the postoperative wound.

It is possible that the surgical technique used may have influenced wound healing, but again it is hoped that the large number of wounds involved and the fact that so many different surgeons operated would have neutralised any such effect on the study’s outcomes.

**Conclusion**

The choice of postoperative wound dressing should not be arbitrary, but neither should it be based solely on the initial cost of the dressing.

This study found significant differences in outcomes associated with the use of specific postoperative dressings, and shows that incorrect dressing selection leads to increased rates of blistering and wound discharge. This, in turn, may translate into additional costs caused by the need for more dressing changes and a prolonged hospital stay.