Partial-Thickness Skin Grafting for Large Thermal Skin Wounds in Dogs

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ABSTRACT:
An optimal clinical outcome for large, full-thickness thermal skin wounds in dogs is predicated on aggressive preoperative wound management, assessment and treatment of concurrent medical problems, careful surgical planning and execution, and intensive postoperative care. Skin stretching, expanding and advancing techniques, skin flaps, omental grafts, and full-thickness skin grafts have been described for use alone or in combination for managing large skin wounds. Partial-thickness skin grafting may be a feasible surgical option when these familiar full-thickness techniques are not practical because of the size and location of the wound(s). This article describes the indications, advantages, disadvantages, and technical aspects of partial-thickness skin grafting and provides case-based examples of its application in dogs.

LARGE THERMAL SKIN WOUNDS INVOLVING
GREATERTHAN 15%TO 20% OF THE TOTAL BODY
SURFACE AREA IN DOGS PRESENT MULTIPLE
MEDICAL AND SURGICAL TREATMENT
CHALLENGES. These skin injuries most
commonly result from accidental or malicious thermal burns, sometimes involving a chemical accelerant. Dogs with these injuries have a wide variety of clinical presentations, from seemingly unaffected to severe shock. Those severely affected require aggressive stabilization and medical management. Concomitant medical problems that can result from loss of large areas of skin include anemia, neutropenia, hypoproteinemia, dehydration, electrolyte imbalances, pain, and weight loss. Repair of the wound prevents loss of red and white blood cells, blood and tissue proteins, body fluid, and electrolytes through the wound.

Some large skin wounds may not be amenable to repair by full-thickness reconstruction techniques. Techniques such as skin stretching, expansion and advancement, tension-relieving primary closure, and skin flaps may not be possible because of insufficient adjacent skin. Free full-thickness skin grafting and microvascular free grafting may not be practical if the size of the defect exceeds what can be covered by the amount of distant donor skin available for full-thickness grafting. The size of the wound may impair wound contraction, and the location may predispose the animal to a function-limiting wound contracture if healing only by second intention is allowed (Figure 1). This article describes the use of partial-thickness skin grafting in dogs with large thermal skin wounds and reviews the advantages, disadvantages, indications, and technical considerations of this surgical treatment option.

INITIAL WOUND MANAGEMENT
AND ASSESSMENT FOR SURGICAL
TREATMENT
Dogs with large thermal skin wounds should first be treated for life-threatening complications, if present, such as shock, smoke inhalation, and hemorrhage. The initial goal of wound
management is to establish a healthy bed of granulation tissue free of necrotic debris and infection. Historically, wound debridement involves serial changes of three-layer bandages containing an adherent contact layer to promote granulation tissue. Once granulation tissue is present, occlusive or semi-occlusive dressings can be used to promote epithelialization, dermal healing, reduction in perceived pain, better cosmetic results, ease of application, and reduction in the number of bandage changes. An important factor in the enhancement of healing open wounds is the composition of the bandage material used. A study evaluating the effects of equine amnion, a biosynthetic hydrogel dressing, transparent polyethylene sheeting, and a semiocclusive rayon–polyethylene nonadherent dressing on open-wound healing in dogs concluded that the mean percentage of wound contraction and total wound healed of the amnion-bandaged wounds was greater than that for wounds bandaged with the other dressings.

Modern advancements in wound management have produced a multitude of medications that stimulate wound healing, dressings that enhance healing, and skin protectants to assist in wound protection. Release of interleukin-1 and tumor necrosis factor by macrophages can be stimulated by products such as acemannan. Together, these cytokines stimulate and enhance fibroblast proliferation, neovascularization, collagen deposition, and epidermal motility and growth. Once the wound is sufficiently covered in healthy granulation tissue, definitive surgical therapy can be initiated.

The location and size of the wound should be considered when selecting an appropriate method of surgical closure. The location of the wound can determine whether healing by second intention will be deleterious to adjacent joints or body orifices, whether neighboring or distant donor tissue for a skin flap is available, or whether recipient vessels are available for a microvascular free-transfer flap. The size of the wound will determine whether secondary closure or full-thickness grafting is feasible. The donor sites for full-thickness grafts must be surgically closed, limiting the size of the recipient site that can be covered. The donor sites for thin and medium partial-thickness grafts are partial-thickness wounds and need not be closed. The partial-thickness defect created can reepithelialize within 3 weeks. Therefore, the amount of donor skin available for partial-thickness grafting greatly exceeds that for full-thickness grafting. Both full- and partial-thickness grafts can be meshed to allow expansion for covering large areas.

The cost of medical and surgical care associated with management of large thermal skin wounds is very high, even without complications. Veterinary clinicians must educate clients thoroughly regarding staged medical and surgical management.

**INDICATIONS, ADVANTAGES, AND DISADVANTAGES**

Partial-thickness skin grafts have a variety of advantages and disadvantages compared with other forms of wound closure. Careful consideration of each is important before managing every case. The primary indication and advantage of partial-thickness skin grafts in dogs is in the reconstruction of large full-thickness wounds without sacrificing full-thickness skin from donor sites. Donor sites heal as partial-thickness wounds and have the advantage of minimal tissue injury because the wound is made under aseptic conditions with minimal trauma. Partial-thickness skin grafts have also been shown to survive more readily than full-thickness skin grafts because of the denser capillary network in the more superficial dermal layers, which more readily allows capillary linkups. This may explain the higher percentage of viability of partial-thickness skin grafts than full-thickness skin grafts in early studies. Although subsequent studies showed that full-thickness grafts had a higher percentage of viability than previously reported, the difference in viability between partial- and full-thickness grafts was not statistically significant.

A previous comparison study by McKeever and Braden of meshed, thin partial-thickness grafts (0.063
cm); meshed, medium partial-thickness grafts (0.127 cm); and meshed, full-thickness grafts in dogs suggested that thin partial-thickness grafts had the highest survival rate (89%), with full-thickness grafts (58%) and medium-thickness grafts (47%) having lower success rates. Meshing both a partial- and full-thickness skin graft decreases graft contracture by increasing the number of edges from which epithelialization can occur. Additional advantages of meshed skin grafts include the reconstruction of irregular surfaces (concave and convex) and application in a graft bed with exudate (blood or serum). Furthermore, meshed partial-thickness skin grafts possess the characteristics of rapid donor site reepithelialization and multiple harvests of partial-thickness skin from areas of thick skin.

Disadvantages of partial-thickness skin grafts include technical difficulty while harvesting, initial low durability of partial-thickness skin that is susceptible to trauma, sparse or absent hair growth on both the grafted and donor sites, and a scaly appearance resulting from the lack of sebaceous glands. Partial-thickness skin grafts also require the use of specialized and expensive equipment and additional training. Furthermore, the expense and time associated with intense postoperative care can be expensive and time-consuming. Despite the difficulty of harvesting, it has been reported to become easier with practice. Our experience supports the use of partial-thickness skin grafting in dogs with large thermal skin wounds that are irreparable by traditional methods.

In summary, partial-thickness skin grafting can be useful when applied in managing large thermal skin wounds in dogs. Partial-thickness skin grafting would most likely be performed at a veterinary medical school or a highly equipped surgical specialty practice because of associated intense postoperative care as well as the required expensive equipment and training for its use. This surgical option is chosen based on the size and location of the wound(s), availability of the necessary equipment, experience of the surgeon, and availability of personnel to provide postoperative care. Furthermore, the primary advantage of partial-thickness skin grafting is that the donor sites do not have to be surgically apposed and are allowed to heal by reepithelialization. This advantage enables more versatility in selecting donor site locations when limited donor sites are present, an obvious advantage over full-thickness skin grafting. Partial-thickness skin grafting should be considered when other forms of wound closure are not practical or achievable as a sole means of therapy.

**SURGICAL TECHNIQUE FOR MESSED, PARTIAL-THICKNESS SKIN GRAFTS**

Allowing a bed of granulation tissue to form over the wound before the surgical application of a partial-thickness skin graft is critical for graft survival. Granulation tissue fills in wound space, functions as a protective barrier, and provides nourishment to applied skin grafts. Healthy granulation tissue does not bleed excessively and is flat, red, and free of a surface film of sloughing collagen.

There are multiple methods for harvesting partial-thickness skin grafts. One method uses various types of freehand skin graft knives and blades. Depth control can be a concern, although several types of knives have depth-control mechanisms. Examples of freehand devices include safety razors (although hard to find), scalpel blades, and skin graft knives. Alternatively, several dermatomes have been used to obtain split-thickness skin grafts in dogs, thereby producing a more consistent result. Examples include the Zimmer Dermatome (Zimmer Manufacturing, Warsaw, IN), the Brown Electric Dermatome (Zimmer Manufacturing), and the disposable Davol/Simon Cordless Dermatome (Davol, Cranston, RI). Dermatome use has also been described in humans and horses. Booth reported an 88% graft acceptance rate of split-thickness autogenous skin transplantation in horses.

Graft donor sites are relatively flat surfaces such as the lateral thoracic wall. However, the ventral thorax, lateral thigh, back, and neck have been described as split-thickness graft donor sites in dogs. Following aseptic preparation of the donor site, sterile saline may be injected subcutaneously to assist in elevating the skin.
from the underlying bony structures in very thin dogs. Next, the skin should be lubricated with sterile water-soluble lubricant or sterile mineral oil. The blade of the dermatome should also be lubricated. A lever and an exchangeable base plate on the dermatome determine the thickness and width of the graft, respectively. Thickness of the graft can be selected from 0 to 0.76 mm. A graft 0.38-mm thick is usually selected for use on dogs. Graft harvesting requires a team of surgeons. A minimum of three surgeons is needed, with the primary surgeon operating the dermatome and assisting with holding the skin taut. One assistant surgeon holds the skin taut in the opposite direction as does the primary surgeon. The second assistant surgeon elevates the graft as it is being harvested (Figure 2), meshes the graft, and then places it on the recipient site.

Meshing the graft can expand it by three to nine times its original area. Templates for graft meshing are selected based on the amount of expansion necessary. Meshing a graft can be performed either by hand, using a No. 11 or 15 scalpel blade, or using a mesh graft expansion unit (Figure 3). The use of a scalpel blade is generally reserved for full-thickness grafts. When using a mesh graft expansion unit, a dermatome-harvested partial-thickness graft is placed dermal side down on the aluminum block with staggered, notched, parallel rows of cutting blades (Padgett Instruments, Kansas City, MO). A Teflon roller is then passed over the graft in the direction of the blades to cut slits in the graft. Repeated application and roller compression may be needed for complete cutting of the graft. Meshing the graft also allows fluid drainage from beneath the graft.

The grafts should be placed on the wound immediately. If this step must be delayed, the skin grafts should be placed in gauze sponges moistened with sterile saline. Grafts should be placed on the wound so that they overlap the wound edges by 1 to 4 mm. The graft can then be carefully attached by simple interrupted sutures or staples to the surrounding skin, and tacking sutures can be used to hold meshed grafts to the central regions of the wound and to assist in pulling the graft into concavities. Careful attention is required while placing these tacking sutures to address and limit bleeding. Affixing the graft to the surrounding skin with tissue adhesives has also been documented in several species. Fibrin glues are preferred by many human surgeons for their hemostatic and adhesive effects and convenience of application. In humans, fibrin glues remain the most versatile and have proven clinical efficacy in improving skin graft survival and in decreasing blood loss when grafting large burn sites. In dogs, a recent study evaluated the tensile strength of sutured skin incisions with and without the application of fibrin glue. Results suggested a significant increase in tensile strength in the fibrin glue group.

Partial-thickness donor sites do not require primary closure, which is one of the major advantages of this technique. It is highly recommended that donor sites be managed as open wounds to avoid painful excitations and primarily closed. After placement of the graft, the wound should be gently irrigated with saline solution or

**Figure 2.** Intraoperative view of a Zimmer Dermatome (Zimmer Manufacturing) in use by a team of surgeons harvesting a partial-thickness skin graft.

**Figure 3.** A mesh graft expansion unit. Templates for graft meshing are selected based on the amount of expansion necessary. Meshing a skin graft expands the total surface area by three to nine times.
thrombin before applying the dressing. Antibiotic ointment on a finely woven, nonadherent dressing or petrolatum-impregnated gauze commercially purchased or prepared by the surgeon can be applied to the wound followed by absorbent bandage layers. The bandage should be secured with circumferential elastic tape on the limbs or umbilical tape tied through suture loops anchored in the skin for trunk, abdominal, and perineal areas.

POSTOPERATIVE MANAGEMENT

Failure of partial-thickness skin graft survival can be caused by motion of the graft over the wound bed, infection, or hematoma and seroma formation beneath the graft, which prevent adhesion and capillary linkup. The adherence and revascularization process occurs over the first 48 to 72 hours. This is a staged process that functions as a continuum involving graft adherence, plasmatic imbibition, inosculation, and the penetration and ingrowth of new vessels. Initially, a fibrin network adheres the graft to its bed. Once the cut vessels dilate, the fibrinogen-free, serum-like fluid and cells are absorbed into the graft. This process in which capillary action pulls cells and serum into dilated graft vessels is called plasmatic imbibition. Inosculation is the anastomosis of graft vessels with recipient bed vessels of approximately the same diameter and takes place as early as 22 hours after graft placement.

Postoperative immobilization and preventing the dog from molesting the graft are critical components of the initial graft adherence process. Immobilization can be achieved by casts/splints, sedation, or general anesthesia. Immobilization choices should be made through a combined assessment of patient status, size and location of the skin grafted sites, and financial concerns of the owners. If general anesthesia is deemed most appropriate for initial postoperative immobilization, controlling complications associated with long-term anesthesia (e.g., hypotension, hypothermia, aspiration pneumonia, renal compromise) is of utmost concern.

The first bandage is usually changed 48 hours after surgery. Because of the risk of contamination or graft movement, the longer the intervals between bandage changes, the better. Skin grafts near joints and high-movement areas can pose a significant challenge with immobilization, and grafts over pressure points require pressure relief. Casts and splints may be used in conjunction with wound dressings to aid in graft immobilization, but improper placement or slippage may put damaging bandage compression on the grafts as well.

Pain Management for Partial-Thickness Skin Grafts

The donor sites of partial-thickness skin grafts are painful. The pain management protocol varies among patients and is determined by patient assessment and status, preexisting thermal injuries, the extensiveness of the skin graft harvests, and concomitant medical problems. Analgesics can be given transdermally, intravenously (intermittent or constant-rate infusion [CRI]), intramuscularly, or subcutaneously at recommended intervals. The following drugs are not the sole or combined means of therapy but are options that can be introduced into a pain management protocol, which is ultimately the responsibility of the attending clinician.

**Fentanyl transdermal patch**
- 25 µg/hr (<10 kg)
- 50 µg/hr (10–25 kg)
- 75 µg/hr (>25 kg)
- Place 12–24 hr before surgery

**Fentanyl**
- 0.01–0.05 mg/kg IV (loading dose)
- 0.001–0.004 mg/kg/hr CRI (maintenance dose)

**Hydromorphone HCl**
- 0.05–0.1 mg/kg SC or IM q4h

**Oxymorphone HCl**
- 0.05–0.1 mg/kg SC, IM, or IV q4–6h (maximum dose: 4.5 mg/dog)

**Ketamine HCl**
- 0.5–1 mg/kg IV (loading dose)
- 0.5–1 mg/kg/hr CRI (maintenance dose)

At every bandage change, skin graft viability should be assessed based on color, swelling, and adherence to the wound bed. Colors to note are pink, blue (cyanotic), black, and white. Pink indicates that the graft is undergoing revascularization. Blue suggests that cyanosis is occurring, which indicates congestion of the graft with resultant fluid and erythrocyte embedment. The erythrocytes within the graft temporarily lose oxygen and produce a blue color. As the graft revascularizes, the cyanosis subsides as the oxygen content increases. Areas of the graft that appear white immediately after graft placement on the recipient site are due to vasospasm of intradermal vessels. As plasmatic imbibition and revascularization occur, the vasospasm subsides and the graft becomes pink. A graft or part of a graft that remains white indicates that revascularization has not occurred. The wound bed should be checked for discharge and a foul smell. Culture and sensitivity samples should be col-

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Case Reports

Burn victims often present myriad clinical problems related to both the initial injury and the medical and surgical management of it. Examples of problems incurred as a direct result of severe burns include pain, shock, smoke inhalation, and hemorrhage. These problems must be addressed before the burns themselves can be treated. Blood and protein loss, wound infection and sepsis, and inadequate nutritional support are all possible sequelae of severe burns and must be addressed as well. The following cases describe the medical and surgical management of severely burned dogs using partial-thickness skin grafting.

Case 1

A 2-year-old intact female mixed-breed dog was presented after sustaining malicious thermal burns involving a chemical accelerant 5 days previously. She had been treated initially with cool water baths, IV fluids, analgesics, and antibiotics. The burn wounds involved the entire caudal abdomen and inguinal areas, bilateral medial thighs, medial crus on the left pelvic limb, left flank, and left axillary region. Initial surgical wound debridement was performed and a percutaneous endoscopic gastrostomy tube placed. Over the next 10 days, the dog was anesthetized daily, the wound was debrided, and the bandages were changed (A). During this period, the patient also received whole-blood and plasma transfusions and gastrostomy tube feedings if oral intake did not meet daily requirements.

A partial-thickness skin grafting procedure was performed 15 days after presentation. A Zimmer Dermatome (Zimmer Manufacturing) was used to collect partial-thickness skin grafts from the right lateral thoracic region. The grafts were meshed to cover an area three times the original size of the graft. The grafts were applied and secured with simple interrupted 4-0 nylon sutures. All of the wounds were covered with triple antibiotic ointment, and a nonadherent dressing was applied over the graft and donor sites.

The patient was maintained under general anesthesia with mechanical ventilation for the first 24 hours. The dog was premedicated with oxymorphone hydrochloride (0.1 mg/kg IM) and glycopyrrolate (0.01 mg/kg IM), induced with ketamine hydrochloride (6 mg/kg IV) and diazepam (0.3 mg/kg IV), and maintained on inhalant isoflurane in 100% oxygen and a continuous-rate infusion of ketamine hydrochloride (1 mg/kg/hr IV). Hydromorphone (0.05 mg/kg IV q6h) was given as needed to address pain and lower the amount of inhalant anesthesia required for a continuously smooth plane of anesthesia. Injectable analgesics and sedatives, including morphine sulfate (0.5 mg/kg SC as needed), ketamine hydrochloride (5 mg/kg IV as needed), and diazepam (0.25 mg/kg IV as needed) were used for the following 4 days. A urinary catheter was used for 5 days postoperatively to evaluate ins and outs.

Over the next week, the patient was kept sedated as needed and the wounds were inspected and cleaned as necessary. IV fluids and antibiotic therapy with lactated Ringer’s solution (50 mL/hr) and cefazolin sodium (22 mg/kg IV q8h), respectively, were also continued at this time.

All of the grafted skin healed on the wound. On discharge of the patient 3 weeks after surgery, only a few small epithelial defects were evident on the caudal
abdomen, which healed by epithelialization (B). When the dog was examined 9 months after surgery, all grafted areas were covered with smooth, hairless, pigmented skin (C).

Case 2

A 3-year-old intact female boxer was admitted for treatment of severe burns incurred in an accidental house fire 1 month previously. The dog was treated by the referring veterinarian with antibiotics, plasma transfusions, and pain medication. The burns were managed using surgical debridement followed by daily whirlpool baths and regular bandage changes. Once healthy beds of granulation tissue formed, the dog was referred for skin grafting.

On physical examination, the patient was bright and alert but thin, with a body condition score of 2/5. The owners reported that the dog had originally lost approximately 25 lb (11.4 kg) since the fire but had recently started to gain weight. An initial serum chemistry and complete blood cell count revealed hypoalbuminemia (albumin level: 2.1 g/dl; reference range: 2.5 to 4.2 g/dl), regenerative anemia (hematocrit level: 27.2%; reference range: 35% to 57%), and neutropenia (polymorphonuclear cells: 2,726/µl; reference range: 2,900 to 12,000 cells/µl). Full-thickness burns covered most of the dog's right side, including the lateral thorax and abdomen, lateral aspect of the axilla and brachium, and caudal aspect of the antebrachium. In addition, the caudal aspects of both stifles and the perineum suffered full-thickness burns. The dog's left side was not as severely affected, with burns covering the lateral side of the thigh and the digital pads of that foot. Partial-thickness burns on the top of the dog's head were healing.

On initial evaluation of the dog, it was determined that the extent and location of the burns and the degree of wound contracture already present warranted treatment with partial-thickness skin grafting. Contracture of the full-thickness burns in the perineum had deviated the vulva and anus slightly to the right. Prevention of further wound contracture was necessary to avoid impairment of urination or defecation and to prevent dystocia in case of future pregnancy. Contracture of the burns on the patient's right brachium and axilla were interfering with normal extension of the shoulder and restricting the forward stride. If left unabated, further contracture of the caudal stifle wounds was likely to prevent normal stifle extension. Partial-thickness skin grafting was determined to be the treatment of choice because it would allow coverage of all the burn, but the donor sites could be allowed to heal by reepithelialization.

The dog was anesthetized daily with propofol (6 mg/kg IV) and isoflurane in 100% oxygen for surgical debridement and wound assessment. The burns were treated with silver sulfadiazine cream and rebandaged. Pain was controlled with a transdermal fentanyl patch (50 µg/kg/hr) and hydromorphone (0.05 mg/kg IV q6h) as needed. Hypoalbuminemia, likely a result of protein loss directly through the wound, was treated with plasma transfusions as needed.

Before surgery, a plan for postoperative immobilization and nutritional supplementation was made. Dorsal recumbency was necessary in this dog because lateral or sternal recumbency would put pressure and shear forces on graft sites. General anesthesia with positive-pressure ventilation for 48 hours postoperatively was deemed the most effective and practical method of keeping the patient immobilized. Nutritional supplementation with a parenteral amino acid solution in the postoperative period was chosen. Although the dog ate well before surgery, we were concerned that the prolonged anesthesia necessary during and after surgery would prevent us from providing nutrition orally and prove detrimental to an already thin animal. Feeding tubes were not good options in this dog because gastrostomy or enterostomy tubes would interfere with the skin graft donor site and nasoesophageal and esophagostomy feedings might have predisposed the patient to aspiration while anesthetized and dorsally recumbent. The risks of metabolic disorders or sepsis associated with total parenteral nutrition outweighed the benefits that would have been gained during the short period in which nutritional support was necessary.

After 4 days of hospitalization and daily surgical debridement of the wounds, the granulation tissue was adequately prepared for skin grafts. Before surgery, a whole-blood transfusion was administered and an indwelling urinary catheter placed. After premedicating the patient with hydromorphone (0.1 mg/kg IM) and glycopyrrolate (0.01 mg/kg IM), anesthesia was induced
with propofol (10 mg/kg IV) and maintained with isoflurane in 100% oxygen. During surgery, lactated Ringer’s solution was administered (10 ml/kg/hr IV) and dobutamine (5 to 10 µg/kg/hr IV) was added as needed to treat hypotension. Anesthetic complications included hypothermia (<88.4°F) and transient hypotension (systolic blood pressure: 60 mm Hg). Partial-thickness skin grafts were harvested from the left lateral thoracic wall and the ventral sternum with a Zimmer Dermatome (Zimmer Manufacturing) and meshed to cover an area three times the original size of the grafts. Because of the extent of the grafting and excessive time necessary to suture all the grafts to the wound beds, we applied the partial-thickness skin grafts to the wound beds without sutures. We suspected the grafts would adhere to the wound beds within 24 hours if the wounds were treated gently. Donor and recipient sites were bandaged with antibiotic ointment, nonadherent pads, and moistened laparotomy pads using tie-over bandages.

After surgery, the dog was immobilized with general anesthesia for 2 days to allow the partial-thickness skin grafts to adhere properly to the underlying wound beds. Such immobilization prevents fragile grafts from being dislodged by the shear forces caused by excessive movement. In addition to a low dose of isoflurane anesthesia for immobilization, the dog received a constant-rate infusion of ketamine hydrochloride (1 mg/kg/hr IV) and hydromorphone (0.05 mg/kg IV q4–6h) for pain management. Total solid, hematocrit, blood glucose, and blood-gas levels; urine output; blood pressure; central venous pressure; complete blood cell count; and blood chemistries were monitored daily. Our main concerns during the immediate postoperative period were inadequate hydration with resultant hypotension and renal hypoperfusion, hypothermia, inadequate nutrition, urinary tract infection, wound infection, aspiration pneumonia, and graft failure.

Bandages were changed every 1 to 2 days after surgery, and the grafts healed well. The patient’s right and left sides are shown 5 days after surgery (D and E). Graft healing and epithelialization was apparent, and the donor sites healed rapidly after treatment with antibacterial ointment and routine bandage changes. The dog’s right and left sides are shown 18 days after surgery (F and G). Epithelialization occurred rapidly, although a few small areas of grafted skin died. Long-term follow-up with the owner (22 months after surgery) revealed
that the dog was active, with normal function of all limbs. Complete coverage of the previous wounds with skin was evident, and a small amount of hair regrowth had occurred, although a small 4 × 4-cm region of skin just dorsal to the right elbow has been persistently pruritic.

D. Right lateral view 5 days after surgery of a 3-year-old female boxer that had partial-thickness skin grafting for severe thermal skin wounds sustained in a house fire. Extensive wounds can be seen along the lateral abdomen, trunk, and forelimb and along the caudolateral hindlimb. Wound contraction, epithelialization, and skin graft survival are apparent.

E. Left lateral view 5 days after surgery. Donor site reepithelialization is evident on the thorax and abdomen, and healing of a partial-thickness skin graft recipient site can be seen on the thigh.

F. Right lateral view 18 days after surgery. Dramatic healing can be visualized with almost complete skin coverage. Only a few small areas of grafted skin died and healed by second intention.

G. Left lateral view 18 days after surgery. Complete epithelialization is noted throughout the donor sites on the thorax and along the graft recipient sites on the thigh.

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lected if infection is suspected. After the first bandage change, subsequent bandage changes can be repeated in a similar fashion every 2 to 3 days, depending on graft appearance. Donor sites can be covered with a light bandage containing a single layer of petrolatum-impregnated gauze or antibiotic-coated nonadherent pads. Donor site bandage changes can coincide with recipient site bandage changes. Special attention should also be
-directed toward pain control, systemic monitoring for sepsis, and testing for hypoalbuminemia and anemia.

CONCLUSION

Thermal wounds in dogs can range from minor epidermal irritations to extensive full-thickness skin defects. We have had successful surgical reconstructive results with partial-thickness skin grafting of large thermal skin wounds when other forms of full-thickness repair are not usable as a sole or combined means of surgical therapy. This technically challenging surgical treatment modality is not intended to replace full-thickness skin grafting but instead is intended to add to the reconstructive options useful in managing large thermal skin wounds in dogs. Patient individualization and assessment determine adjunctive surgical needs, and consideration of referral to a highly equipped surgical center for partial-thickness skin grafting is an option.

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REFERENCES


ARTICLE #3 CE TEST

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I. Which of the following statements regarding large thermal skin wound management (involving more than 15% to 20% of total body surface area) is false?
   a. Large wounds should initially be managed appropriately to promote granulation tissue before definitive surgical management.
   b. Possible detrimental complications that can be associated with large skin wounds include sepsis, hypoproteinemia, electrolyte imbalances, dehydration, and anemia.
   c. The size and location of the wound play a vital role in the decision-making process of surgical management.
   d. Primary closure is the definitive treatment of choice and should be performed regardless of the size and location of a large thermal skin wound.
2. **Partial-thickness skin grafting**
   a. requires surgical closure of the donor site.
   b. can be performed using multiple methods of graft-harvesting techniques.
   c. is the best choice for all surgical wound management.
   d. is easiest when the distal limbs are used for donor site harvesting.

3. **In terms of the selection and consistency of graft thickness, the ____________ is(are) best for partial-thickness skin graft harvesting.**
   a. scalpel blade
   b. dermatome
   c. safety razor
   d. elevator and curette

4. **__________ is the process in which capillary action pulls cells and serum into dilated graft vessels.**
   a. Inosculation
   b. Vasospasm
   c. Imbibition
   d. Innidiation

5. **Regarding partial-thickness skin grafting, the initial postoperative bandage change should be performed**
   a. within approximately the first 6 hours after surgery.
   b. at discharge of the patient.
   c. on approximately day 10 after surgery.
   d. approximately 2 days after surgery.

6. **Little or no hair growth is most commonly associated with**
   a. full-thickness skin grafting.
   b. partial-thickness skin grafting.
   c. skin flap techniques.
   d. primary or delayed primary closure.

7. **Which of the following statements regarding the management of large skin wounds using partial-thickness skin grafts is true?**
   a. Postoperative bandaging of the recipient sites can be advantageous but poses a risk to skin graft viability.
   b. Hematoma formation beneath the skin graft is advantageous to skin graft adherence.
   c. Partial-thickness grafts require primary closure and hence are less painful than full-thickness grafts.
   d. Meshing the graft delays reepithelialization and can prevent graft expansion.
8. **Which of the following is not a benefit of granulation tissue?**
   a. aids in filling in the wound space
   b. supplies vascular linkup for skin graft nourishment
   c. functions as a protective barrier
   d. negates the need for postoperative bandaging

9. **Postoperative immobilization of a patient to promote graft adherence cannot be performed by using**
   a. casts/splints.
   b. compression bandages.
   c. sedation.
   d. general anesthesia.

10. **When harvesting a partial-thickness skin graft with a dermatome, which of the following does not aid in ease and consistency?**
    a. applying thrombin to the epithelial surface
    b. lubricating the skin with sterile mineral oil
    c. pulling the skin taut
    d. subcutaneously injecting sterile saline beneath the donor site