RECONSTRUCTIVE DERMATOLOGIC SURGERY

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Reconstructive
Dermatologic Surgery

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Dedicated to

My wife, Jeannie, and my son, Max, for their support, patience, and love. My sincere gratitude also goes to my mother Shu Hua, and my father Shii Sheng, for their unwavering willingness to sacrifice their own dreams to provide a better future for my sister Grace, my brother Kevin, and myself.

My mentors, colleagues, mentees, staff, and patients who made it all possible for me to have a fulfilling academic career.

S Brian Jiang

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Preface

Reconstructive Dermatologic Surgery offers a practical and comprehensive guide to dermatologic surgical reconstruction. The focus of the textbook is geared towards surgical repair of Mohs Micrographic Surgery defects beginning with basic surgical techniques and covering the breadth and depth of extensive repair options through an image-rich format. The chapters are broken down into fundamentals of reconstruction by flap types and by anatomic region to allow for a quick reference to specific anatomic defects. Other topics covered in the textbook include designing a surgical suite and postoperative management. This practical resource is meant for residents, fellows and experienced surgeons across a wide-range of surgical specialties who want to hone their surgical skills. We have included authors from various academic centers around the United States to represent a cross-section of different philosophies and approaches to surgical repairs culminating many years of experience in the surgical management of skin cancers.

S Brian Jiang
Arisa E Ortiz

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CHAPTER

12 Skin, Cartilage, and Composite Grafts

Syril Keena T Que, Omar A Ibrahimi

INTRODUCTION

Skin and cartilage grafting is a useful reconstructive modality for the dermatologic surgeon. Sites in dermatologic surgery where grafts are most commonly used include the nasal tip and ala, ears, medial canthus, digits, and extremities. Generally, grafts are considered in areas where it is not possible to do a primary closure without significant distortion, where healing by secondary intention is likely to lead to poor cosmesis, when a patient cannot tolerate a larger reconstructive procedure, or for defects where the use of a flap is likely to violate aesthetic units and result in pincushioning or when a sufficient tissue reservoir does not exist.

Grafts can be classified according to the source of the donor tissue. An autograft is taken from a donor site on an individual and placed at a recipient site on the same individual. A homograft is obtained from an individual and transplanted to another individual of the same species. A xenograft is a graft transplanted between species (i.e. from a pig to a human). The nomenclature of grafts also depends on the thickness of skin and subcutaneous tissue involved. These graft types include full-thickness, split-thickness, cartilage, and composite grafts.

A full-thickness skin graft includes the epidermis, dermis, and adnexal structures, while a split-thickness skin graft contains epidermis and varying amounts of dermis. The advantage of using a full-thickness skin graft over a split-thickness graft is the more complete filling of surgical defects, the improved color and texture match, and the lower risk of contracture. The benefits of using a split-thickness graft are the lower rate of graft failure and the ability to fill in larger defects, including defects >5 cm. Some argue that split-thickness skin grafts allow for better monitoring for tumor recurrence as well.

Cartilage grafts are useful when significant amounts of supporting tissue and/or cartilage are removed during an excision, resulting in potential structural and functional deficits. Replacement of cartilage can be achieved by grafting cartilage separately and subsequently covering it with a cutaneous graft or flap or by grafting a composite graft, which consists of both cartilage and overlying skin. A composite graft has a higher rate of graft failure than a cartilage graft alone.

Generally, a graft undergoes several stages after it is attached to the wound bed: (i) imbibition, where fibrin and granulation tissue are deposited to underlying tissues and the graft absorbs nutrients passively through the wound bed,[1] (ii) inosculation, which involves the formation of anastomoses between graft vessels and existing vessels,[2] and (iii) neovascularization, defined as the formation of new vessels. Graft survival is dependent on these three stages. Graft necrosis may result when a hematoma or seroma forms because any fluid accumulation between the graft and wound bed impairs the processes of imbibition and inosculation.

GRAFT TYPES

Full-Thickness Skin Grafts

Indications and Contraindications

Indications for using a full-thickness skin graft (Figs. 12.1A to C) include the following: when primary closure could cause significant distortion, when secondary intention healing is likely to lead to poor cosmesis, when patients cannot tolerate larger flaps, or when the use of a flap may not give a superior cosmetic result, i.e. wide, superficial defects on the ear or bald scalp. Full-thickness skin grafts are also considered when margin control is difficult or

Figs. 12.1A to C: Full-thickness skin graft. (A) Appearance of defect on left nasal ala following basal cell carcinoma tumor extirpation with Mohs surgery. (B) Full-thickness graft from left conchal bowl immediately postreconstruction. (C) Appearance of surgical site 3 months post-Mohs and reconstructive surgery.

when dealing with aggressive cancers, as grafts make it easier to monitor for skin cancer recurrence.

The major contraindication for using full-thickness skin grafts is the presence of avascular tissue, i.e. areas of exposed bone or cartilage with no periosteum or perichondrium. Additional preparation (i.e. fenestrating cartilage on the ear) or other reconstructive modalities should be considered because these sites will not support full-thickness skin grafts.

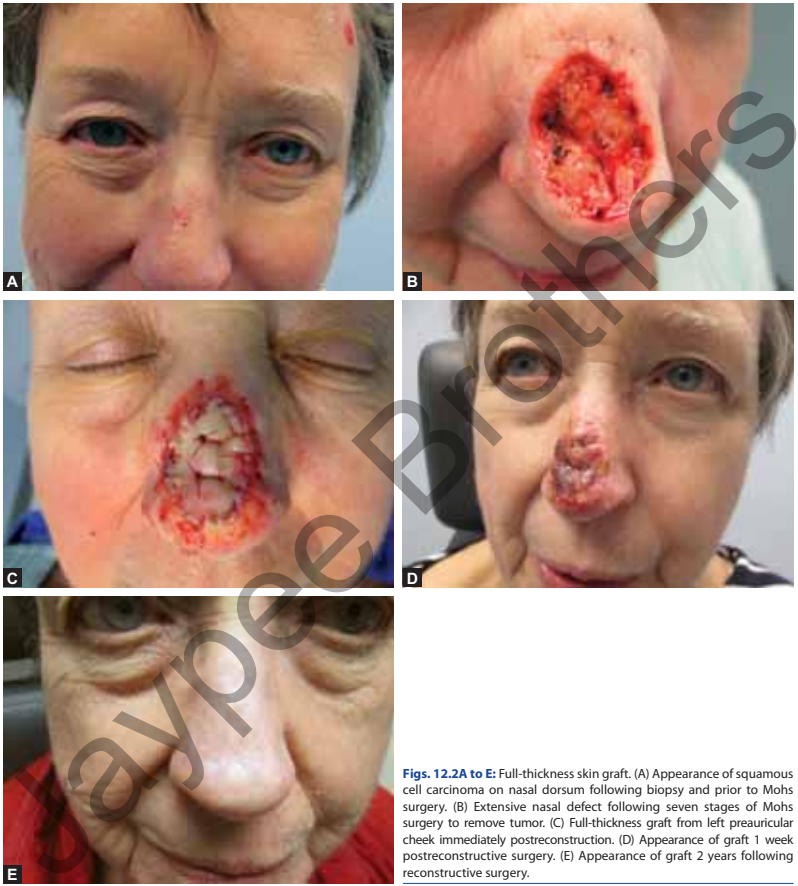
Preoperative History and Donor Site Considerations

Preoperative evaluation before the placement of a full-thickness skin graft should include assessment of bleeding tendencies, use of anticoagulants, history of hypertension, diabetes mellitus, smoking history, and other factors that may decrease the likelihood of graft survival. Smoking is one factor that plays a significant role in graft loss. Nicotine impairs healing through vasoconstriction.

The method for harvesting full-thickness skin grafts begins with the selection of an appropriate donor site. Selection of a donor site should take into consideration the color, texture, thickness, sun exposure, and sebaceous qualities of the skin around the surgical defect. For a defect on the nasal ala (Figs. 12.1A to C) and tip, where skin is thick, the conchal bowl, forehead, or preauricular skin (Figs. 12.2A to E) are ideal donor sites.[3] Postauricular skin, which is thinner and less exposed to the sun, might be considered as a donor site for defects of the nasal sidewall.

Description of Technique

Harvesting and placing a full-thickness skin graft over a surgical defect begins by making a template of the defect on gauze, Telfa (Covidien, Mansfield, MA, USA) or



Figs. 12.2A to E: Full-thickness skin graft. (A) Appearance of squamous cell carcinoma on nasal dorsum following biopsy and prior to Mohs surgery. (B) Extensive nasal defect following seven stages of Mohs surgery to remove tumor. (C) Full-thickness graft from left preauricular cheek immediately postreconstruction. (D) Appearance of graft 1 week postreconstructive surgery. (E) Appearance of graft 2 years following reconstructive surgery.

aluminum foil. This template is applied to the donor site and is used to outline the area that will be removed. The graft should be 3–5% larger in size than the template to allow for natural contraction of the graft after it has been harvested. Local anesthesia is injected into the donor and recipient sites, and the sites are prepped with chlo-

rhexidine and draped in a sterile manner. The donor tissue is excised and immediately placed in a Petri dish containing normal saline, where excess adipose tissue is trimmed using curved Iris or Supercut scissors. Trimming excess adipose tissue enhances nutrient and oxygen delivery during the processes of imbibition and inosculation. Removal of any cartilage not needed for structural support also increases the chances of graft survival, although meticulous surgical technique should allow for harvesting a full thickness skin graft without any underlying cartilage.[4]

At this stage, the graft is ready to be attached to the defect. A series of simple interrupted sutures or a running suture technique can be used to anchor the graft in place. Basting sutures that anchor the graft to the wound bed are not necessary but are generally recommended if grafts are large or placed over convex surfaces.[5] Any basting sutures should be placed while at least half of the graft is still free so that hemostasis can be achieved before the entire perimeter of the graft has been adhered to the wound bed.[6] After all perimeter sutures are placed, a petrolatum ointment is applied, and a bolster dressing can be applied to protect and immobilize the graft. A bolster dressing typically consists of a nonadherent layer such as Xeroform (Johnson & Johnson Medical, Arlington, TX, USA) or Adaptic (Johnson & Johnson Medical, Arlington, TX, USA) followed by gauze, foam, or cotton balls as a top layer. Three to four sutures at opposite ends can be tied over the dressing or a strong, elastic, adhesive tape such as Hypafix (Smith & Nephew, London, UK) can be used to secure the bandage. The bolster dressing serves to provide constant pressure, which ensures complete adherence between the graft and wound bed and increases the chance of graft survival. The bolster dressing is especially useful for grafts on the extremities or areas more likely to get traumatized. Bolster dressings and any non-absorbable sutures should be removed after 1 week.

Grafts may also be attached using cyanoacrylate tissue adhesives, such as 2-octyl cyanoacrylate.[7] Some advantages of tissue adhesives over suturing is faster closure time and ability of the tissue adhesive to act as a water and antimicrobial barrier. The cyanoacrylate tissue adhesive also enhances graft survival by helping to maintain close contact between the graft and the wound bed.

Postoperative Care and Complications

The most common short-term complications for full-thickness skin grafts include graft hypertrophy, partial graft failure, and graft contraction, which occurred in ~11% of full-thickness grafts according to the Australian Mohs database, which records all patients treated with Mohs surgery in Australia and monitored by the Skin and Cancer Foundation between 1993 and 2002.[8]

Fig. 12.3: Necrosis of full-thickness skin graft. Black appearance of graft 1 week postprocedure indicates graft failure.

Transient Graft Hypertrophy Following a Full-thickness Skin Graft

Grafts have been reported to undergo hypertrophy weeks after surgery, even in the absence of hematoma or fluid accumulation. Treatment modalities to correct for graft hypertrophy include silicone gel sheets, topical and intralesional corticosteroids, dermabrasion, and CO_2 laser resurfacing. Spot dermabrasion can be used as early as 6 weeks, but it is advisable to wait until the graft has significantly matured for 3–4 months, in case the hypertrophy is temporary. In one case report, a patient who developed hypertrophy of her full-thickness skin graft experienced spontaneous resolution of the graft thickness with gentle manual massage alone.[9]

Graft Necrosis

A full-thickness skin graft is ideally expected to be light pink in color when the bolster dressing is removed 1 week after the surgery. A white graft indicates the lack of revascularization and signals that the graft will fail. A black graft signifies necrosis (Fig. 12.3). There can be a range of normal color changes to the graft, ranging from pink or red to darker blue or purple. Skin graft necrosis is more likely to occur in men than in women.[10] This may be because men have a greater sebaceous gland density in

the nose, which affects the process of skin graft vascularization, either by promoting a larger number of microorganisms that affect wound healing or by affecting wound edge apposition.

Indications for Postoperative Antibiotics

Some indications for postoperative antibiotics include delayed grafts, a lengthy surgery >6 hours, and surgical sites close to mouth or nostrils. Full-thickness skin grafts on the nose more often become necrotic than grafts on other parts of the face, possibly because bacteria in the nose causes a subclinical wound infection or compromises circulation. A higher rate of graft survival has been reported in patients receiving antibiotics after having a full-thickness skin graft placed on the nose—86% of graft survival was reported with a 3-day course of azithromycin at day 10 versus 36% survival without antibiotics (p = 0.002).[11] Aside from the indications mentioned above, infection of skin grafts is rare and the routine use of prophylactic antibiotics is not recommended. However, many surgeons still prefer to use postoperative antibiotics when performing a full-thickness skin graft (FTSG) includes the epidermis, dermis in locations with high risk for surgical site infection. There is a more in depth discussion of antibiotic use for cutaneous surgery in our preoperative considerations chapter.

Hematoma and Seroma

The development of hematomas or seromas can affect graft survival and are prevented with the use of meticulous hemostasis, in addition to basting sutures and/or a bolster dressing, both of which maintain contact between the wound bed and the graft. Additionally, patients are advised to avoid strenuous activity for at least 2 weeks postoperatively, as this may raise their blood pressure. Medications that increase the risk of bleeding that are not medically necessary can also be avoided prior to surgery. For all medically necessary antithrombotic therapy, the evidence in the literature suggests the continuation of these medications when undergoing cutaneous surgery. For patients on warfarin, screening the international normalized ratio to maintain the therapeutic range of 2–3.5 one week prior to surgery is recommended.[12-14] There is a more detailed discussion of antithrombotic use during cutaneous surgery in our preoperative considerations chapter.

Cosmetic Concerns

To optimize the cosmetic results of a graft, dermabrasion or laser resurfacing may be considered 6 weeks to 6 months postoperatively.[15] Any evidence of graft hyperpigmentation can be treated with topical hydroquinone and/or tretinoin.

Variations of the Technique Delayed Full-thickness skin grafts

Delay of skin graft placement by more than one day was correlated with subsequent skin graft success (p = 0.015).[10] Delayed skin grafting is an option for patients undergoing Mohs surgery who are not candidates for an immediate full-thickness skin graft (i.e. the graft bed is a large avascular surface or the defect is too deep to be covered by a full-thickness graft).[16] It is also useful for patients who lack an appropriate donor site. Delaying placement of a full-thickness skin graft to 12–14 days after Mohs micrographic surgery gives the surgeon time to determine which patients can instead be allowed to heal by secondary intention. Delaying skin graft placement also allows for the formation of granulation tissue in the wound base, which helps to fill in some of the defect and guarantees adequate vascularity.[17] It additionally prevents the incidence of hematoma and seroma formation, which could complicate graft survival. Studies have shown that there is no difference in texture irregularity, hypopigmentation, hyperpigmentation, or erythema when the placement of skin grafts is delayed rather than immediate.[18]

Prior to placement of a delayed full-thickness skin graft, the surgical defect can be cleansed daily with dilute acetic acid at a ratio of 3 tablespoons of vinegar to 1 quart of clean tap water. It is otherwise covered for 1–3 weeks and allowed to granulate. Since the delay between tumor excision and reconstruction can slightly increase the risk of infection, it may be beneficial to start the patient on preoperative and/or postoperative antibiotics, specifically antibiotics that cover *Staphylococcus aureus* and *Streptococcus pyogenes*. There is limited evidence for the use of prophylactic antibiotics in delayed full-thickness skin grafts, but many surgeons prefer to use antibiotics postoperatively for procedures on certain anatomic sites, i.e. locations with high risk for surgical infection. On the day of surgery, the wound is scrubbed with chlorhexidine, peripheral margins are cleaned, and any eschar is removed. The full-thickness skin graft is then placed as mentioned above.

Cartilage, Dermal Grafts, Subcutaneous Hinge Flap, Myocutaneous Hinge Flap, and Porcine Xenografts

If immediate reconstruction is preferred for a deep defect, cartilage or dermal grafts can be used as tissue filler prior to the placement of a full-thickness skin graft.[19-22] Another option is to use a subcutaneous or myocutaneous hinge flap to occupy the base of the defect with well-vascularized tissue, with the remaining defect covered by a

full-thickness skin graft.[23,24] For defects involving the nasal dorsum, sidewall, supratip, or ala, a myocutaneous hinge flap can be performed by outlining and excising a standing cone immediately superior to the defect. After the skin is removed, underlying muscle is incised, elevated above the periosteum, and turned downward into the defect in a "hinge" motion, thereby providing a rich vascular bed for the graft. The previously excised standing cone is then used to fill in the defect. The subcutaneous hinge flap is created in a similar manner and is useful for nasal defects extending to the cheek. This flap is performed by transposing subcutaneous tissue from the cheek in a "hinge" motion toward the defect, followed by a cheek advancement flap. Any remaining defect can be covered using a full-thickness skin graft.

Porcine xenografts and other synthetic grafts are also options for promoting granulation and enhancing autograft survival. They are sometimes used temporarily in situations where delayed repairs are being considered and help to protect and preserve vital structures such as bone, cartilage, tendons, and nerves prior to the placement of the autograft.[25] Synthetic grafts are usually replaced every 7–10 days until an autograft is placed.[26,27] Porcine grafts are obtained from domestic swine and harvested with a dermatome as split-thickness skin grafts of 0.01 inch thickness. The porcine xenograft is usually replaced every 7–14 days until an autograft is ready to be placed.

Purse-string Sutures

The purse-string suture is a subcuticular stitch placed around the periphery of a circular or oval defect to advance the skin from the entire periphery and to reduce the size of the defect.[28] The remaining defect can then be covered with a full-thickness skin graft. This technique can help minimize large defects so that they can be covered with relatively smaller full-thickness grafts.

Burow's Graft

A Burow's graft uses the skin adjacent to a defect as the donor site and therefore provides a superior tissue and color match compared to grafts from other locations. To obtain a Burow's graft, tissue removed from the dog-ear repair of a partial primary closure is defatted, trimmed, and sutured into the residual defect. For large defects on the nasal sidewall, ala, or cheek, one option is to use a cheek advancement flap in combination with a melolabial Burow's graft.[29] This technique is very useful and can be utilized in many anatomical locations with limited tissue mobility. The editors frequently use Burow's grafts on the nose, scalp, hands, and feet.

Hair-bearing Grafts

Hair-bearing grafts can be performed on locations like the eyebrows, with some important considerations.[30] When performing a hair-bearing graft, hair density and orientation of hair follicles must match that of the recipient site. In contrast to full-thickness skin grafts on nonhair bearing skin, hair-bearing grafts should be defatted minimally, with only the fat between hair bulbs removed, if possible. Care must be taken to preserve the hair follicles.

Split-Thickness Skin Grafts

Indications and Contraindications

Much of the literature for split-thickness skin grafts comes from burn patients or from patients with chronic ulcers. Split-thickness skin grafts tend to be used less often by Mohs surgeons due to the less than ideal cosmesis resulting from split-thickness skin grafts. The main advantages of split-thickness skin grafts are the ability to cover larger surface areas and the higher likelihood of graft survival. Because they are semitransparent, they are also useful for excised tumors that are aggressive and have a possibility of recurring. One of the main disadvantages is poor cosmesis, as the color and texture may not necessarily match that of the recipient site. A split thickness skin graft is more likely to experience contraction and may also result in a depressed appearance because of its inability to completely fill a deep defect. These types of grafts should be used with caution near free margins, including the eyes, oral commissure, and nasal alae. Split-thickness skin grafts are most commonly used in Mohs repair for large defects on the scalp or legs.[31,32]

Donor Site Considerations

The most common donor sites for split-thickness skin grafts are the upper thighs, lateral hips, inner aspect of upper arms, low back, and abdomen.[5] These are all locations where a large area of skin can be removed but where the area can remain hidden beneath clothing.

Description of Technique

The donor site is prepped with chlorhexidine and local anesthesia and draped in a sterile fashion. After a template is made to ensure a graft of the correct size, the split-thickness skin graft is obtained by one of several methods: (i) by pinch graft, which involves using forceps, a skin hook,

needle tip or suction to elevate the skin and a scalpel or scissors to shave off the skin,[33] (ii) by using a Weck blade, which can be placed flat on taut skin and advanced to harvest a split-thickness skin graft of uniform size, or (iii) by using a powered dermatome to cut grafts of a fixed diameter and thickness. Once obtained, the graft is transferred to a sterile saline-containing Petri dish or directly to the recipient site. The donor site is temporarily covered with gauze soaked in 1% lidocaine with 1:100,000 epinephrine. At this point, a mechanical meshing device can be used to create fenestrations within the graft, if desired. The presence of fenestrations prevents blood and serum from accumulating under the graft, therefore increasing the likelihood of graft survival. Fenestrations additionally help to expand the surface area of split-thickness skin grafts by 24–35% and are useful for defects >8 cm in diameter.[5]

After harvesting and preparing the split-thickness skin graft, it can be attached to the recipient site using a combination of basting sutures centrally and running or interrupted sutures 5–6 mm apart peripherally. The edges do not require careful approximation because graft skin that does not make direct contact with the wound bed will naturally slough off. After sutures are placed, a bolster or pressure dressing may be applied to maintain adequate contact between the graft and the wound bed.

Additionally, the donor site is treated as an abrasion and covered with petrolatum gauze or another moist occlusive dressing. To help reduce pain at the donor site, one might consider using a dressing soaked in lidocaine or other anesthetic.[34] A pressure dressing over the donor site, in particular a dressing containing calcium alginate,[35] can be used to reduce the amount of serum exudate since there typically is a significant amount of drainage over the donor site for the first 48 hours.

Postoperative Care and Complications

Graft Failure

Graft failure can result from the development of hematoma or seroma. Bolster dressings help prevent this complication. The other option is to create fenestrations within the graft that allow the blood and other fluid to leak out instead of accumulating under the graft.

Cosmetic Concerns

Color and texture mismatch is a predictable complication of a split-thickness skin graft. Split-thickness skin grafts often remain erythematous and become hyper- or hypopigmented compared to surrounding skin. Patients should be advised to minimize sun exposure and to use sunscreens. Additionally, the absence of adnexal structures often predisposes the graft site to xerosis and scaling. Contraction of the graft is another major concern, and contraction of facial grafts can result in alar retraction, ectropion, helical rim distortion, and other facial deformities.[36] It is best to avoid split-thickness skin grafts in these regions.

Variations of Technique

Intermediate-thickness Graft

To overcome the disadvantages of either full-thickness or split-thickness skin graft, some surgeons advocate the use of an intermediate-thickness graft (Figs. 12.4A to D), which is obtained by using a No. 15 or No. 10 blade to score the edges of skin elevated by tumescent anesthesia, with a resultant depth <1 mm.[37] In comparison, full-thickness skin grafts tend to be 1–4 mm deep and split-thickness skin grafts tend to be 0.5–1 mm deep.

Combined Flap and Graft Technique for Large Defects on the Scalp

For large defects on the scalp with exposed bone, it is difficult to use a split-thickness graft alone because of the low rate of graft survival. In this case, it may be possible to combine a rotation flap with a split-thickness skin graft to achieve better results. For this technique, a flap is created adjacent to the primary defect, with a width equal to that of the primary defect. The flap is incised to the deep dermis, leaving the galea and periosteum intact, and rotated into the primary defect. The flap is closed in a layered manner and the donor site is closed with a split-thickness skin graft.[38]

Cartilage Grafts

Indications, Contraindications and Donor Site Considerations

Cartilage grafts are used for deep defects of the nasal alae (Figs. 12.5A to C) or sidewall, where there is loss of alar shape, loss of nasal valve function, or the risk of rim retraction.[39] The nasal sidewall and dorsum are sections of the nose less likely to require cartilage grafting.[40]

Free cartilage that is used to repair a defect on the nose, ear, or lower eyelid can be obtained from the nasal septum, ear, or rib. Cartilage obtained from the ear, which is classified as elastic cartilage, has excellent pliability

Figs. 12.4A to D: Intermediate-thickness skin graft. (A) Appearance of biopsy-proven squamous cell carcinoma on the left dorsal foot prior to Mohs surgery. (B) Defect following tumor extirpation with Mohs surgery. (C) Appearance following placement of intermediate-thickness skin graft. (D) Appearance of graft site 3 months following procedure.

compared to the other types of cartilage and is the most frequently used donor site for free cartilage in dermatologic surgery.[41,42] The antihelix is a donor site that is readily accessible and easily repaired. Other reasons to choose this site over the concha or the helix include the fact that the cartilage in this area is more pliable, has greater memory than other types of cartilage, and is less brittle. Nasal septum and costal cartilage is less flexible but has greater rigidity and strength. Taking cartilage from a rib is performed infrequently in Mohs surgery, however, as it may result in complications that include iatrogenic pneumothorax, chest wall scarring, and postoperative pain.[43] Cartilage that is actively inflamed due to infection, trauma, or other disorders (collagen vascular diseases, rheumatic disease, immunologic disorders) should not be harvested.[44]

Description of Technique

Nasal alae

A cartilage graft, which is 4–6 mm longer than the surgical defect, is obtained, typically from the ear. After injecting local anesthesia and prepping the donor site on the ear with chlorhexidine, the auricular skin is incised and skin flaps are raised to expose the underlying cartilage. Blunt dissection is used to free the inferior portion of the cartilage from underlying soft tissue and hemostasis is obtained from the donor site as soon as the cartilage is removed. Subdermal pockets are created on the anterior and lateral aspects of the defect, and the cartilage graft is inserted into these pockets to prevent migration of the cartilage. The cartilage graft can then be secured with tie-over sutures, which are first inserted at the base of the defect

Figs. 12.5A to C: Free cartilage grafting to repair a deep nasal ala defect. (A) Appearance of defect on right nasal ala near free margin following tumor extirpation with Mohs surgery. (B) Placement of cartilage graft to wound bed. (C) Appearance of graft site at 12 weeks post-Mohs and reconstructive surgery.
Courtesy: Daniel Eisen MD, Sacramento, CA, USA.

and tied over the top of the cartilage without ever penetrating the cartilage.

Cartilage grafts can be combined with flaps or full-thickness skin grafts.[21] Another option for preventing alar collapse is to use a cartilage graft followed by second intention healing.[22] A dressing composed of nonstick products such as Adaptic (Johnson & Johnson Medical, Arlington, TX, USA) or Xeroform (Johnson & Johnson Medical, Arlington, TX, USA) can be used to cover the area.

Nasal Tip

Nasal tip revision can be achieved with the use of a "tripod" graft.[45] The nasal tip is marked, ear cartilage grafts are harvested from the concha, and the grafts are sculpted and molded to have lateral and medial crura as well as a shield graft in the center. The whole graft is then inserted via endonasal or external approach and inserted into pockets made in the nose. The graft is then sutured into the lower lateral cartilage of the nose and the anterior skin with 5-0 polyglactin sutures. The conchal bowl donor site can be closed or allowed to heal by secondary intention.[46] Another option for reconstructing the nasal tip is to use a septal extension graft, using autologous septal cartilage as the donor material for the graft.[47]

Ear

Partial defects of the helix can be repaired in a single stage using a postauricular advancement flap combined with an ipsilateral conchal cartilage graft.[48] Alternatively, the defect can also be repaired with a staged interpolation flap from the neck/scalp combined with antihelical or conchal cartilage graft.

Postoperative Care and Complications

Ice packs can be applied to the grafted area postoperatively to minimize graft edema. Oral antibiotics are often used for surgery around the nose and ear because of the high bacterial colonization in this area. The ear is prone to infection with *Pseudomonas*, which can be prevented with the use of gentamicin ointment or oral fluoroquinolones.

Aside from infection, other complications associated with cartilage grafts include necrosis, contraction, and textural changes. Contraction and textural changes can be addressed by using dermabrasion or laser resurfacing 6 weeks to 6 months postoperatively.

Composite Grafts

Indications, Contraindications, and Donor Site Considerations

A composite graft is a modified full-thickness skin graft with more than one tissue component, with cartilage for the most part being the additional component. Composite grafts from the ear have been used for full-thickness defects of the lower 1/3 of the nose—to reconstruct the nasal tip and to repair alar retraction as well as septal perforation. The ear helix is most often used as a donor site for alar reconstruction because its curved contour is similar to the curvature of the alar rim. The concha of the ear is useful as a donor site for even deeper nasal defects because of the increased bulk of the concha. Composite grafts not only provide structural support but additionally replace missing skin.

A major limitation to the use of composite grafts is the lower rate of graft survival. Cartilage itself is avascular and relies on passive diffusion of oxygen and nutrients from adjacent tissue. Composite grafts should be limited to a diameter of 1–2 cm to keep all points of the graft within proximity of a vascular source.[49] Grafts larger than this are at risk for central necrosis. To reduce the risk of necrosis, perforations can be created through a large piece of cartilage to allow granulation tissue to penetrate and provide nutrition to the cartilage.

Description of Technique

After donor and recipient sites are anesthetized with local anesthesia and cleaned with chlorhexidine, the defect is measured and a template made. A tongue-in-groove technique is usually implemented to increase the stability of the graft and its chance for survival. To carry out this technique, two cartilaginous wings are marked out and removed from the donor site. These wings are inserted into pockets created on both sides of the defect. This technique ensures that the graft stays within the defect. The skin overlying the graft is then sutured using two layers, often using an absorbable suture for the deeper layer followed by a nonabsorbable suture. The cartilage itself does not need to be sutured.

The donor site may be closed by primary repair or with the aid of an advancement, transposition, or rotation flap if the donor is the helical crus or rim. The concha, if used as the donor site, is often allowed to heal by second intention.

Postoperative Care and Possible Complications

Ice packs can be applied to the grafted area postoperatively to minimize graft edema. Oral antibiotics are often used because of the high bacterial colonization around the nose.

Ways to Improve Outcomes of Composite Graft

One of the deterrents to using composite grafts is the low rate of graft survival. Corticosteroids,[50] hyperbaric oxygen therapy,[51,52] and postoperative cooling[53] are methods that have been documented to increase the survival of composite grafts. In one study involving an auricular composite graft, preoperative steroids were administered 1 hour before surgery and postoperatively for 3 days. With this regimen, graft survival increased from 23% to 71%. The hypothesized mechanism for increased survival with corticosteroids involves cell membrane stabilization, inhibition of phospholipase and inflammatory mediators, stimulation of gluconeogenesis, and reduction of lactic acid levels.[54]

SUMMARY

Skin and cartilage grafting is a safe and effective closure technique for dermatologic surgery. Essential to success of grafts is an understanding of the indications, techniques, appropriate donor sites, and possible complications. Grafts can be used alone or in combination with flaps and other reconstructive techniques to improve cosmesis and functional outcome. Attention to hemostasis and the use of bolster dressings can help to prevent

graft failure by decreasing the development of hematoma and seroma formation. Prophylactic antibiotics can be considered for sites more likely to get infected and for cases when there is a 1–3 week delay between tumor excision and surgical reconstruction. With careful planning and attention to detail, surgical reconstruction with cutaneous and cartilage grafts can have a successful outcome.

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