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Background: Split thickness skin grafting is a commonly used technique in burn surgery for resurfacing wounds that are unlikely to heal without scarring. Meshing and expanding skin grafts allow for reconstruction of larger wounds with smaller donor sites. Methods: A retrospective chart review was performed of 210 patients with burns equal to or greater than 20% total body surface area admitted to Vancouver General Hospital between 1998 and 2014. Charts were reviewed to collect data on patient and burn demographics. A survey was sent to Canadian plastic surgeons registered with the CSPS to collect data on common practices in burn surgery nationwide. Results: The patients that received 3:1 or higher meshed grafts were all flame burns, had a significantly higher average TBSA (51.89%±14.87 vs 29.13%±9.48, p=0.001), and a significantly higher full thickness burn TBSA (25.76%±21.97 vs 6.20%±9.04, p=0.001). We found no significant differences in gender, age, or burn location between the less than 2:1 and 3:1 or greater meshing ratio groups. The survey of plastic surgeons performing burn surgery in Canada revealed that 60% of responders had experience with skin grafts using meshing ratios of 3:1 or higher. Of these surgeons, 100% felt that burn size and 36% felt that burn location would influence their decision to use a 3:1 or higher meshing ratio. Conclusions: A larger burn size is the major influencing factor for the use of higher skin graft meshing ratios by Canadian burn surgeons. Furthermore, burn location determines the choice of donor and recipient sites in these cases. Keywords: Burn; Meshing; Skin graft. Padilla PL, Khoo KH, Ho T, Cole EL, Sirvent RZ, Phillips LG. Plastic surgery. In: Townsend CM Jr, Beauchamp RD, Evers BM, Mattox KL, eds. Sabiston Textbook of Surgery. 21st ed. St Louis, MO: Elsevier; 2022:chap 69.Ratner D, Nayyar PM. 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The medicine will wear off quickly, so it is used for short, uncomplicated procedures.You may receive the medicine through an intravenous line (IV, in a vein) or a shot into a muscle. You will begin to feel drowsy and relaxed very quickly. If your provider gives you the medicine to swallow, you will feel the effects after about 30 to 60 minutes.Your breathing will slow and your blood pressure may drop a little. Your provider will monitor you during the procedure to make sure you are OK. This provider will stay with you at all times during the procedure.You should not need help with your breathing. But you may receive extra oxygen through a mask or IV fluids through a catheter (tube) into a vein.You may fall asleep, but you will wake up easily to respond to people in the room. You may be able to respond to verbal cues. After conscious sedation, you may feel drowsy and not remember much about your procedure.Page 4American College of Radiology website. 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Middleton's Allergy Principles and Practice. 9th ed. Philadelphia, PA: Elsevier; 2020:chap 39. Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material.

What are the two main types of skin graft? Split-thickness skin graft (STSG) and full-thickness skin graft (FTSG).

Which parts of skin are included in skin grafts? The epidermis and part (STSG) or all (FTSG) of the dermis.

What structures are included with the dermis in both split-thickness and full-thickness skin grafts? Adnexal structures including sebaceous glands, hair follicles, sweat glands, and capillaries.

How thick is a “thin” STSG? 0.005 to 0.012 in.

How thick is an “intermediate” STSG? 0.012 to 0.018 in.

How thick is a “thick” STSG? 0.018 to 0.028 in.

What are the advantages of meshing a partial-thickness skin graft? Expansion of graft surface area up to six times, better contouring, decreased seroma or hematoma formation beneath the graft.

How does the mesher ratio affect the graft surface area? A mesher expansion ratio of 1:1.5 (most commonly used) increases surface area by 50%, a ratio of 1:2 increases surface area by 100%, etc.

What are the disadvantages of meshing? Waffled appearance, increased graft contraction (may be an advantage in some situations).

Where should meshing be avoided? On the face, hand, or forearm (cosmetically sensitive areas), and over joints, where contracture becomes a problem.

What is the postoperative bolster made of? Xeroform, cotton balls, or batting moistened in saline/mineral oil, secured with tie-over sutures or a stapled-on foam dressing.

How long should the bolster stay on postoperatively? Five to seven days. Two to three days if the recipient site is contaminated.

What are typical donor sites for STSGs? Anterior or lateral thigh in adults, buttock in children (for concealment of scar). The abdomen, back, chest, and scalp are often used if other donor sites are limited.

What is an appropriate donor-site dressing? Xeroform gauze dried with a hair-dryer or heat lamp is the traditional dressing. An occlusive semipermeable dressing, such as Opsite or Tegaderm may be used.

What is the advantage of Tegaderm or Opsite for the donor-site dressing? Faster healing and pain reduction.

Do the dermis and epidermis regenerate in split-thickness donor sites? The donor site epidermis regenerates from the periphery and from adnexal structures, but the dermis does not regenerate. The donor site can be reharvested after it is well healed, if the underlying dermis is thick enough. Only gold members can continue reading. Log In or Register to continue Janis JE, Kwon RK, Attinger CE. The new reconstructive ladder: modifications to the traditional model. Plast Reconstr Surg. 2011;127(Suppl 1):205S–12S.Article CAS PubMed Google Scholar Johnson TM, Ratner D, Nelson BR. Soft tissue reconstruction with skin grafting. J Am Acad Dermatol. 1992;27(2 Pt 1):151–65.Article CAS PubMed Google Scholar Converse JM, Uhlschmid GK, Ballantyne DL Jr. “Plasmatic circulation” in skin grafts. The phase of serum imbibition. Plast Reconstr Surg. 1969;43(5):495–9.Article CAS PubMed Google Scholar Rudolph R, Klein L. Healing processes in skin grafts. Surg Gynecol Obstet. 1973;136(4):641–54.CAS PubMed Google Scholar Converse JM, Smahel J, Ballantyne DL Jr, Harper AD. Inosculation of vessels of skin graft and host bed: a fortuitous encounter. Br J Plast Surg. 1975;28(4):274–82.Article CAS PubMed Google Scholar Greenwood J, Amjadi M, Dearman B, Mackie I. Real-time demonstration of split skin graft inosculation and integra dermal matrix neovascularization using confocal laser scanning microscopy. Eplasty. 2009;9:e33.PubMed PubMed Central Google Scholar Birch J, Branemark PI. The vascularization of a free full thickness skin graft. I. A vital microscopic study. Scand J Plast Reconstr Surg. 1969;3(1):1–10.CAS PubMed Google Scholar Birch J, Branemark PI, Lundskog J. The vascularization of a free full thickness skin graft. II. A microangiographic study. Scand J Plast Reconstr Surg. 1969;3(1):11–7.CAS PubMed Google Scholar Birch J, Branemark PI, Nilsson K. The vascularization of a free full thickness skin graft. 3. An infrared thermographic study. Scand J Plast Reconstr Surg. 1969;3(1):18–22.CAS PubMed Google Scholar Lindenblatt N, Calcagni M, Contaldo C, Menger MD, Giovanoli P, Vollmar B. A new model for studying the revascularization of skin grafts in vivo: the role of angiogenesis. Plast Reconstr Surg. 2008;122(6):1669–80.Article CAS PubMed Google Scholar Shimizu R, Kishi K. Skin graft. Plast Surg Int. 2012;2012:563493.PubMed PubMed Central Google Scholar Harrison CA, MacNeil S. The mechanism of skin graft contraction: an update on current research and potential future therapies. Burns. 2008;34(2):153–63.Article PubMed Google Scholar Braza ME, Fahrenkopf MP. Split-thickness skin grafts. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2020. Google Scholar Fuller DA. Split thickness skin graft to lower leg. J Orthop Trauma. 2016;30(Suppl 2):S34.Article PubMed Google Scholar Enshaei A, Masoudi N. Survey of early complications of primary skin graft and secondary skin graft (delayed) surgery after resection of burn waste in hospitalized burn patients. Glob J Health Sci. 2014;6(7 Spec No):98–102. Google Scholar Reddy S, El-Haddawi F, Fancourt M, et al. The incidence and risk factors for lower limb skin graft failure. Dermatol Res Pract. 2014;2014:582080.Article PubMed PubMed Central Google Scholar Thourani VH, Ingram WL, Feliciano DV. Factors affecting success of split-thickness skin grafts in the modern burn unit. J Trauma. 2003;54(3):562–8.Article PubMed Google Scholar Halim AS, Khoo TL, Mohd Yussof SJ. Biologic and synthetic skin substitutes: an overview. Indian J Plast Surg. 2010;43(Suppl):S23–8.Article PubMed PubMed Central Google Scholar Lucich EA, Rendon JL, Valerio IL. Advances in addressing full-thickness skin defects: a review of dermal and epidermal substitutes. Regen Med. 2018;13(4):443–56. ⓪ CAS PubMed Google Scholar Greenwood JE, Clausen J, Kavanagh S. Experience with biobrane: uses and caveats for success. Eplasty. 2009;9:e25.PubMed PubMed Central Google Scholar Supp DM, Boyce ST. Engineered skin substitutes: practices and potentials. Clin Dermatol. 2005;23(4):403–12.Article PubMed Google Scholar Alrubaiy L, Al-Rubaiy KK. Skin substitutes: a brief review of types and clinical applications. Oman Med J. 2009;24(1):4–6.PubMed PubMed Central Google Scholar Shores JT, Gabriel A, Gupta S. Skin substitutes and alternatives: a review. Adv Skin Wound Care. 2007;20(9 Pt 1):493–508; quiz 509–510.Article PubMed Google Scholar

Article Skin grafting involves covering an area of missing skin with healthy skin tissue harvested from another part of the body. The aim of this clinical overview is to give a short introduction to the procedure. Burns, scalds, trauma and cancer surgery can result in major defects in the skin that must be covered and reconstructed. The reconstructive ladder is a well-known principle within reconstructive surgery that arranges the various treatment strategies for skin defects in order of increasing complexity (Figure 1) (1). The idea behind this principle is to choose the most efficient treatment option, i.e. the best possible result with the simplest procedure. Examples of strategies are healing by secondary intention, vacuum-assisted closure therapy, primary closure, skin grafting, tissue expansion and flap surgery. Primary closure (2), tissue expansion (3) and flap surgery (4, 5) have been discussed in the Journal of the Norwegian Medical Association before. This clinical overview only deals with skin grafting. The article is based on plastic surgery textbooks, selected journal articles and clinical experience. Full-thickness skin grafting The skin is traditionally divided into three layers: epidermis, dermis and hypodermis/subcutis. Based on this, skin grafts can be classified as either full-thickness or split-thickness (Figure 2) (6). Full-thickness skin grafts consist of both the epidermis and dermis. This type of graft is typically used in the reconstruction of tissue defects of the face and hands, but in exceptional cases also in other parts of the body in patients with poor skin quality, or in instances where harvesting of split-thickness skin may cause wound healing problems at the donor surface. Traditionally, full-thickness skin grafts are harvested with a fusiform incision with primary closure of the donor site, which limits the amount of skin that can be harvested with this technique. Common donor sites for full-thickness skin grafts are areas of the body that often have excess skin: inner arm and thigh, supraclavicular area, groin, lower abdomen, preauricular and postauricular areas, or eyelid. Split-thickness skin grafting Split-thickness skin grafts consist of the epidermis and a portion of the dermis and are harvested with an instrument called a dermatome (Figure 3a). The grafts are usually 0.15–0.30 mm thick. By passing the graft through a device that makes multiple cuts in the graft (meshing) (Figure 3b), the split-thickness skin graft can be stretched to cover an area larger than the original donor tissue (Figure 3c). Hence, a larger wound surface area can be covered with split-thickness skin grafts than with full-thickness skin grafts. The usual mesh ratio for split-thickness skin is 1:1.5, but it is possible to use mesh plates that make the graft up to nine times larger. Besides expanding the surface area of the donor tissue, the cuts also allow drainage of wound fluid, which is important for graft take and prevention of complications. The donor site is covered perioperatively with sterile pads soaked in adrenaline and local anaesthetic diluted in saline. Postoperative wound care of the donor site varies, but generally includes the use of Vaseline gauze and moist dressings, various types of foam dressings and dressings containing silver. The donor site will normally heal by secondary intention within about two weeks, depending on the size of the graft harvested. Both full-thickness and split-thickness skin grafts are fixed to healthy skin margins with staples or rapidly absorbable sutures (Figure 3d). Perioperative considerations Prior to grafting, the surgeon performs a careful assessment of the clinical indication, including assessment of the tissue defect and wound bed, donor site and alternatives to skin grafting. In terms of the wound bed, a graft will be dependent on the underlying blood circulation to enable capillary in-growth and adherence. Therefore, skin grafting directly over bone, cartilage and tendons is generally avoided. Nevertheless, skin grafting on fatty tissue, which is also poorly perfused, is considered in burns, but with somewhat poorer graft take as a result. Chronic wounds with poor blood supply would also be unsuitable for direct skin grafting. Moreover, microbiological contamination of the wound bed is undesirable, and bacterial colonisation is common in burns (7). Efforts are made to decontaminate the wound bed prior to covering with the skin graft. Skin grafts involving less than about 1 % of total body surface area are generally performed under local anaesthesia. Larger procedures, for example involving burns, are usually performed under general anaesthesia. Postoperative conditions In the first few hours following grafting, the graft will not have any blood supply and will receive nutrition through passive diffusion from the wound bed. Revascularisation will then commence, typically within 24 to 48 hours after grafting (8). For optimal graft take, movement must be minimised between the graft and the wound bed for the first five to ten postoperative days. A range of measures can be taken for this purpose, for example spraying the dermal side of the graft with tissue adhesive, suturing or stapling the dressing directly over the graft (called a tie-over) and use of negative-pressure dressings that draw out fluid while at the same time pressing the graft and wound bed together (9). The first dressing change, when the dressing that is fixed over the graft by sutures or staples is removed, normally takes place five to seven days postoperatively, by a surgeon or the treatment facility where the graft was performed. Removal of the tie-over is performed at an outpatient clinic or on the ward unless other factors (e.g. pain) necessitate general anaesthesia. In procedures involving hair follicles or sweat glands, hair growth and sweat secretion can be expected within two to three months. Moisturising cream is recommended to avoid skin dryness, particularly in the period before secretory function has resumed. As with all scars, use of sunscreen is also recommended during sun exposure, both on the graft area and the donor surface (10). Recovery of sensory function often takes longer, typically a year. However, many people find that skin sensitivity never becomes 'fully normal'. Complications Successful skin grafting depends on multiple factors. Comorbidities increasing the risk of complications include heart failure, diabetes, peripheral vascular disease and poor nutritional status (1). Smoking is associated with graft necrosis (10). Factors related to the wound itself, such as circulation, microbiological contamination and appropriate dressing, are also crucial for graft take (11). Blood and other fluid accumulating between the wound bed and the overlying graft may form a haematoma or seroma, which prevents graft take. Grafting can also be complicated by infection. Preventative measures such as optimal cleansing of the wound bed, meshing and incisions in the graft, vacuum-assisted therapy and appropriate dressing can prevent the aforementioned complications (12). Furthermore, preoperative injection of adrenaline solution into the subdermal fatty layer can reduce donor site bleeding associated with graft harvesting (13). Scar hypertrophy and contraction of the graft are other complications that occasionally occur. Alternatives to skin grafting In case of major injury or poor donor skin availability, commercial skin substitutes or cultured cells can be used as alternatives to skin grafting or as temporary covering prior to grafting at a later date. This applies to highly specific cases and will generally be performed in specialist departments. The interested reader is referred to a review by Debels et al. on this subject (14). Another strategy that has attracted a great deal of interest in recent years is 3D-printing of skin products (15). The advantage is that there is no need to shave donor tissue from the patient. The 'ink' in 3D-bioprinting may be a mixture of growth factors, cultured cells and intercellular substance which can be deposited directly into the tissue defect in a single layer, or in different layers with each layer consisting of different components. It is hoped that further research and development can improve these techniques. Conclusion There is long clinical experience with skin grafting, and it is carried out in most (plastic) surgery departments in Norway. Thorough perioperative assessments and optimisation of conditions to ensure good healing following grafting are crucial for a good result. The main complications are poor graft take, seroma and infection. In the future, it is hoped that dermal substitutes and 3D-bioprinting will contribute to continued development of skin grafting techniques. The article has been peer-reviewed.