

Solutions for Embalming the Skin Donor

By Chris Donhost



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Tissue donation is a complex postmortem surgical recovery of human tissue for the purpose of transplantation. There are a multitude of tissues, or grafts, that can be recovered from a single donor. In fact, one tissue donor can help as many as 75 recipients. Sometimes tissues and organs are recovered for research and education, but this Donate Life series will focus on those recovery and restoration methods as they relate to donation for transplant. These donated tissues provide a viable alternative to an autograft, animal tissue grafts, or synthetic materials. Having several choices available produces best outcomes based on surgeons' preferences and patients' needs. As it relates to the funeral profession, recovery of tissues from the deceased human body presents numerous challenges for the embalmer. In this segment we will cover the topic of skin donation. This article will address the different types of skin recovery, the methods and areas for recovering skin from a donor, how the skin is used to help those in need, several embalming treatment methods of the skin donor, and how skin donation has directly benefitted a licensed embalmer post-mastectomy.

There are generally two classifications of skin recovery - the first being split thickness, and the second is full thickness. The split thickness skin graft is most widely known for its application as a temporary biological wound dressing for the burn patient. There is no doubt that this type of graft can be lifesaving by shielding the wound from sources of infection, and simultaneously allowing the patient's skin to regenerate. The burn wound is best treated with an autologous skin graft. The term autologous refers to a graft that is recovered from the patient being treated; it is also known as an autograft. There are drawbacks to an autologous graft because the patient being treated must recover from the original wound site as well as the location where the autograft is recovered from. This results in additional pain and extended healing times, as well as additional risk of infection to the patient. In fact, it is widely reported that the autograft site is more painful and has longer healing times than the site of the original injury.

The next best alternative wound dressing is the allogeneous skin graft, also known as an allograft. This term refers to a graft received from a donor that isn't genetically identical, most commonly from a deceased donor. One of the drawbacks with this type of graft is rejection. When a burn patient receives an allograft dressing, the body will begin to reject the dressing in about ten days. Therefore, it is necessary for these dressings to be periodically changed.

The recovery of donated skin is a surgical procedure and therefore requires the same level of preparation as any other surgical procedure including

surgical prepping, draping, and the utilization of sterile surgical instrumentation and aseptic technique. Split thickness (burn skin) allografts are recovered from a donor utilizing a specialized surgical instrument called a dermatome. There are two different types of dermatomes utilized for the recovery procedure. Both are made from surgical grade steel, so they can be sterilized for the recovery process. The first type utilizes an oscillating (side to side) flat knife blade. Because of the large rectangular flat blade, this device may limit the anatomical areas where a graft can be recovered to the thighs, back, and buttocks. The second surgical recovery instrument is an amalgatome. The blade on this instrument is circular, so it can recover from uneven areas. The amalgatome produces a narrower graft, but allows for recovery in areas the dermatome is unable to recover from. Both instruments will produce a similar and distinct type of mark on the surface of the skin. The recovery site is usually a long rectangular strip, but this will vary from one tissue recovery agency to another.

The embalmer will receive the burn skin donor typically with some sort of wrapping in the areas where skin was recovered. The recovery agencies refer to this as reconstruction. Many embalmers appreciate the effort to minimize the leaking, and the practice meets a mandate set forth by the American Association of Tissue Banks (AATB). While AATB requires reconstruction of some type on every donor, they don't specify how the reconstruction needs to be done. Therefore, there will be variances from one recovery agency to the next on how that process looks. Usually the recovery site will be slippery. The dermal layer of the skin remains intact with a burn skin donor and will ultimately require a topical treatment.

Depending on the extent of the other tissues recovered and the status of the arterial system, an arterial injection should be attempted first - even if there have been other disruptions to the system. Arterial injection will almost always produce better results for proper preservation. When burn skin is recovered on a deceased donor, there will likely be little bleeding. However, when the embalmer begins injection, a considerable amount of oozing from the recovery sites should be expected. That is a good thing, because the oozing provides visual proof that the fluid is being distributed to the areas of recovery. Should arterial injection fail, then hypodermic injection will be required.

Following either arterial and/or hypodermic injection, it would be best to cauterize the recovery sites topically. This can be accomplished in several ways. The recovery site can be covered with a pack consisting of an application of Dryene II Gel, or a Webril towel soaked in Basic Dryene or Dryene II, and

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then the area can be covered with plastic. Allow that pack some time to penetrate the tissue for best results.

Once the embalmer has achieved preservation results to satisfaction, the pack should be removed and allowed to air dry. The recovery site can then be wrapped. I would recommend at minimum two layers. If the recovery site still appears moist, then an absorbent pad manufactured by a Dodge partner, Absorbent Specialty Products would be the preferred first layer. If the tissue is relatively dry, then I suggest using an industrial-strength plastic wrap for the first layer. The second layer of protection would be a unionall or similar plastic undergarment. Be sure to ask your Dodge Representative for the catalog showing the complete line of Absorbent Specialty Products materials. You might consider suggesting your tissue recovery agency include one or two of the products that would be most helpful to you with every donor, or at least every donor when the family indicates viewing preference as “yes or unknown.”

The second classification of skin donor is the full thickness skin donor, also known as a dermal skin donor. Historically, skin was only used as a burn wound dressing. Today there are more skin transplants occurring for non-burn patients than for the burn patient. Unlike the previous classification that only took the topical layer of skin, the full thickness skin procurement recovers all layers of the skin down into the fatty pad between the skin and muscle. There are both mechanical and freehand methods for recovering dermal skin. The mechanical method for recovery of dermal skin utilizes a specialized instrument similar to that previously described for burn skin recovery. Mechanical recovery leaves behind large rectangular strips at the recovery site. It was quickly realized by the transplant surgeons that there is a tremendous limitation to the usefulness of the graft when strips had to be sewn together for procedures requiring a large graft, such as an abdominal wall repair. In fact, the suture lines between the sewn together graft strips were subject to infection, or failure. Surgeons requested the larger graft, and the freehand skin graft is the result. The donor’s back can result in a single graft, as can the abdomen and circumferential recovery of the legs and arms.

Dermal skin provides many uses in transplantation, and the recipient won’t have to take anti-rejection medication, as is necessary with organ transplant. The reason is due to the processing of the skin after recovery. Essentially the skin is stripped of all cellular material through de-epidermization and decellularization. The cells of the hair follicles and blood vessels, as well as any pigmentation, are removed. What remains is an acellular dermal matrix. Basically, it is akin to a complete stripping of a house: the roof, sheetrock, wiring, and plumbing are all removed and only the frame remains. That acellular dermal matrix is then prepared into several different grafts. The single graft from the donor can remain in its largest state as originally recovered. This could be used for abdominal wall repair, or for an accident victim that has a large gaping wound that needs to be closed.

Trauma can require unique treatment options, such as a child whose foot was run over by the family

car and degloved. In this case, amputation was initially considered to be the only way to prevent infection, but instead a dermal skin graft was used to cover the foot. The transplant surgery was a success, and amputation of the child’s foot was avoided. Once transplanted, the acellular matrix is repopulated with the recipient’s own DNA. The graft is revascularized and recellularized, thus becoming a part of the recipient. In fact, the recipient will also repigment the graft to match his or her own ethnicity. A partial list of other uses from dermal skin recovery include post-mastectomy breast reconstruction, bladder slings, periodontal procedures, contracture release (following burn wound rehabilitation), pelvic floor repair, hernia repair, and tunneling ulcer repair for the diabetic.

While dermal skin grafts are arguably one of the greatest advancements in tissue transplant medicine, the resulting condition of the deceased donor presents numerous challenges to the embalmer. First and foremost is the sheer size of the resulting recovery site from the freehand dermal graft – something that most embalmers might only otherwise encounter following a traumatic car accident. There is a tremendous amount of exposed raw tissue under the reconstruction materials when the donor arrives at the funeral home after tissue recovery.

Some have suggested it is acceptable for the embalmer to leave the reconstruction material in place, arterially inject, and dress in a unionall. However, that method just leaves too much to chance with no adequate way to verify distribution and diffusion of chemical into the tissues. Furthermore, that gives no opportunity for the tissue to dry thus leaving significant potential for leaks.

The best-practice method begins with the removal of all donor reconstruction materials to expose all the raw tissue. From here there are two acceptable avenues for treatment – one suggests that you start with treating the raw tissue with Dryene II Gel, wrap, then proceed with arterial injection. The second method is to begin with the arterial injection. Both methods have proven successful. By injecting first there is less exposure to the external pack and it permits the embalmer to visualize the tissues for proper distribution. Arterial injection will result in significant weeping from the recovery sites, and that is a good sign of proper distribution. Should there be an area that isn’t embalmed to liking, then the exposed tissue areas will point the way to those places that require hypodermic treatment. Following arterial injection with the embalmed recovery sites exposed, prior to any packs or wrapping, the donor needs to be thoroughly dried.

Embalmer Donald Kellerhall, CFSP, and Damien Tillman devised a technique called the “wind tunnel” for drying out tissue on a tissue donor. This technique can also be utilized on any advanced restoration case where drying out exposed tissue is necessary. Wind tunnel supplies needed are a plastic casket cover, dressing table or secondary embalming table, three body blocks, box tape, massage cream, and a 12-14” box fan. Take the empty dressing/embalming table and drape with the plastic casket cover. Place the three body blocks on the plastic and move the donor over

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onto the blocks. Generously cover the facial tissue and the tops of the hands with massage cream. You might even want to cut out small pieces of plastic and cover the face and hands to help prevent unwanted dehydration to those sensitive areas. Pull the plastic up over the donor, and seal at the top with the box tape. Leave a small opening at the foot end for the box fan to sit and point into the tunnel. Also leave a small opening at the head end to act as an exhaust. Turn on the fan.

The wind tunnel should inflate like a balloon with the air blowing over the exposed tissues. The more time the donor can remain in the tunnel, the better the results. The preferred time being 10-12 hours, the minimum being 6-8 hours. It is possible that the time of year and humidity levels could have an impact on the outcomes. This technique was developed in Sacramento, California and has proved to be beneficial year-round. The end result is dry tissue. Because the donor is up on blocks, and the recovery sites are left open, air is able to completely envelope the donor and dry out the areas where deep tissue has been recovered. It is possible that the procurement areas might be so dry that no further treatment is necessary. That said, it might still be good measure to place an external pack with Dryene II Gel or Webril towel saturated with Basic Dryene or Dryene II. This could be done before the wind tunnel plastic is discarded. Just remove the fan, open the top plastic seam created with the tape, apply the external pack and rewrap with the wind tunnel plastic. Allow the pack as much time as possible to cauterize the tissue, at least a couple hours. Remove the pack and dry.

For the final restoration of the donor, Absorbent Specialty Products has coverings that are specifically designed for different areas of the body. They also have mats with a white absorbent material on one side, and black plastic on the other. I would suggest laying several of these mats black side down on a clean embalming/dressing table. Transfer the donor out of the wind tunnel onto the white side of the absorbent pad. These mats can be pulled up around the donor and taped at the top to tightly wrap the donor; there is no need to suture mats or towels to the donor.

For example, the mat on the head end can be cut out where the head is, and the two sides then pulled over the shoulders and secured with tape to the sides that were previously secured on the chest/abdomen area, essentially creating a vest out of the absorbent mat material. That same idea can be done with the pad under the buttocks, cut the mat between the legs and pull up between the legs securing to the abdomen. If skin was recovered from the legs or arms, these same mats can be cut to size and wrapped with tape or industrial-strength plastic. Once the custom donor absorbent suit has been created, the donor should be dry and tissues should be well preserved. The last step is to dress the donor into a Unionall as the second layer of protection from leaking as an extra precaution.

Embalmer Savannah Hall has strong cancer history on both sides of her family. She decided to undergo genetic testing which resulted in a BRCA-2 diagnosis. At the age of 33, Savannah underwent a double mastectomy. Initially the procedure went as expected, until it didn't. For reasons still unknown,

Savannah's skin didn't want to heal and became necrotic. The surgeon had to go back and remove more tissue and skin. That is when her surgeon suggested a dermal matrix skin transplant for breast reconstruction. Savannah agreed, and thankfully the subsequent surgery went exactly as planned with positive results and outcomes. Savannah is back to work managing a funeral home, caring for her family, and regularly playing soccer in a competitive women's soccer league. Savannah is very thankful for the generosity of her donor. She regularly gives talks about her post-mastectomy experience, about being a tissue recipient, and encourages other women to get tested for breast cancer awareness.

I've never heard an embalmer ask "why" when a decedent is on their table in poor condition following a traumatic accident. However, that question is frequently asked regarding the tissue donor. Recovery agencies have historically done a poor job of including funeral professionals in the good that comes from donation. Thankfully, there is a nation-wide movement of change among Donate Life professionals who recognize that error and are making concerted effort to build bridges within the funeral profession community. While the information contained within this article won't lessen the amount of work required for an embalmer to care for the skin donor, hopefully there will be better understanding.

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Wind Tunnel



Absorbent Mats

Photo courtesy of Chris Donhost

Photo courtesy of Chris Donhost