# FREE SKIN GRAFTS

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A 6 year-old male, neutered Pomeranian pre-sented through the Emergency Critical Care (ECC) service for puncture wounds and lac-erations extending over his dorsal thorax to his right axillary region after being attacked by a larger dog. The dog was stabilized and his lac-erations were repaired that day. Five days later he presented for a recheck and the previously bruised areas were necrotic with underlying purulent exudate and necrosis of the subcutane-ous tissues and musculature. Intense supportive care was initiated to combat dehydration, hypo-albuminemia(<1.0 g/dl), and infection. Six days after initial presentation the necrotic area was extensively debrided, an esophagostomy tube was placed, and twice daily wet-to-dry bandages were initiated. Over the next four days supportive care included intravenous antibiotics, bandage changes, plasma transfusions, analgesics, and enteral nutrition.

Thirteen days after initial presentation primary closure of his wounds was attempted. The wound over his right elbow was closed by rotating his axillary skin over the olecranon. Over the next four days the majority of his wounds exhibited healthy healing however the skin overlying his olecranon had progressively necrosed and was excised leaving a large defect. Due to his previous extensive thoracic wounds that were still healing, thoracodorsal and axial pattern flaps were not repair options and the defect was too large for primary closure. The owners followed surgical recommendations of proceeding with a full thickness free skin graft, declining the other option of healing by second intention.

Nineteen days after the initial dog attack, a full thickness skin graft was harvested from the right thorax at the level of the last rib. The harvested graft was prepared by removal of all subcutaneous tissue below the dermis. Visualization of the base of the hair follicles indicated that the appropriate thick-ness had been achieved. Small (~0.5cm) full thickness inci-sions were made throughout the graft over a stainless steel bowl. The graft donor site had a routine closure with 3-0 and 4-0 PDS and 3-0 Fluorofil. The defect over the olecranon had minor debridement of the edges, providing a uniformly thick layer of healthy, pink, granulation tissue. Placement of the graft was such that the hair direction was matching. The graft was sutured around the periphery using 3-0 Fluorfil in an interrupted pattern (Figure 1).


Figure 1: Immediate post-operative photo. Caudal incision is graft donor site. Mesh free graft over right elbow. Incision line dorsal to right elbow was incision line from previous repair.

Immediately post-op a petroleum-impregnated dressing (Adaptic) was applied over the

graft and secured with skin staples approximately 0.5cm from the graft edges. The entire right forelimb was bandaged with cast padding and a lateral splint was applied to assure immobilization of the elbow. The bandage was not disturbed for 72 hours. Over the next 14 days the dog's bandage was changed every two days. On day 14, at suture removal, 90% of the graft was viable. The remain-ing defect was allowed to close by second intention healing. The wound was completely closed 23 days after grafting ;42 days after initial injury (Figure 2).

Figure 2: Final picture of healed graft site.

Free skin grafts may be utilized where there has been a major loss of skin due to trauma, mass removal, or other factors. They have been primarily used for injuries of the extremities, where skin immobility can be challenging to create adequate clo-sure using direct apposition or skin flap procedures. The graft should be placed on vascularized fresh wounds or a healthy, uniform bed of granulation tissue which is free of infection and debris. The donor site for the skin graft should be as similar in hair color, texture, length, and thickness as possible to the skin surrounding the wound. It should also come from a location that can be closed easily without tension after graft removal.

There are four steps that must happen for a free skin graft to heal or "take": adherence, plasmatic imbibition, inoscula-tion, and ingrowth of blood and lymph vessels. Adherence occurs within the first eight hours, when fibroblasts, leuko-cytes, and phagocytes invade the area forming a fibrin seal between the wound bed and graft. Adherence is ongoing with a firm union occurring around the tenth postoperative day. Plasmatic imbibition (PI) provides initial nourishment to the graft by keeping the graft vessels dilated until revas-cularization. During PI, capillary action moves the cells and serum-like fluid into the dilated graft vessels and interstitial graft tissues. During PI the graft will appear edematous and cyanotic, with maximum edema at 48-72 hours. Inosculation follows PI with vessel anastomosis between the graft bed and graft. Eventually vessel ingrowth of new blood and lymph ves-sels occurs around the fifth to sixth day. Hair growth usually occurs two to three weeks after graft placement. Re-innerva-tion of the graft is variable depending on the thickness, graft type, scar formation, and surrounding tissue innervation.

Graft healing may be impeded by movement (prevent-ing adherence), graft separation from graft bed (hematoma, seroma), and infection. If the fibrin bonds are disrupted, subsequent steps in graft healing (neovascularization) are hindered resulting in graft failure. Promotion of graft drain-age with mesh grafts and vacuum-assisted drainage should be considered. Advantages of the mesh grafts include that they have slits in them that help provide flexibility to con-form over convex or concave surfaces, they can provide more stability by placing sutures through the slits, and they allow exudate, serum, and blood to drain through the slits. One disadvantage is the possibility of excess granulation tis-sue growing through the slits and over the top of the graft. Extremities with grafts should be immobilized and activ-ity should be limited. The initial bandage should include a non-stick contact layer that should not be disturbed for at least 48-72 hours initially. The authors recommend seda-tion for initial bandage changes so that the graft is not dis-turbed. Wound management requires frequent bandage changes, compliant owners, and time.

Complications of reconstructive surgery in companion animals. Amsellem P. Vet Clin Small Anim 41 (2011) 995-1006.

Review of factors that negatively affect wound healing in general. Hypoproteinemia, uremia, wound infection, and hyperadrenocorticism are endogenous factors that may delay wound healing. Nutrition and feeding tube placement are important considerations in patients with severe wounds. Onco-logic therapies (effects of chemotherapy, radiation therapy, and tumor type) may delay wound healing and contamination with neoplastic cells should be prevented. Feline wounds heal slower when compared to dogs. Seromas and hematomas will delay wound healing and should be prevented and managed. Seromas and heamatomas under a free skin graft prevent adhesion of graft, resulting in graft loss. Wound infection prolongs inflam-matory phase of healing and predisposes to dehiscence. Tension can result in ischemia, necrosis, and wound dehiscence. Patho-genesis of skin flap necrosis reviewed. Free skin graft failure can be secondary to lack of immobilization, infection, and inad-equate vascularization. Self-trauma secondary to paresthesia of a graft or flap is discussed. Complications of specific reconstruc-tive procedures (maxillectomy, hemipelvectomy) are discussed.

Free skin grafting for treatment of distal limb skin defects in cats. Shahar R et al. Journal of Small Animal Practice 40 (1999) 378-382.

Describes indications, surgical technique and outcome for thick split-thickness skin grafts for large skin defects in cats. Seventeen grafts performed in 16 cats reported. Cats first underwent care of open, contaminated wound prior to graft-ing for two to three weeks. Donor site was lower thoracic area or abdominal wall lateral to mammary glands, avoiding thick dorsal skin. Four main stages of procedure: prepara-tion of recipient site, graft harvesting, placing the graft, and application of protective bandage. Recipient site prepped into smooth granulation bed, measured for pattern, and covered with saline gauze during graft harvest. Graft harvested using pre-cut paper pattern, skin cut to subcutis, epidermis/dermis removed, undersurface cleaned until hair follicles visualized. Graft placed within 10 minutes of harvest. Graft overlapped boarders and secured with sutures. Two parts to bandag-ing included layer to secure graft and layer to immobilize. At day 3 and 6 bandage changed, day 10-14 bandage and sutures removed. Grafts survival was 100% in 14/17 grafts.

Small animal wound management: Options for wound closure. Bowlt K, Friend E. Companion Animal 16 (2011) 13-18.

Reviews options for closure to prevent tension when healthy wound bed develops. Four main types of closure: primary clo-sure, delayed primary closure, secondary closure, and second intention healing. Important to adhere to Halstead's prin-ciples. Avoidance of wound tension is most important con-sideration in wound reconstruction. Tension minimized by suturing wound perpendicular to line of tension, undermining surrounding tissues, a Z or V-Y-plasty, or releasing incisions. Skin stretchers and vacuum assisted wound closure are addi-tional devices to assist with wound management. Free skin grafts, most commonly full thickness, are utilized for large wounds. Skin flaps are consideration when wound bed can-not support graft, when insufficient vascularity, immobiliza-tion difficult, or when padded repair required. Complications include tension, inadequate blood supply, seromas, hemato-mas, and dehiscence.

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