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The development of a treatment pathway for dermal regenerative matrix (DRM)☆

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ARTICLE INFO

Article history:
Accepted 16 June 2018

Keywords:
Burn care
Nationwide protocols
Dermal regenerative matrix
Canadian burn network

ABSTRACT

The process of standardising burn care and creating protocols within burn centres has, at its core, evidence-based practice principles combined with the clinical experiences of burn care specialists. Although protocols and pathways have been created for certain topics of burn care, they tend to be tailored to the local individual needs of each burn centre, which is a limiting factor for consideration of larger/nationwide approaches. In order to continue to improve the short and long term outcomes after burn injuries, such as increasing the survival rate, reduction in the incidence of sepsis and organ failure, and improving wound healing and scarring, more generalised care pathways combining the recommendations of a nationwide working group of burn care specialists should be created around the topics of interest to ultimately improve patients' outcomes. We describe the steps put in place in Canada to design and adopt a nationwide protocol from a single burn centre on the topic of wound healing and dermal substitutes as the initial exemplary process. This report summarizes the Canadian experience for this type of initiative, which can be used as framework for

☆ The meeting was part of the Canadian Burn Symposium held in Winnipeg from 23rd to 26th of September 2017.

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https://doi.org/10.1016/j.burns.2018.06.005

developing additional guidelines/protocols in other relevant burn care related topics in Canada or other countries.

1. Background

Protocols designed for burn care by individual burn centres have played an important role in significantly improving outcomes of thermal injuries over the last decades [1–6]. The process of standardising burn care and creating protocols within burn centres has, at its core, evidence-based practice principles combined with the clinical experiences of burn care specialists. Pathways and guidelines have led to better outcomes, in terms of reducing the overall mortality and morbidity, improving resuscitation, critical care, wound care and long-term functional and psychological outcomes [1,5,7]. Although protocols and pathways have been created for certain topics of burn care, they tend to be tailored to the local individual needs of each burn centre, which is a limiting factor for consideration of larger/nationwide approaches. In order to continue to improve the short and long term outcomes after burn injuries, such as increasing the survival rate, reduction in the incidence of sepsis and organ failure, and improving wound healing and scarring, more generalised care pathways combining the recommendations of a nationwide working group of burn care specialists should be created around the topics of interest to ultimately improve patients' outcomes. One way of creating a generalised protocols consists of choosing a well-established pathway for a specific topic developed by a burn centre and then presenting it to an established national forum for discussion with the burn leaders from across the country giving their input. This intuitive process however is faced with various challenges and ultimately a national platform to communicate and agree upon various generalised pathways in burn care is essential for the development of improved treatment protocols across the country.

We describe the steps put in place in Canada to design and adopt a nationwide protocol from a single burn centre on the topic of wound healing and dermal substitutes as the initial exemplary process. This report summarizes the Canadian experience for this type of initiative, which can be used as a framework for developing additional guidelines and protocols in other relevant burn care related topics in Canada or other countries.

2. Canadian burn demographics

In Canada, there are 17 burn centres and units that all face individual regional challenges in the overall treatment of thermal injuries. The exact burn incidence in Canada is estimated at around 43,600 patients per annum (Table 1) [8,9]. According to Statistics Canada over 12 months period 2009–2010, 127,000 people over age 12 had sustained a burn injury which limited their activity [10]. Of these approximately 2100 patients are considered more severe burns and hospitalized, requiring specialised burn services. Per annum there are 234 deaths and 982 permanently disabled patients due to burns [9]. At present there is no standardised nationwide capture of information related to patients' treatment protocols and outcomes. For example, some patients with thermal injuries may be potential candidates for dermal substitute application in the acute setting, or later on for scar contracture release. The number of dermal substitute applications in Canada varies widely and is based on the experiences of burn surgeons in each centre. To date, there is no standardised tool to compare the indications, technique, complications and final outcomes of acute burn, scar contracture release and burn reconstruction patients. The absence of standardised tools used across all Canadian burn centres directly reflects the lack of QI analysis of burn outcomes regionally and nationwide (availability to compare aesthetic, functional and psychosocial outcomes, return to work) in adult and paediatric patients in Canada, and thus all Canadian centres have agreed that a standardised way to collect patient outcomes measures should be encourage and considered nationwide.

For this consensus, the Canadian Burn Network– Canada's first step towards a standardized approach to burn care– was created and has grown under the leadership of Drs. Sarvesh Logsetty and Marc Jeschke. The Canadian Institute of Health Research funded a grant (PI Dr. Logsetty) to form the Canadian Burn Network, which enabled a wide, interprovincial collaboration with the aim to have a better understanding of the needs of burn care in Canada. As part of this network, standardised data capturing the quality and performance improvement, the outcomes of burn care are significant areas of focus for the stakeholders within this organization. The Canadian Burn Network is now in its 3rd year of partnership and facilitates various projects, as well as partners with collaborative initiatives to improve outcomes for thermal injury in Canada. To further the Canadian consensus on standardising a nationwide forum for Canadian burn providers, the Canadian Burn Symposium (held annually since 2014) was created. In 2017, the Symposium became a true conference when the Canadian Association for Burn Nurses joined the network. These meetings have now merged into one, and the vision for 2018 is to create the Canadian Burn Association. The partnerships and the creation of the Canadian Burn Association aims

Table 1 – Incidence of burns in Canada [9].

Description	Deaths	Hospitalizations	Emergency room visits	Permanent partial disability	Permanent total disability
Fire/Burns	234	2099	43,684	982	50

to create a dynamic working platform that will allow stakeholders to play an active role in the development of nation-wide strategies for advancing burn care in Canada.

The third step involves the joint collaboration of the Canadian burn centres in multi-centre trials across the country. The Canadian burn centres are now working together and participate in trials that are not only based on performance or quality, but also include interventions through a platform that merges data entry and outcome measurements. These three initiatives– the creation of the Canadian Burn Network, the Canadian Burn Symposium and the joint collaboration of multi-centre trials – are leading to a more synchronized and harmonized approach to burn care, and have opened the possibility to create Canada wide protocols for certain topics in burn care.

For the first nation-wide working group exercise, a topic that is relatively straight forward, but with a wide variability between burn care providers was chosen: the role of dermal substitutes in the acute burn care, burn reconstruction and scar contracture release.

3. Materials and methods

3.1. *Objectives*

Experts indicated that there is a significant need for standardizing a patient care pathway and indications for the use of DRM across Canada. This is to provide guidance on the role of DRM to improve functional and aesthetic outcomes, how to access DRM easier in Canada, when and how to use and apply DRM appropriately in the acute burn care setting and the techniques related to DRM placement in order to provide the best possible outcomes for patients. This is intended to be a clinical guideline for all clinicians who treat burn patients, when DRM is considered as an option in their treatment plan. In addition, this pathway is intended to become a reference point for healthcare system administrators and policy decision-makers facilitating access this novel and essential technology.

3.2. *Approach to developing the DRM recommendations*

After identifying the subject matter experts and the potential stakeholders, one-on-one telephone interviews were conducted with 9 burn care providers from across Canada between June 15 and July 28, 2017. The information from the interviews confirmed the need for developing a standardised patient pathway to identify the clinical indications for DRM in burn care across Canada. The information from the interviews was utilized to create the agenda for the Expert Council of Burn Surgeons round table meeting and provided the starting point for the development of the pathway for DRM use in burn care. Prior to the meeting, leaders from the Canadian Burn Symposium put together an initial draft of DRM pathway that was distributed for review and feedback to all experts who participated in the interviews and to those who were invited to attend the Expert Council of Surgeons meeting in Winnipeg.

3.3. *Expert Council of Surgeons*

The Expert Council of Surgeons was made up of 10 burn surgeons and academicians (Table 2), who participated in the Expert Council of Surgeons on September 23, 2017 in Winnipeg, Manitoba (nine out of 10) and/or were interviewed in June-July 2017.

On September 23rd, 2017 prior to the start of the 4th Annual Canadian Burn Symposium, in Winnipeg, Manitoba, the Expert Council of Surgeons, began with an extensive review of the published literature on DRM. This was followed by a presentation from Dr. Warren Garner, Professor of Surgery, Burn Center Director, University of Southern California who has vast expertise with DRM use in his clinical practice. Next, the Council identified the areas of the pathway that the experts felt needed further discussion, adjustments and/or clarification to gain alignment on the recommendations that would be published by the Expert Council of Surgeons.

3.4. *Dermal regeneration matrix*

The initial design criteria of DRMs were set out around physical properties, biological compatibility and fibrosis, with the aim to provide immediate wound closure while conferring the functional benefits of non-fibrotic healing [11–13]. DRMs were initially developed to improve the functional results after the acute phase of bums, however the good aesthetic and functional results obtained in the treatment of acute bums suggest an application in general plastic surgery as well [14].

DRMs use biocompatible cross-linked collagen/glycosaminoglycan (GAG) with specific biochemistry made up of bovine collagen type I from tendon and the glycosaminoglycan chondroitin-6-sulfate. Some DRMs are designed to suppress inflammation by inhibiting the collagen-induced platelet aggregation driving the production of cytokines that are implicated in the inflammatory wound healing process and the formation of granulation tissue.

Collagen–glycosaminoglycan also has a significantly more open pore structure when freeze dried than collagen alone [11]. This open porosity with controlled pore size and resorption rate permits dermal cellular ingrowth and remodeling without contraction and scarring [15,16]. Epidermal function of the scaffold is achieved via a second, silastic layer of a defined thickness to prevent excess moisture loss. This silicone layer also prevents the formation of granulation tissue on the surface of the matrix. The resultant DRM controls contraction and fibrosis in vitro and in pre-clinical models [17].

Within 2–3 weeks after DRM application, a neodermis forms and an autograft can be placed over the neodermis [18]. Once the DRM-supported autograft is healed, the histological structure and physical properties of the skin are closely similar to those of normal skin [19–21].

4. Results

The first recommendation decided upon by the burn leaders was the terminology to be used to describe the use of dermal substitutes. After much discussion, it was decided to be termed “dermal regeneration matrix” or “DRM”, and this

Table 2 – Expert Council of Surgeons.

Ariane Bussières, MD, FRCSC, Quebec City, Quebec	Marc Jeschke (Co-Chair), MD, PhD, FACS, FCCM, FRCSC, Toronto, Ontario	Duncan Nickerson, MD, FRCSC, FACS, Calgary, Alberta
Homan Cheng, MD, FRCSC, Victoria, BC	Sarvesh Logsetty (Co-Chair), MD, FRCSC, FACS, Winnipeg, Manitoba	Isabelle Perreault, MD, FRCSC, Montreal, Quebec
James Cooper, MD, FRCSC, Hamilton, Ontario (Dr Cooper was interview but not at the meeting in person)	Claudia Malic, MD, MRCS(Eng), MD, (FRCS(Plast), FRCSC, Ottawa, Ontario	Anthony Papp, MD, PhD, FRCSC, Vancouver, BC
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terminology will subsequently be uniformly used in the protocol as the official language.

Second step was to set the indication for the DRM usage. All surgeons present agreed upon the indications of dermal regenerative matrices in the acute burn care setting, as well as for later reconstruction purposes. There is sufficient evidence to indicate that acute patients should be considered for the use of DRMs for full thickness or deep partial thickness burns to the face, hands, axilla, and over exposed bones and tendons, where function and movement is necessary, and/or when an improvement in aesthetic gains would be significantly increased. All participating burn care providers agreed upon this indication.

Based on published data, the next recommendation was for the use of dermal regenerative matrices in reconstruction of full thickness defects in areas (faces, necks or complex areas), where an improved reconstructive outcome would be achieved. All burn care providers also agreed upon this statement.

4.1. *Defining the appropriate acute burn patients for DRM*

The experts agreed on the following definition for recommended use of DRM:

"For the treatment of full-thickness and deep partial-thickness burn wound injuries after excision where insufficient skin is available for grafting at the time of excision, or not desirable due to the physiological condition of the patient."

The decision was made not to put any age limitation in the recommendations, but to rather focus on the physiological condition of the patient, regardless of age. It was noted that paediatric patients should be strong candidates for DRM use.

4.2. *Defining the appropriate reconstruction patients for DRM*

For reconstruction, the experts agreed on the following recommendation:

"For use in reconstruction of full-thickness defects after excision of the integument where potential benefit to patient is present by improving the functional and aesthetic outcomes, in the opinion of the treating surgeon."

4.3. *Defining the appropriate reconstruction patients for DRM*

DRM should be considered and could be used:

1) For treatment of acute burn or non burned wounds in areas where functional or aesthetic gains would be significantly improved;
2) Wounds that are un-graftable with traditional grafting techniques (exposed bone and tendons);
3) Inadequate donor sites to close wounds after excision.

4.4. *Training requirements*

The experts agreed that there should be some minimum requirements for training for surgeons to use DRM, in order to ensure the correct procedures are followed in preparing the wound bed, DRM application, post-operative care and for planning and performing the epidermal grafting as the final step of the reconstruction. It was agreed that if the surgeon has no previous exposure to DRM, they would require both knowledge training and practicum training.

4.4.1. *Knowledge training*

See knowledge training website link: http://www.ilstraining.com/idrt/idrt/brs_it_00.html.

4.4.2. *Practicum training*

Options are to:

- Visit a Centre of Excellence.
- Access to a consultant surgeon for the first 3 DRM cases OR.
- Access to an experienced DRM consultant for the first 5 DRM cases.

The entire and in depth protocol can be found in Appendix 1.

5. Discussion and recommendations

As Canadian leaders in burn surgery, we acknowledge that to further improve the outcome of burns, it is important to create

more generalised nationwide protocols in burn care, by utilizing the experience from a single burn centre as a starting point from which we can gain agreement and subsequently develop a relevant protocol for national scale. For our first pathway we chose the development of a Canada-wide protocol for the use of dermal substitutes in acute burn care and burn reconstruction.

From this discussion, the outcomes of the consensus have been successfully determined and during this inaugural pathway meeting, we realized that open dialogue amongst our colleagues is of upmost importance, as different opinions and experiences exist amongst burn care clinicians. For our pathway meeting, the use of both a facilitator and a moderator helped to guide the discussion and the structure of the meeting with clinicians and to shape our dialogue into a successful outcome. During the discussion, if there were concerns, voting or further dialogue was implemented. At the end of the meeting, consensus was met for most of the recommendations and a national pathway for the use of DRM in the burn care was developed.

This initiative took into account the advantages of focus group along with one to one interview. A Delphi consensus survey was not required as the aim of this exercise was to describe the indications and the steps required for DRM use in patients with burn injuries rather than degree of importance of the items. Some of the advantages of focus group were: good representation of the main stakeholders in the burn care across Canada, it allowed open discussions about current practices, the evidence based DRM use was adapted to our practice in Canada (cultural, standard of care, policies) and it confirmed insights obtained through other qualitative methodologies. During the forum discussion, all attendees had a proportionate contribution to the final document and the moderators kept to time and were not biased.

The one to one interview over the phone, although it was difficult to organize and was more complex to interpret, provided less bias than a focus group. It also gave us robust insights prior to expert council meeting on the use, applications, issues, complications and barriers when DRM was used in burn care in Canada.

It seems beneficial for burn patients to have protocols or recommendations for therapeutic applications, based on a larger area rather than based on a single centre. This not only will allow for the improvement of outcomes in burn patients, but will be a stronger argument for further financial support for these types of treatments from national funding agencies and licensing agencies. It will also permit burn surgeons nationwide to conduct multi-centre perspective trials or collect standardized retrospective data in a collaborative, open dialogue manner. It is of utmost importance to prospectively capture outcomes of burn patients, and whether the approach of a national protocol will in fact improve the outcome has yet to be determined. However, this is the first initiative to protocolize a burn care topic at a national level, and the Canadian Burn Association will vigorously monitor and analyze the data to understand whether this recommendation will result in optimized outcomes for burn patients.

In summary, this initiative indicates that the burn care providers can get together and develop protocols and standards of care for various topics, if it is considered a nationwide agreed topic of importance. This initiative aimed to adapt the evidence present in the literature to the standard of care and clinical needs characteristic to Canadian population. Similar process could be replicated for another aspects of burn care and in another countries or burn associations. It is important to adjust the protocols to cultural and populations characteristics.

Funding

This manuscript was supported by an unrestricted grant from Integra Life Sciences, but there is no conflict of interest to report. Integra Life Sciences had no influence on the outcome of this project.

Appendix 1.

Dermal regeneration matrix (DRM) recommendations

Suggested use of a dermal regeneration matrix (DRM) in acute and reconstruction procedures:

Acute patient use recommendation DRMs should be considered for use in the treatment of full-thickness and deep partial-thickness burn wound injuries where sufficient skin autograft is not available at the time of excision or not desirable due to the physiological condition of the patient. In addition, DRMs should be considered for use in full-thickness or deep partial-thickness thermal injuries to the face, hands, axilla, avascular structures (bones and tendons), as well as areas where functional movement is necessary (i.e. joint surfaces) and/or aesthetic gains would be significantly improved. In addition, DRMs should be strongly considered for use in paediatric patients. **Reconstruction patient use recommendation** DRMs should be considered for use in reconstruction of post-excisional, full-thickness defects of the integument where there is a potential benefit to the patient by improving the reconstructive outcome, in the opinion of the treating surgeon.

Procedure #1: excision and application

I. Pre-operative guidelines

1. Operating room supplies

In addition to standard OR supplies for an acute burn or reconstructive procedure, the following supplies should be available in the OR:

i. Electrocautery instrumentation (i.e., Bovie, double plug, bipolar) for pin-point coagulation.

ii. Elastic net dressings if necessary.

iii. Antimicrobial agents/dressings.

iv. Compression dressings/wraps.

v. "Non-crushing" Mesher** if planning to mesh DRM.
Note: "pie-crusting" is also acceptable.

vi.Splints and brace.

2. Requirements for a wound bed ready for ADM application

i. Free from contamination and infection:

a. All non-viable tissue removed—eschar, necrotic, devitalized and contaminated tissue.

b. If wound infection is detected, topically and/or systemically treatment is required as per unit protocols.
c. For staged burn excision, it is preferable to have a "barrier zone" between the DRM and the remaining burn eschar. This "safety zone" should be 2–4 cm wide and the excised zone is then covered with one of the following: allograft, xenograft, antimicrobial silver dressing, 5% antibiotic soaked gauze, 0.5% silver nitrate soaked gauze. The safety zone is left in place until the patient is brought back and the remaining eschar is excised.

ii. Adequate vascular supply

a. Adequate vascular supply is required prior to DRM application.
b. Punctate, uniform capillary bleeding indicates adequate excision of non-viable tissue.
c. In certain situations, i.e., obese patients, excising to viable fat may not provide an adequate blood supply.

iii. Dry with no signs of bleeding (meticulous hemostasis):

a. Meticulous hemostasis needs to be achieved to prevent hematomas or excessive fluid accumulation, which will reduce the DRM adhesion and increase the risk of failure and further infection of the DRM
b. Use of topical epinephrine, pinpoint electrocautery, thrombin spray, thrombin-soaked gauze or other topical hemostatic agents should be use to achieve adequate hemostasis. Avoid cauterization over large surfaces as could lead to devitalized tissue.

iv. Uniform and flat wound bed to ensure intimate contact with the DRM:

a. Achieve level tissue planes

3. Wound bed preparation

i. Complete excision to viable tissue. Fascia, fat, dermis, muscle, and avascular structures are all suitable for application of DRM, if the wound bed meets the following requirements:

a. Free from contamination and infection.
b. Adequate vascular supply, unless the wound bed is over exposed bone and/or tendon.
c. Dry with no signs of bleeding (meticulous hemostasis).
d. Fairly flat smooth surface in order to ensure intimate contact with the DRM.

ii. Prior to placing the DRM, the wound bed may be prepped with a surgical prep/wound cleaner or solution scrub. Do not use Dakin's solution to prep the wound bed.

iii. Change gloves before handling the DRM and new sterile instruments are required for DRM placement, shaping, and cutting (scissors and non-tooth forceps). Additional steps can be taken at the discretion of the burn clinician with respect to re-draping the area and re-gowning following wound bed preparation.

4. Meshing the DRM

i. If meshing:

a. Extra care should be used if meshing DRM sheets larger than 10 cm × 25 cm to avoid folding.
b. Sheets can be meshed after rinsing.
c. Run sheets through a 1:1 "non-crushing" mesher (i.e. Brennen™ Mesher).
d. Handle the DRM sheets with gloved hands, do not use instruments.
e. Mesh sheets 1:1 but do not expand

5. Application of DRM

It is critical that the DRM is in direct contact with the prepared wound bed.

i. Gently remove the sheets from the packaging with gloved hands and place the DRM directly onto the wound bed, starting at the edge.

a. Do not allow the DRM to come into contact with un-excised necrotic or infected tissue.
b. Do not try to move or "float" sheets like a split-thickness skin graft (STSG). Instead, lift sheets up and reposition.
c. Place the line between two DRM sheets along Langer's Lines to reduce the risk of contracture.
d. Make sure the DRM lays flat with no wrinkles or bubbles.

ii. Cut or trim the DRM to size and select sheet fixation method. DRM should be secured using sutures or staples, or as per the manufacturer's instructions.

a. If using more than 1 piece of the DRM, cut sheets to avoid gaps and overlaps. If the DRM placement involves the surface area close to larger joint (shoulder, elbow, knee), the joint should be placed in different positions to see what is the best shape DRM should be cut in order to avoid excessive folds in the DRM.

iii. Sheet fixation

a. Parallel suture/staple orientation– place sheets on excised wound bed, suture/staple parallel to inside edge of wound bed and trim excess.
b. Perpendicular suture/staple orientation– place sheets on excised wound bed, trim sheets to fit site and suture/staple perpendicular to seam.

iv. Sheet fixation notes

a. Fix sheets independently and/or staple adjacent sheets together to minimize gaps, reducing granulation tissue formation.
b. Interrupted stapling (i.e. leaving 1–2 cm space between staples) can be used to seal edges.

v. Proceed to dressing

a. Initial dressing should be an antimicrobial dressing. Additional dressing options include:

b. Antimicrobial + negative pressure wound therapy + silver based dressings.

c. Antimicrobial+negative pressure wound therapy only.
d. Antimicrobial bulky dressing+compression only.
e. Antimicrobial+wound irrigant+bulky dressing +compression.

vi. Dressing notes:

a. Follow manufacturer's instructions with respect to Dakin's Solution coming into contact with the DRM.
b. Use splints or bolsters, per unit protocols, during first 5–7 days. Splints should be applied in the OR and should stay on at all times (except when performing wound care).

II. Post-operative care guidelines

6. Dressing changes

i. Initial dressings should be left for 3–5 days. The less activity around the wound the better.
ii. Subsequent dressings should be changed approximately every 2–3 days or more often based on how well the wound is healing.

7. Inspection

i. If an elastic net dressing is used, do not remove staples/sutures.
ii. Take down all dressings to inspect DRM sites, seams, and edges for evidence of hematomas, fluid accumulation, infection/purulence, premature silicone layer separation (if applicable), and areas of non-take. Inspection may be performed through interstices of elastic net dressing- do not remove unless necessary.
iii. Remoisten antimicrobial dressings after DRM inspection, depending on the brand of dressing used. Please follow manufacturer's instructions for the dressing.
iv. Replace or change new antimicrobial dressings every two to three days.

Note: continue with antimicrobial of choice/institutional preference based on ongoing evaluation.

8. Positioning and moving the patient

i. The goal, when positioning or moving the patient, is to minimize shear forces on DRM sites.
ii. Common methods used to move the patient include: log rolling, use of bed sheet to position patient, use of board to move patient, and use of plastic-coated surfaces (i.e., plastic bag, Mayo Stand cover) designed to reduce friction on the DRM.
iii. When using your hands to move patient, care should be taken to reduce stress on the DRM.
iv. If the DRM is used on the back, place patients in prone position. Care should be used when DRM is on a location that may receive shear (i.e., back).
v. Use of air fluidized, intermittent zero pressure specialty beds, or low air loss beds may be appropriate.

9. Physical therapy/occupational therapy

Gentle range of motion (ROM) exercises can begin between POD 5–7, progressing as per your PT/OT's protocol. If complications have delayed healing or the DRM sheets are not firmly adhered to the wound bed, delay ROM accordingly.

iii. The decision to remove bulky dressings, bolsters or splints to perform ROM exercises must be made on a case-by-case basis under consultation with PT/OT.

iv. Care must be taken during PT/OT to minimize the risk of shearing.

Procedure #2: silicone removal and autografting – where applicable

10. Planning for skin grafting

i. Prior to the removal of silicone (if applicable), assess the availability of donor sites;

a. Estimate size of the skin graft, based on amount of tissue required.
b. Do not remove and expose more neodermis than expanded skin graft will cover. The silicone layer may be left in place for extended periods if the staging of the skin graft autograft procedure is required.

• Removal of silicone

■ Remove staples or sutures.
■ Use forceps to gently remove silicone; while lifting from edges, peel back carefully (use spatula or blunt instrument to separate if necessary).

* Difficult separation may indicate that the neodermis has not fully matured.

• Inspect and prepare the neodermis

■ Inspect the neodermis carefully and remove any of the following:

○ Any excessive granulation tissue at seams, edges, interstices and staple sites.
○ Any necrotic tissue.
○ Areas of incomplete take.

■ Prepare a flat, clean surface using scalpel, scissors, or curettes.
■ In preparation for skin graft placement lightly debride the surface of the neodermis with a gauze pad or surgical scrub brush.
■ Although neodermis does not bleed easily, if bleeding occurs, control bleeding with an epinephrine-soaked gauze pad.

• Harvesting the thin skin autograft

■ Expand the site by infusing with saline to facilitate harvesting.
■ Harvest a thin skin autograft at approximately 0.006–0.010 in. The thickness of the skin graft is up to the discretion of the clinician as patient's skin thickness may vary,

○ Grafts taken thinner 0.004 in. may result in the poor engraftment due to an insufficient transfer of the basement membrane.

- Placement of skin graft

■ Thin skin grafts are more fragile than conventional STSG, making handling more difficult:

  - ○ Thinness of graft makes orientation easy to confuse (curl under indicates correct orientation.
  - ○ Use saline to float graft into position.
  - ○ Interstices should be of uniform size and no more than 2mm.

- Fixation of skin graft

■ Fixate the epidermal graft as per unit protocols.

11. Skin autograft dressings and care

i. Dress the donor site per surgical unit protocol.
ii. Dress and care for skin graft sites using the protocols typically used for split-thickness skin grafts.
iii. Similar to dressing the DRM sites, build dressings in layers and immobilize joints in a flexed position.
iv. Change dressings every third day, unless positive cultures require daily changes.
v. If the epidermal graft seems to "disappear", obtain cultures. In some cases, this is typically the result of the graft being too thin or the presence of infection:

   a. If negative, continue to dress normally. Engraftment and confluence should occur within 21 days.
   b. If positive, at the discretion of the clinician, primarily treat the infection topically. If needed antibiotics can be considered.
   c. Note: certain locations, such as the bottom of the foot or hand, are exposed to increased levels of pressure and general wear; therefore, they have an increased risk of injury and breakdown. Due to this, a skin graft greater than 0.008in. may be needed.

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