WHAT YOU NEED TO KNOW ABOUT SKIN GRAFTS AND DONOR SITE WOUNDS

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Skin grafting is used for extensive wounds that are difficult to suture or for wounds that will produce prominent scars that could cause physical or psychological problems for the patient. Grafting involves the creation of another wound at the donor site that will also need nursing attention. In this article the different types of grafting procedures are described and guidance is given on the care of the resulting wounds.

The skin is a vital organ with several major functions: protection, sensation, thermoregulation, excretion, absorption, metabolism and non-verbal communication (Timmons, 2006). Any breach in skin integrity may lead to the disruption of one or more functions as well as pain, discomfort and possible infection. Some wounds may be sutured (primary intention healing) whereas open wounds may heal by secondary intention, which is a slower process. The longer a wound exists, the greater the potential for infection as it will require regular dressing changes over a period of time; a procedure that will always carry a risk of potential infection.

Skin grafting will cover a wound, excelerate healing and minimise scarring and should be considered when wounds are extensive, unsuitable for closure by suturing, or are likely to cause physical or psychological problems through scarring particularly in prominent places (Beldon, 2003). Skin grafting is not a new procedure and has been performed for thousands of years. Accounts of skin grafting have been found in India from about 2,500 years ago (Davis, 1941).

Definition of a skin graft

A skin graft is a section of epidermis and dermis which has been completely separated from its blood supply in one part of the body, the donor site, before being transplanted to another area of the body, its recipient site (Grabb and Smith, 1991).

The type of skin graft most commonly used is the autograft, when the donor and recipient of the skin graft are the same person, for example when a patient has a skin graft taken from their thigh (*Figure 1*) and applied to a wound on their lower leg (*Figure 2*).

Classification of skin grafts

Skin grafts may be classified as partial or full-thickness grafts, depending on how much of the dermis is harvested by the surgeon (*Figure 3*).

A split-skin or partial-dermal skin graft involves excision of the epidermis and part of the dermis, but leaves behind sufficient reticular (deep) dermis in the wound bed to enable the skin to regenerate itself. The most common donor site areas for split-skin grafts include the thigh, buttock, back, upper arm, forearm and abdominal wall (Coull, 1991).

A full-thickness graft consists of the epidermis and the full-thickness of the dermis. Since none of the reticular dermis remains to allow spontaneous regeneration of skin, the wound must be directly closed to heal by primary intention. Consequently, the surgeon must select a donor site where

Figure 1. A split-skin graft taken from an anterior thigh donor site.

Figure 2. Anterior tibia recipient site.

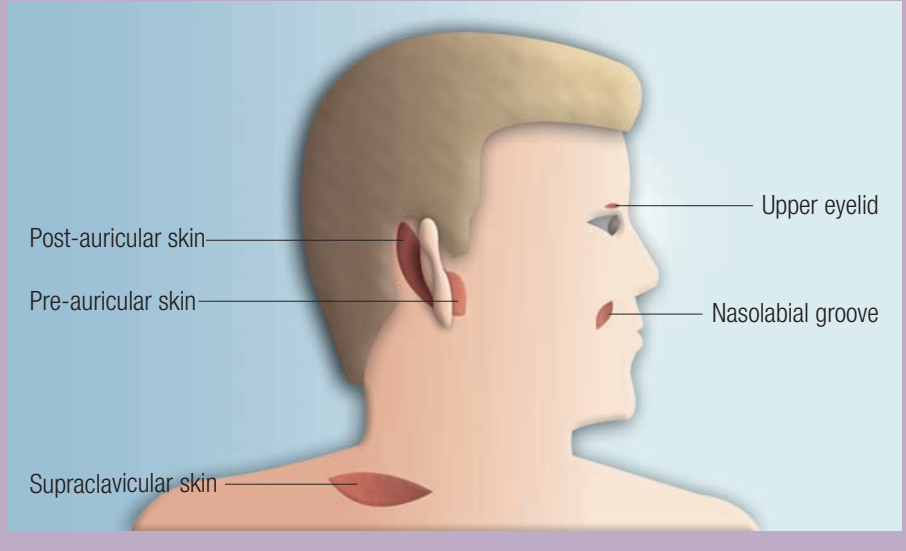

Figure 4. Common donor site areas for full-thickness skin grafts.

a small area of skin may be excised and the wound sutured to leave minimal scarring. Common donor site areas for full-thickness skin grafts include the pre- and post-auricular (ear), supraclavicular and antecubital (inner elbow) areas, the upper eyelid, scalp, groin and areola (*Figure 4*; Nanchahal, 1999). Full-thickness skin grafts do not contract as much as split-skin grafts, so are used to cover exposed areas of the body, usually the face or neck.

Meshed skin grafts

If a skin graft is passed through a meshing device made from two metal rollers, it will insert multiple fenestrations (holes) into the skin graft, allowing the surface area to be dramatically increased. A graft which originally measured 5x5cm, may be doubled or tripled in size. This avoids the need to harvest large areas of skin and spares the patient a large donor site wound.

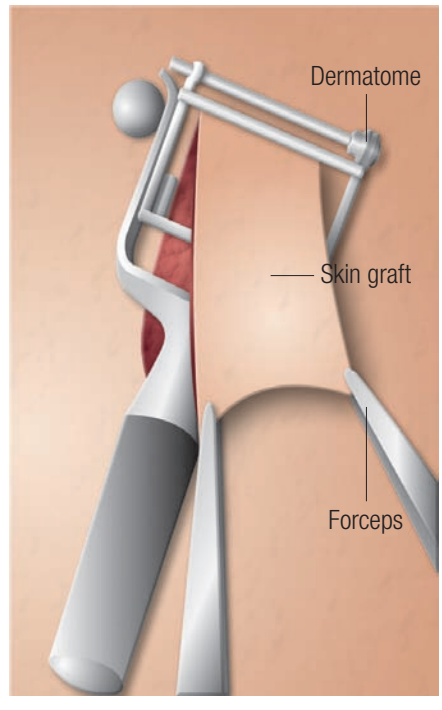

Figure 3. The harvesting of a skin graft.

Meshed skin grafts (*Figure 5*) are particularly useful if the wound is expected to bleed or produce copious amounts of serous fluid. The meshed graft allows fluid to pass through and into the dressing and this prevents the development of haematoma or seroma. The fenestrated area rapidly epithelialises to provide complete skin cover. Unfortunately, meshed skin grafts are not suitable for all areas of the body, since the skin retains a meshed appearance and would be unsightly on the hands, neck or face (McGregor and McGregor, 1995) (*Figure 6*).

Application of the skin graft to the recipient site

For a skin graft to adhere successfully to the wound bed, two conditions must be satisfied. First, the wound bed should be clean and free from necrotic or sloughy tissue which would be heavily colonised with bacteria. Ideally, no bone or tendon should be exposed, since skin grafts will not adhere to these structures.

If the application of the skin graft to the wound is delayed, usually because of an infected wound bed, the skin graft may be stored for up to seven days at 4°C after being wrapped in saline-soaked gauze. Delayed skin graft application is usually performed by an experienced nurse within a hospital setting.

Second, it must be held in close proximity to the wound bed and immobilised. This can be achieved by suturing the graft in place, then using a firm dressing to ensure that shearing does not occur, positioning the graft against the wound bed. A tie-over pack may be used to secure small grafts, especially to the head or neck area, or grafts placed into deep defects, e.g. an axilla wound. Sutures are placed around the edge of the graft and the ends drawn together over a pack of foam or sterile wool to ensure even pressure is applied by the pack which thus secures the skin graft to the site. Staples and clips have also been used as a rapid means of securing a graft in position.

Adherence of the skin graft to the wound bed

Soon after application of the skin graft, a fibrin network is produced which acts as a biological 'glue' and adheres the graft to the wound bed. This network is then infiltrated by fibroblasts, leucocytes and phagocyte cells from the wound bed, and is converted into a fibrous tissue attachment between the skin graft and the wound bed.

Simultaneously, serous fluid containing erythrocytes (red blood cells) and polymorphonucleocytes (white cells), accumulates between the skin graft and the wound bed, leaked from the smallest veins (venules) in the wound bed. There are severed vessels within the skin graft which dilate and capillary action draws this serous fluid into them to provide nutrition for the graft tissues. This process is known as plasmatic (serous) imbibition. The graft has a white appearance at this time as there are few erythrocytes present. Thinner skin grafts fare better since the amount of nutrients able to reach the graft by plasmatic imbibition is inversely proportional to the thickness of the graft.

Innosculation occurs when severed blood vessels in the skin graft anastomose or unite with the severed ends of vessels of approximately the same diameter in the wound bed. This occurs between 24–72 hours after application of the graft. The fibrin network acts as a supportive frame along which endothelial buds from blood vessels in the wound bed grow to meet the blood vessels in the skin graft. Blood flows through the anastomoses into the graft vessels on day 3–4 and is sluggish until day 5–6 (Converse et al, 1975). Once this is established the skin graft gradually takes on colour and becomes red-purple. The skin graft begins to develop its own system of blood vessels (Pope, 1988) and lymphatic vessels (Swaim, 1990).

As the graft continues to mature in its new site, it regains partial sensation from the sensory nerves of the wound bed. Split-skin grafts are innervated more quickly than full-thickness skin grafts, but not as completely. This is thought to be due to the thickness of the skin graft (Branham and Thomas, 1990). Scar contracture happens gradually over the following 6–12 months, and the thicker the graft, the less contracture occurs (Branham and Thomas, 1990). This is another reason for using thick or full-dermal skin grafts on the face as scarring can be minimised.

Figure 5. Dermal meshed graft.

Figure 6. Meshed skin graft applied to the foot retains a meshed appearance.

Figure 7. A skin graft to the antero-lateral thigh has a red/mauve appearance due to revascularisation.

Figure 8. A donor site two days after graft removal.

First inspection of the graft

The first post-operative inspection of the skin graft is usually performed between 2–5 days (Young and Fowler, 1998). The timing of the first inspection is dependent on the wound site, the thickness of the skin graft, how the skin graft has been immobilised, the age of the patient and the existence of any underlying medical conditions which could delay healing.

The first inspection may take place in hospital, a clinic or in the community, provided the doctor or nurse has the necessary expertise to assess the graft's adherence and determine further management of the wound.

Patients are understandably anxious before the first inspection and they need to be prepared and informed about the expected appearance of the skin graft. It is unlikely to appear the same as the surrounding skin and is likely to be red/mauve in colour due to inosculation and revascularisation (*Figure 7*). If a large amount of devitalised tissue or a lesion has been removed there may be a significant depression to the normal outline (*Figure 5*), which may be shocking to the patient. If the presence of infection is suspected, the patient should be warned that the skin graft may not have survived (Beldon, 2003).

On first inspecting a skin graft site, it is important to remove the overlying dressings with care. Occasionally these are firmly adhered to the graft by

dried blood or exudate and they may need to be soaked away. It is possible to traumatise the new vascularity of the graft by clumsy removal of the dressing.

Successful adherence of the graft to the wound bed is determined by colour and immobility. A partial or split-skin graft should be pink/red due to successful inosculation and revascularisation, a full-thickness graft will be slightly paler.

On placing a gloved finger onto the skin graft it should not be mobile but firmly attached to the underlying wound bed. During this assessment the percentage of skin graft which has adhered successfully to the wound bed should be estimated. A completely covered wound with immobile, vascularised graft is deemed to have 100% coverage.

All sutures, staples or glue should be removed whether or not the skin graft has adhered to the wound bed. Their purpose has been served. There is nothing to be gained from leaving dissolvable sutures in situ and, in fact, they may act as an irritant and detract from the aesthetic result. In addition, any graft overlapping the edges of the wound should be trimmed away using sterile scissors.

Dressings for skin graft sites

If a skin graft has completely covered a wound bed and is well adhered it may require no further dressings, unless it is in an area of the body which may be subjected to mechanical stress, i.e. clothes rubbing.

A full-thickness skin graft to the head or neck area will be left exposed and the patient advised to gently wash the area and pat it dry. Gentle, regular massage with a non-perfumed emollient will help the graft to become supple.

If the skin graft has only been partially successful in covering a wound area, it will require dressings to encourage epithelialisation of the whole wound. If there is infection present an antimicrobial dressing will be appropriate to reduce the bacterial load. The choice of antimicrobial dressing is dictated by the bacteria causing the infection, e.g. if *Pseudomonas aeruginosa* is present, indicated by a typical fluorescent green exudate, a silver dressing can be used to eradicate it.

Skin graft sites which produce large amounts of exudate will require an absorbent dressing and must be changed regularly. It is important to prevent maceration of the remaining skin graft or the surrounding skin. Foam, alginate or hydrofibre dressings should be used.

If there are only small areas which have not been successfully covered by the skin graft, a simple non-adherent dressing is suitable, which may be left undisturbed for several days to allow continued epithelialisation.

Once the whole skin graft site has regained full skin integrity it will no longer require dressings. The patient should be advised to wash and dry carefully and apply an emollient regularly as the area tends to be very dry initially. Patients should also be cautioned to use a full sun block cream for at least two years, especially if the area is likely to be exposed to the sun naturally, e.g. the face.

Glossary

Autograft: a skin graft which is taken from an individual and re-applied to the same individual.

Haematoma: a collection of blood under the skin.

Seroma: a collection of serous fluid within a wound.

Fenestration: perforations, window or hole.

Fibrin network: a protein which is leaded from the blood circulation and becomes an insoluble protein in wounds.

Full thickness skin graft: a skin graft which is excised from the body at or under the deep or reticular dermal level, the resulting donor site cannot re-epithelialise spontaneously.

Endothelial buds: endothelial cells provide the inner lining of blood vessels and are sent out as buds to infiltrate areas of new tissue to begin a new blood supply.

Donor site wounds

There tends to be great importance placed on the success of the skin graft by the patient, surgeon and nurse. However, a second wound is created in order to gain a skin graft — the donor site wound. The surgeon chooses the donor site wound according to the closest match in skin tone,

Key Points

- Skin grafts are used to cover extensive wound areas or wounds which may result in scarring.
- Donor site wounds are often more painful than the skin graft wound.
- Skin graft and donor site wounds should be cared for by a knowledgeable practitioner trained in the care and management of skin graft and donor site wounds.
- Patients require information and involvement in their wound care.

colour and texture, how large a skin graft is required and how visible the donor site scar will be in public. It is of vital importance that the patient is aware that in order to heal the original wound a second wound must be created, which will also produce a scar. The patient should also be warned that the donor site wound may be more uncomfortable than the graft site wound due to the exposure of sensory nerve endings (Weber et al, 1995).

Healing of donor site wounds

Healing of donor site wounds occurs through re-epithelialisation (*Figure 8*). Epithelial cells migrate from the remnants of hair follicles, sebaceous and sweat glands remaining in the reticular dermis of the skin and spread across the wound bed until full skin integrity is restored. This usually occurs within 7–10 days, but may take as long as 21 days, depending on the age and nutritional status of the patient. Wound healing in the elderly may be speedier if the surgeon uses a small amount of the skin graft and widely fenestrates it to apply as a dressing to the donor site (Fatah and Ward, 1984). The dual action of the skin graft spreading across the wound, together with re-epithelialisation from the remains of hair follicles, sweat and sebaceous glands would speed healing.

In the first 3–4 days post-surgery, the donor site wound produces moderate to heavy amounts of exudate, depending on the size of the wound area. After this, exudate levels diminish as re-epithelialisation progresses.

Discussion

To minimise discomfort for the patient it is vital to use an appropriate dressing. Removal of an inappropriate dressing can cause a great deal of pain and may even delay wound healing (European Wound Management Association [EWMA], 2002). One dressing which could be applied to the donor site and left in situ until the wound is healed would be ideal. However, this is unlikely due to the variability of patient, skin texture, wound site, etc.

The healing of donor site wounds can be divided into two phases. The wet phase is when copious amounts of exudate is produced. An absorbent dressing such as a foam, alginate or hydrofibre dressing can be used to absorb the excess. The dry phase is when the exudate levels fall dramatically and the wound bed becomes dry. It can be treated with a simple non-adherent silicone dressing, which can remain undisturbed without adhering to the wound bed for several days or until the wound has healed.

It is in the patient's best interests that one dressing is applied and remains in situ until healing is achieved. Unfortunately if an alginate or hydrofibre dressing is left in situ throughout healing, the dressing is likely to dry out and possibly adhere to the wound bed (Brady et al, 1980). Foam dressings draw excess moisture away and have low adherence to the wound bed so may be appropriate (Wilkinson, 1997). Perhaps the most appropriate dressing is a simple non-adherent silicone dressing (Platt et al, 1996). During the initial 'wet phase' this would need padding and the outer dressing renewed regularly, otherwise the weight of the dressing could cause slippage, resulting in exposure of the wound and distress to the patient.

One innovative practice uses an adhesive retention tape — Mefix® (Mölnlycke, Dunstable) (Giele et al, 2001). This is applied directly to the donor site wound. In the initial stages extra padding is required, however, the author reports that patients are able to shower and have no fear of dressing slippage and, on healing, the dressing can be removed without trauma to the wound or patient.

The most comprehensive care of donor site wounds was described by Fowler and Dempsey (1998) who advised:

- Administer analgesia regularly
- Aid pain management by elevation and/or immobilisation of the donor site area
- Observe and act upon signs of excess bleeding and pain from infection that is unrelieved by analgesia and pyrexia
- Reassure the patient regarding wound odour which may cause embarrassment
- Only remove the dressing before the agreed date if it is contaminated. Review the initial primary dressing choice and change to an antimicrobial dressing if appropriate
- Ensure that the choice of dressing is practical and appropriate for the patient
- Allow the primary wound contact layer to separate spontaneously
- Classify a donor site as healed only if the primary contact layer is removed without pain leaving a dry, re-epithelialised surface
- Ensure the patient has appropriate advice regarding aftercare.

Advice for patients about the donor site wound

Patients need to be reassured that once the wound is healed it is appropriate for them to take over their own aftercare. The donor site wound will appear dry, very pink and possibly itchy when it has recently healed. Patients will often be wary because it does not appear the same as the rest of their skin and will wonder whether this is normal and whether the wound has healed. Patients should be given the following advice:

- Although the wound may be itchy it is best not to scratch as the new skin is fragile and may be broken by scratching. Regular application of emollients may help
- The skin should be washed using a non-perfumed soap and then patted dry rather than rubbed
- Avoid sunbathing and apply a total sun block cream for the first year to avoid burning (Fowler and Dempsey, 1998).

Conclusion

Movement of skin from one area of the body to another appears very dramatic to patients, and they require explanations regarding procedures and expected progress of both the skin graft and donor site wounds. Care of these wounds demands knowledge, expertise and confidence. **WE**

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