Soft Tissue Reconstruction of Parotidectomy Defect

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KEYWORDS

• Parotidectomy • Reconstruction • Fat graft • Alloderm • Frey syndrome • Free flap

KEY POINTS

- Parotidectomy creates a soft tissue defect for which reconstruction will improve both facial contour and patient satisfaction.
- Postoperative Frey syndrome (gustatory sweating) can be prevented with soft tissue reconstruction by creating a barrier to aberrant reinnervation of the cheek skin.
- Acellular dermis, autologous fat transfer with/without dermis, and local/regional flaps are used for reconstruction for most defects of the parotid bed.
- For extensive composite large volume or surface area defects, consider free tissue transfer.

INTRODUCTION

Surgical resection of parotid tumors leads to a loss in lateral facial volume, resulting in a noticeable facial deformity with asymmetry. This defect can vary from a small posterior mandibular depression to significant facial concavity. In larger composite defects, the loss of volume may cause inferior displacement and medial rotation of the auricle. In a study of patients having undergone parotidectomy, 70% reported a change in appearance, with greater than half reporting a noticeable depression. Furthermore, casual observers notice this contour defect.[1,2] Facial appearance and deformity is a critical aspect affecting quality of life and carries strong social penalties.[3] Multiple studies have shown facial deformities affect attractiveness, self-esteem, academic and occupational satisfaction, income, and quality of life. Because patients may be concerned regarding facial contour after parotidectomy, soft tissue reconstruction can normalize facial appearance and decrease the psychosocial impacts with an overall increase in patient satisfaction.[4,5]

In addition to restoring facial contour, postoperative Frey syndrome can be prevented with soft tissue reconstruction. Frey syndrome, or gustatory sweating, is the postparotidectomy phenomenon where sweating occurs in the skin of the cheek while eating. It is attributed to aberrant reinnervation of parotid parasympathetic nerve fibers

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to the sympathetic fibers in the skin of the cheek. The manifestations can develop years after parotidectomy. Although this phenomenon is reported by 38% of patients, objective testing for Frey syndrome using the minor starch-iodine test shows that up to 96% of patients have this phenomenon after parotidectomy without reconstruction.[6] Surgical reconstruction can prevent Frey syndrome by creating a barrier between the parasympathetic nerves of the parotid bed and the overlying skin. This barrier can be created with local flaps, fat grafts, acellular dermal matrix, or free tissue transfer.

This chapter discusses soft tissue reconstruction options for the parotidectomy defect, including wound healing, Frey syndrome, and tumor surveillance.

SKIN INCISION

The modified Blair incision (Fig. 1A) is widely used as an approach for parotid surgery. A reliable incision camouflages well and provides good exposure of the mastoid tip,

Fig. 1. Skin incisions. (*A*) Modified Blair incision; (*B*) modified facelift incision; (*C*) postauricular incision.

sternocleidomastoid and posterior digastric belly muscles, and the entire parotid gland. Alternatively, the modified facelift incision (Fig. 1B) obviates the neck incision yet provides similar exposure. The modified facelift incision is associated with improved patient satisfaction without an increase in surgical time or complications.[7,8] Caution should be taken in large, anterior tumors, where retrograde dissection of the facial nerve may be required, as this approach may not provide safe exposure.[7] The contraindications described in the literature are tumors with parapharyngeal space extension, recurrent tumors, and arteriovenous malformation.[9]

When a lateral or subtotal temporal bone resection with or without auriculectomy is performed, a postauricular incision [Fig. 1C] is made and carried anteroinferiorly to a neck skin crease.

Reconstructive Options

The volume of removed parotid tissue, the individual patient's facial anatomy, and the patient's desires and values should be considered in choosing a reconstruction technique. Reconstructive options range from primary closure, fat or acellular implants to locoregional flaps, and free tissue transfer. Table 1 summarizes each reconstructive option, with indications, advantages, disadvantages, and surgical tips.

Primary closure is an excellent option for most superficial parotidectomy defects with minimal-to-no skin loss. Wide undermining of the soft tissue deep to the superficial musculoaponeurotic system (SMAS) allows plication and prevents excessive tension on the skin edges. The scalp does not offer the same laxity as the face and neck for assisting in primary closure. However, galeal-releasing incisions made at 1-cm intervals can provide some additional reach while maintaining adequate blood supply to the skin edge. A tension-free repair is especially important in an irradiated field where there is a propensity for wound healing complications.

Acellular dermal implants, such as AlloDerm (LifeCell Corporation, Branchburg, New Jersey) and DermaMatrix (Synthes Corporation, Westchester, Pennsylvania), are off-the-shelf and ready-to-use sheets derived from human cadaveric skin (Fig. 2). Because of their availability, simplicity, and lack of donor site morbidity, acellular dermal implants are a favored reconstructive option for limited parotidectomy defects, despite concerns for these materials increasing the risk of seroma and sialocele.[10] A meta-analysis of 5 clinical controlled studies showed acellular dermal implants significantly reduced the rate of Frey syndrome and salivary leaks without an increase in wound complications.[11] Use of a single sheet allows for the best healing potential, whereas using more than one sheet can increase local wound complications, limiting the degree of contour improvement that can be achieved. Although contour improvement is underreported, a randomized controlled trial of 36 patients undergoing parotidectomy compared acellular dermis with free fat grafting. This study showed free fat reconstruction resulted in better aesthetic outcomes, and lower cost and complication rates,[12] suggesting a limitation in the degree of augmentation attainable with AlloDerm. AlloDerm has been more widely used for parotidectomy reconstruction than DermaMatrix. Limited studies directly comparing these materials are available.[10]

Fat grafting is a popular reconstructive option for parotidectomy defects, given its simplicity, limited donor morbidity, and generally satisfactory outcomes. Fat grafting improves facial symmetry and reduces the incidence of Frey syndrome with better patient satisfaction scores.[4,13–15] This technique has been used in tumors ranging in size from less than 1 to 7 cm and with volumes of up to 70 cm.[3,4,14,16,17] Fat grafts are harvested either as a free graft or as a dermal graft from the abdomen or thigh. Free fat grafts are typically harvested from the periumbilical fat, through a well-hidden incision in the lower half of the umbilicus.[4] Harvesting a single generous piece of abdominal fat

Table 1
Pros and cons of reconstructive option

	Indicated Defect	Advantages	Disadvantages	Surgical Tips
Primary closure	Superficial parotidectomies, tail of parotid	No donor morbidity, short OR time	Only for small defects, wound healing concerns for postradiated wounds	Wide undermining, SMAS plicating, and galeal releasing incisions can help create a tension-free skin closure
Acellular dermal implant	Superficial parotidectomies, tail of parotid	No donor morbidity, short OR time	Cost	Limit to 1 sheet of implant to prevent complications
Fat graft	Superficial parotidectomies, tail of parotid, deep lobe	Low-donor site morbidity, similar consistency to parotid tissue, limited additional operative time	Risk of fat necrosis, infection, and fat reabsorption	Harvest as a single-large piece; overcorrect 10%–30% in anticipation of atrophy, consider a dermal fat graft to reduce atrophy
Local and regional grafts	Deep/total parotidectomy, skin defects	Excellent skin match	Reach can be limited, wound healing concerns in postirradiated fields	Inferiorly based flaps require strategically placed tacking sutures to prevent flap ptosis and dehiscence
Cervicofacial rotational flap	Skin defects	Excellent skin match with low donor site morbidity	Lacks tridimensional volume restoration	Can extend onto chest to gain additional reach
Temporalis muscle/ temporoparietal fascia flap	Superior defects without skin involvement	Short OR time	Donor site defect, limited reach inferiorly, relies on intact superficial temporal vessels, risk to frontal branch of the facial nerve	
Sternomastoid myofacial flap	Tail of parotid, mastoid defects	Minimal morbidity, similar intraoperative exposure, short OR time	Limited reach, added risk to CN XI	Use caution with concurrent neck dissection to prevent loss of blood supply

Pectoralis myofacial or myocutaneous flap	Deep/total parotidectomy, skin defects	Reliable flap with good bulk	Donor site morbidity	Place superiorly placed tacking sutures to prevent ptosis, can add length by dissecting muscle away from pedicle as muscle heads to humerus. Most common with auriculectomies
Latissimus dorsi myofascial or myocutaneous flap	Deep/total parotidectomy, skin defects	Large, thin muscle that can be contoured in defect, low donor site morbidity	Poor skin match, added OR time	Place superiorly placed tacking sutures to prevent ptosis. Most commonly used with auriculectomies
Keystone island flap	Deep/total parotidectomy, skin defects	Excellent skin match with low donor site morbidity	Lacks tridimensional volume restoration	Can be harvested posterosuperiorly based on occipital and posterior auricular perforators, anterioinferiorly based on the facial or submental perforators, or inferiorly based on the transverse cervical or superficial cervical arteries
Submental island flap	Deep/total parotidectomy, skin defects	Excellent skin match with low donor site morbidity	Requires intact facial vessels, limited bulk	Harvest with underlying muscles for added strength and bulk
Supraclavicular island flap	Deep/total parotidectomy, skin defects	Excellent skin match with low donor site morbidity	Can be folded on itself to provide adequate bulk	Most common complication is wound dehiscence, therefore placating deep dermal sutures to ensure a tension-free skin closure is imperative

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Table 1
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	Indicated Defect	Advantages	Disadvantages	Surgical Tips
Free tissue transfer	Total parotidectomy, skin defects, chemo/radiation	Highly vascularized to withstand chemotherapy and radiation	Increased OR time, donor site morbidity	Can be deepithelalized and buried for bulk
Radial forearm	Skin defect, with minimal volume loss	Long pedicle length, reliable, no atrophy	Lacks bulk, donor site morbidity, requires skin graft	Can be deepithelalized and buried for bulk or by including upper forearm subcutaneous fat
Anterolateral thigh	Total parotidectomy, skin defects, chemo/radiation	Excellent bulk that can be modified to accommodate defect and cover vital structures, relatively low morbidity	Short pedicle length, can be too bulky in overweight/obese patients	Ability to include fascia lata for static facial reanimation and/or vastus lateralis with its motor nerve to be grafted for dynamic facial reanimation

Abbreviations: CN, cranial nerve; OR, operating room.

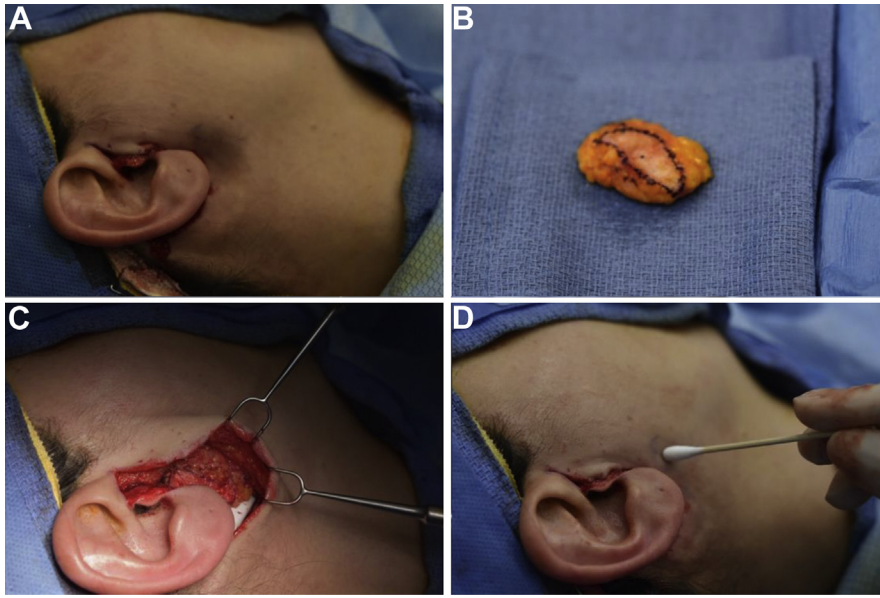

Fig. 2. Dermal fat grafting. (*A*) Retromandibular concavity following parotidectomy; (*B*) dermal fat graft, with deepithelialized dermis outlined in black ink; (*C*) inset of fat graft; (*D*) improvement of contour defect following dermal fat graft.

is preferred over multiple small grafts, as it minimizes graft trauma and devascularization, which may lead to increased graft necrosis and loss. Dermal fat grafts (Fig. 3) theoretically support vascularization of the fat through the subdermal plexus. Dermal fat grafts are harvested from the lower abdomen with a Pfannenstiel incision below the bikini line.[13,18,19] One advantage of a dermal fat graft is that the subdermal tissue can

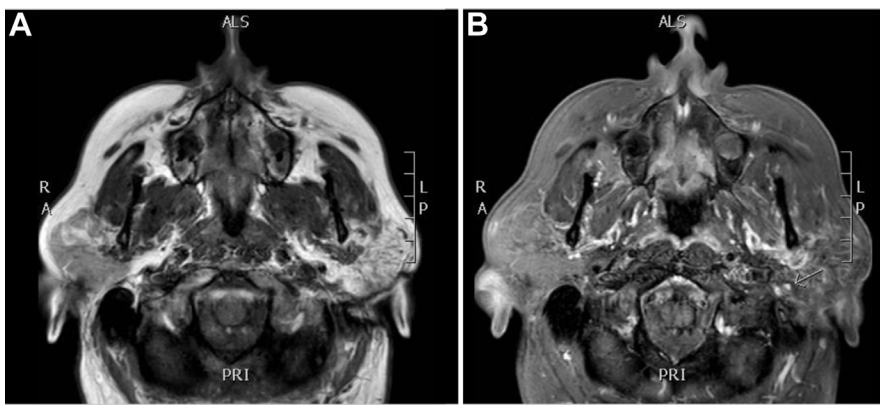

Fig. 3. MRI postparotidectomy with dermal fat graft. Right parotid gland has normal appearance. The left side is post–total parotidectomy with mastoidectomy and dermal fat grafting for recurrent pleomorphic adenoma. (*A*) Axial T1-weighted without contrast; (*B*) axial T1-weighted with fat suppression. Residual disease is easily delineated from surrounding fat graft (*arrow*).

readily be sutured to allow for better positioning of the graft in the defect. High patient and surgeon satisfaction with the reconstructive contour and the donor site have been reported for both techniques of fat grafting[16,17,19,20]; however, studies directly comparing free fat grafts with dermal fat grafts are not available.

Local wound complications after fat graft reconstruction of the parotidectomy are rare. Hematomas, seromas, and wound infections can occur at both the donor and the reconstructive sites.[4,16,17] Fat necrosis can lead to infection, which may improve with antibiotics and local wound care. In more severe cases, fat necrosis may require graft removal. Although rare, epithelial cysts can develop in dermal fat grafts if the epidermis is not carefully removed.[19] The primary downside of fat grafting is variable reabsorption over time. Most surgeons recommend overcorrecting volume loss by 10% to 30%.[4,12,17,18,21] Although the fat graft stabilizes after 6 months, it can be debulked if overcorrection persists.[16] Some investigators speculate using a SMAS flap can improve the viability of the fat graft and decrease resorption[17]; however, studies that objectively measure graft survival over time are lacking. A limited case series reviewed 5 cases of postparotidectomy/fat graft MRI showing stable graft volume 1 to 3 years after implantation.[22]

Historically, there has been concern that reconstructive techniques can obstruct the ability to assess tumor recurrence.[14] However, advanced imaging techniques, computed tomography, MRI, and PET imaging can reliably delineate between normal reconstructive and parotid tissues from tumor recurrence (**Fig. 4**).[4,22] Although some investigators advocate waiting 6 months to 2 years,[19] several have published successful use of fat grafting in parotid malignancy reconstruction.[4,14,17]

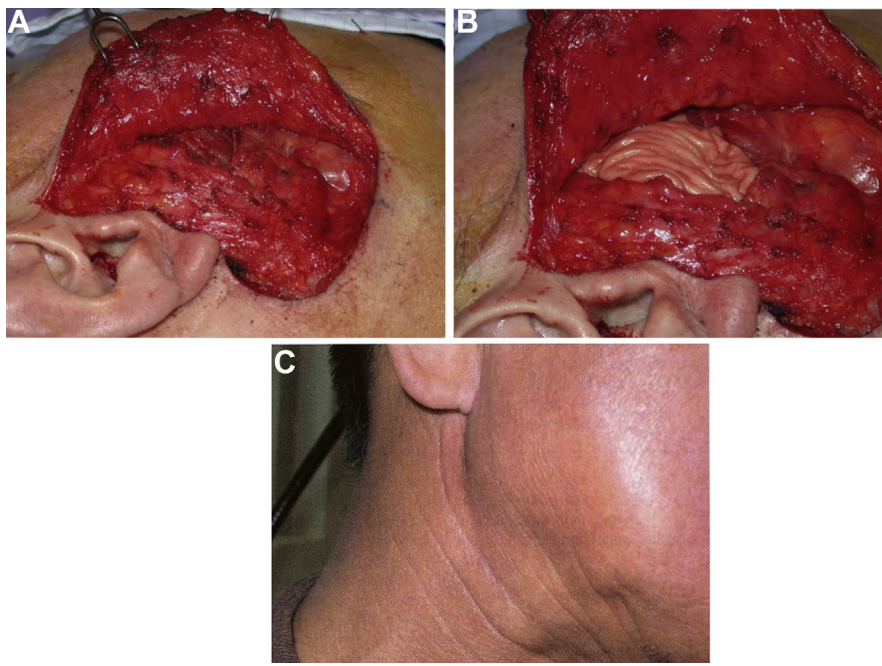

Fig. 4. Alloderm reconstruction. (*A*) Anterior parotid defect; (*B*) alloderm implant into defect, (*C*) postoperative outcome with lack of facial concavity.

Local and Regional Flaps

Local and regional flaps, including myofascial, myocutaneous, and fasciocutaneous flaps, are particularly useful in small to moderate defects. In cases in which skin restoration is necessary, they provide excellent skin color match with lower distant morbidity. They are well vascularized, allowing longer random pattern paddles with smaller pedicles than would be allowed elsewhere in the body. However, they do require incision planning with the ablative surgeons and often lack adequate bulk to provide good facial contour in larger resections. Because of decreased vascularization and fibrosis, rotational flaps are not ideal for moderate to large defects in postirradiated patients.

The SMAS can be used as a local muscle flap to assist in volume replacement and reduction of Frey syndrome incidence. When the SMAS is mobilized, advanced, and plicated posteriorly into the defect, it can be used for volume restoration. However, facial asymmetry may result from significant unilateral plication, necessitating contralateral SMAS rhytidectomy.[23] Because of its thin nature and limited volume, the SMAS may not be available in all cases, especially in superficial tumors where resection of this layer is required for adequate margins.

The *cervicofacial rotation flap* can cover large skin defects with excellent skin color match (Fig. 5). Although it lacks tridimensionality, a concurrent muscle flap, such as temporalis, *sternocleidomastoid (SCM)*, or pectoralis can provide this bulk. The reliability of this flap is compromised by prior radiation, smoking, and sacrifice of the facial artery during resection or neck dissection. Because of its caudally based vascular supply, there is reduced survival and increased dehiscence above the zygoma. However, extension of the incision onto the chest improves reach and vascularity.

By extending the incision into the temporal region, the *temporalis muscle* and/or *temporoparietal fascia (TPF) flap* can be used as a rotational flap to provide soft tissue bulk to the parotid defect. Many argue against the use of the temporalis muscle flap for contour, as it results in temporal "hollowing," thus creating one defect to fix another. In addition, the temporalis muscle flap has limited reach beyond the mastoid.[24] Conversely, the TPF flap is thin, with excellent pliability that can provide coverage of the entire parotid bed, including the retromandibular area.[25] Although it has excellent vascularity, damage to the superficial temporal vessels during parotidectomy can

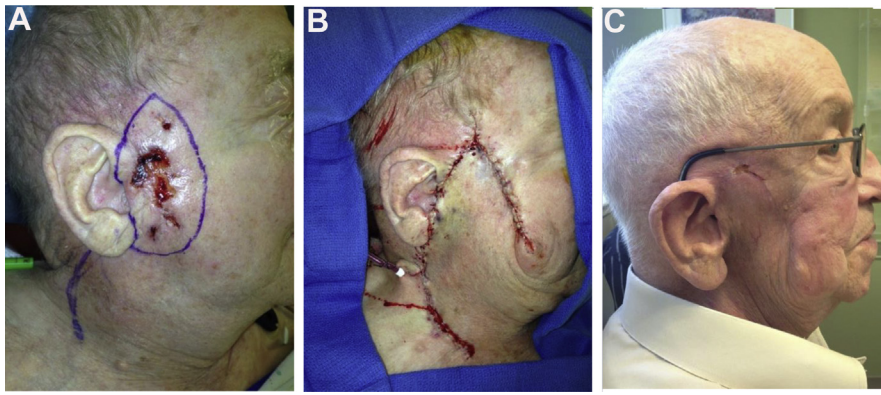

Fig. 5. Cervicofacial rotation flap. (*A*) Cutaneous carcinoma with planned incision drawn; (*B*) postablation with cervicofacial rotation flap; (*C*) six-month follow-up.

compromise the flap viability. Although these flaps have been shown to reduce the incidence of Frey syndrome to 8% from 43%, they have added risk to the frontal branch of the facial nerve, alopecia, hematoma, and increased operative time with less than optimal cosmetic reconstruction.[25]

The *SCM, pectoralis*, and *latissimus muscle flaps* can also be used as local rotational flaps to provide soft tissue restoration for the parotid defect. The SCM flap is harvested through the parotidectomy incision with improved bulk compared with the SMAS flap.[26] Several studies have failed to show improved facial contour after SCM flap,[26,27] whereas other studies have shown some degree of improvement.[28,29] The SCM flap can be harvested superiorly or inferiorly. A superiorly based flap is harvested from the superior third of the SCM, freed from the inferior attachment and rotated 180° around its anterior margin and sutured to the remnant parotid fascia or periosteum of the zygoma. The inferiorly based SCM flap is incised superiorly and anteriorly, then rotated into inferior and midparotid defects. The SCM flap has the potential to create a depression in the donor site and expose the spinal accessory nerve to damage.[28] An additional consideration in patients undergoing concurrent neck dissection is disrupting the tenuous blood supply to the SCM.

The pectoralis and latissimus flaps can be harvested as myocutaneous flaps to provide both bulk and cutaneous reconstruction if needed. These muscle flaps are usually reserved for parotidectomy defects with auriculectomy. The pectoralis flap carries significant donor site morbidity with poor contouring capability. The latissimus can be contoured more easily with the laxity of the posterior back skin allowing nearly all wounds to be closed primarily with minimal morbidity. When using inferiorly based rotational flaps, superior tacking sutures are important to prevent descent and dehiscence.

There has been great success in the use of various island flaps for the reconstruction of the parotidectomy defect. These include the *keystone*, *submental*, and *supraclavicular island flaps* (**Fig. 6**). Although they have excellent skin color match and low donor site morbidity, they lack 3-dimensional bulk for large contour defects.[30–32] Care must be taken in patients who have received preoperative radiation, concurrent neck dissection, or anticipate postoperative radiation.[32]

Free Tissue Transfer

In patients with large volume composite defects, recurrent tumor, dural defects, and prior irradiated fields or when postoperative radiation is anticipated, free tissue transfer is the most appropriate reconstructive option. Free flaps offer flexibility in size, bulk, reliability, and resilience. There are many donor site options for free flaps. The choice depends on the cutaneous tissue loss, contour defect, or exposed vital structures. The use of a deepithelialized buried free flap has been used with great success, with good facial contour, and vascularized soft tissue coverage of vital structures.[33]

The *radial forearm free flap (RFFF)* is a reliable flap with a long vascular pedicle that offers significant surface area coverage. It is limited by its modest bulk, depending on the habitus of the patient; thus, it is best suited for smaller defects with auricular preservation. However, additional bulk can be achieved if the upper forearm subcutaneous tissue is concurrently harvested. With deepithelialization, the flap can be placed within the parotid bed as a buried flap for contouring if there is no significant skin defect. The thin quality of the flap and lack of considerable change over time (ie muscle atrophy) obviates flap revision. However, closure of the donor site requires an additional skin graft, contributing to the morbidity in this flap. High-volume composite defects are best reconstructed with flaps containing muscle or a thick, soft tissue component.

Fig. 6. Supraclavicular island flap. (*A*) Defect with supraclavicular island flap incised; (*B*) immediate postoperative reconstruction; (*C*) six-month follow-up.

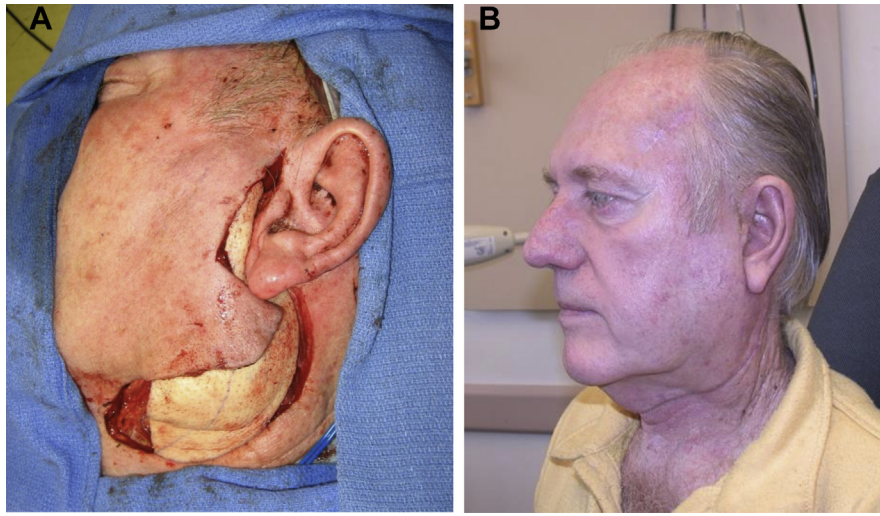

Fig. 7. Deepithelialized buried anterolateral thigh free flap. (*A*) Flap placed within parotid defect before deepithelialization; (*B*) six-month follow-up.

The *anterolateral thigh (ALT) free flap* is the ideal reconstructive option for large volume composite defects, especially with significant cutaneous loss and or lateral skull base resections with or without dural defects. The pedicle is based off the lateral circumflex femoral artery and can be up to 12 cm long. The skin paddle is limited to 8 to 12 cm in width to accommodate primary closure of the thigh, whereas the bulk of this flap largely depends on the gender and habitus of the patient. However, there are many options to choose from in the ALT flap in order to obtain ideal bulk, contour, and skin reconstruction. It can be harvested as a myofascial flap, to provide bulk, or a myocutaneous or fasciocutaneous flap to provide bulk and skin coverage. The ALT flap can be further deepithealialized for placement as a buried flap, if little to no skin defect is created (Fig. 7). Although this flap carries excellent resilience through postoperative radiation,[33] it has drawbacks such as the need for frequent debulking procedures, increased donor site seromas, and wound dehiscence when compared with the RFFF.[34,35]

SUMMARY

Soft tissue reconstruction of the parotidectomy defect can vary from primary closure to acellular dermal implants or fat grafts to local, regional, or free flaps. Many studies have shown improved facial contour, reduced incidence of Frey syndrome, and improved patient satisfaction with soft tissue reconstruction. Each reconstructive option carries specific indications, advantages, and risk. Patient anatomy and desires should be considered when selecting a reconstruction option.

CLINICS CARE POINTS

- Most parotidectomy defects can be successfully reconstructed with acellular matrix, fat grafts, or locoregional flaps with excellent patient satisfaction, reduced Frey syndrome, and minimal donor site morbidity.

- Fat grafts have a propensity to resorb, especially after radiation. Overcorrection, avoiding piece-meal harvesting, and/or using dermal fat or a local flap concurrently may reduce this phenomenon.
- Ensure to place superiorly placed tacking sutures on inferiorly based rotational flaps to prevent descent and dehiscence.
- Free tissue transfer is a superior option in large composite resections and when adjuvant radiation is expected.

DISCLOSURE

The authors have no disclosures.

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