ORIGINAL ARTICLE

Simultaneous Anterolateral Thigh Flap and Temporalis Tendon Transfer to Optimize Facial Form and Function After Radical Parotidectomy

Peter C. Revenaugh, MD; P. Daniel Knott, MD; Joseph Scharpf, MD; Michael A. Fritz, MD

Background: Extirpation of aggressive parotid or cutaneous facial tumors often involves facial nerve sacrifice and the creation of a large soft-tissue defect. We describe a method for single-stage reconstruction during radical parotidectomy to restore facial form and function without additional morbidity.

Methods: We conducted a review of immediate reconstruction/reanimation of radical parotidectomy defects with the use of anterolateral thigh (ALT) fat and fascia flaps for facial contouring, orthodromic temporalis tendon transfer (OTTT), cable grafting of the facial nerve, and fascia lata lower lip suspension.

Results: Five patients (mean age, 67.4 years) underwent extirpation of malignant tumors with facial nerve sacrifice resulting in large soft-tissue deficits. All patients had ALT free tissue transfer to correct facial contour defects and OTTT to restore facial form and function. Four patients underwent cable grafting of facial nerve branches. Branches of the motor nerve to the vastus lateralis harvested from the ALT surgical site were used for cable nerve grafting in 3 patients. Fascia lata from the same ALT harvest site was used for lower lip suspension to the OTTT in 4 patients. There were no donor site complications. All patients achieved midfacial symmetry at rest, oral competence with dynamic corner-of-mouth movement, and full eye closure.

Conclusions: Tumor clearance, symmetric facial appearance, as well as dynamic facial rehabilitation were accomplished in a single-stage procedure using the method described herein. The ALT free flap provides versatile options for soft-tissue defects as well as access to motor nerves optimal for grafting without additional morbidity. Patients undergoing extirpation of malignant tumors requiring facial nerve sacrifice can undergo immediate free tissue contour reconstruction and facial reanimation procedures with no additional morbidity.

Arch Facial Plast Surg. 2012;14(2):104-109

PAROTIDECTOMY IS THE TREATMENT of choice for many benign and malignant salivary gland tumors, whether metastatic or primary, and is often considered for aggressive cutaneous and temporal bone malignant tumors. High-grade parotid and aggressive cutaneous malignant tumors of the head and neck with neurotropic spread, direct parotid invasion, or metastatic spread commonly necessitate total parotidectomy with facial nerve sacrifice.

Nonmelanomatous skin cancer is the most common cancer in the United States, with more than 2 million cases diagnosed annually.[1] Overall cure rates approach 99%, but aggressive or recurrent tumors with regional metastasis, large size (>2 cm), rapid growth, or involvement of cosmetically significant portions of the face warrant surgical intervention and postoperative radiotherapy.[2] Likewise, specific high-grade parotid malignant tumors or those exhibiting perineural invasion may warrant aggressive excision, including facial nerve sacrifice, and radiotherapy similar to the treatment used in advanced nonmelanomatous skin cancer.[3] Treatment of these tumors can be challenging for the reconstructive surgeon because extirpation often results in large defects, facial paralysis, facial asymmetry, and the potential morbidity associated with postoperative radiotherapy.

Universally, total parotid resection results in a noticeable soft-tissue defect over the lateral face and mandible. More than 50% of patients may develop facial contour abnormalities after parotidectomy.[4] Resection of skin, muscle, auricle, temporal bone, and mandible may be necessary to obtain adequate margins, expanding the surgical defect. Once negative

Authors Affiliations: Head and Neck Institute, Department of Otolaryngology–Head and Neck Surgery, Cleveland Clinic, Cleveland, Ohio (Drs Revenaugh, Scharpf, and Fritz); and Department of Otolaryngology–Head and Neck Surgery, University of California, San Francisco (Dr Knott).

histologic margins are ensured, the reconstructive goals include restoration of facial form and function with limited donor site and overall morbidity. Various regional flaps or implantable materials have been proposed for reconstruction of this defect, but adequate tissue volume, skin availability, sculpting ability, and technical difficulties limit these strategies. Given its ability to impart accurate and lasting volume correction (even with radiotherapy), vascularized free tissue transfer is becoming the criterion standard for postparotidectomy defect reconstruction, regardless of facial nerve involvement.[5,6] In particular, the anterolateral thigh (ALT) flap provides an ideal soft-tissue flap because of its component versatility, straightforward harvest, low donor site morbidity, and access to redundant motor nerves suitable for grafting.

Irrespective of facial contour issues, sacrifice of the facial nerve imparts devastating compromise of facial appearance and function. Facial nerve invasion occurs in approximately 7% to 20% of malignant tumors involving the parotid. This finding warrants neural resection to negative margins.[7,8] Facial nerve involvement necessitating resection may be subclinical or readily apparent on physical examination, with isolated nerve branch weakness or frank paralysis. Regardless of preoperative functional capacity, complete hemifacial paralysis following nerve resection places the patient at risk for ocular complications and oral incompetence and introduces a myriad of social and aesthetic stigmata.

Direct nerve anastomosis, or cable grafting, is the preferred reconstruction technique, yielding optimal functional outcomes in patients undergoing facial nerve sacrifice.[9] Most patients undergoing nerve grafting have some return of facial function, but significant results may not be observed for up to 2 years.[9] If grafting is possible, dynamic and static techniques can be combined with neural anastomosis to provide patients with immediate form and function until neural return is complete.

This study aimed to present a treatment paradigm and review outcomes of a single-stage approach to radical parotidectomy reconstruction including ALT, orthodromic temporalis tendon transfer (OTTT), and facial nerve grafting when possible. Our technique addresses the soft-tissue and potential cutaneous defect while providing contoured vascularized tissue for lasting defect reconstruction, support for nerve grafting techniques, and immediate dynamic reanimation in the form of OTTT.

METHODS

Institutional review board approval was obtained from Cleveland Clinic, Cleveland, Ohio. All patients undergoing free flap reconstruction between January 1, 2008, and October 1, 2010, were identified and reviewed using prospective free flap databases. Of those patients, only patients undergoing simultaneous free flap and OTTT at the time of primary tumor extirpation were included. This comprised 5 patients. Immediate cable nerve grafting was accomplished in 4 patients who had available proximal and distal nerve segments. Patient demographics, tumor characteristics, surgical interventions and details, postoperative complications, tumor recurrence, and adjuvant therapies, as well as cosmetic and mimetic results of the reconstruction, were recorded.

RESULTS

All patients were men, and the mean age was 67.4 years (range, 48-82 years). Pathologic diagnoses included high-grade adenocarcinoma of the parotid in 2 patients (40%), cutaneous squamous cell carcinoma in 2 patients (40%), and recurrent dermatofibrosarcoma protuberans in 1 patient (20%). All tumors were diagnosed as T4 category. Major medical comorbidities included hypertension (3 patients [60%]), coronary artery disease (2 [40%]), diabetes mellitus (1 [20%]), and prior renal transplant (1 [20%]).

Anterolateral thigh free flap was used in all patients for soft-tissue augmentation. Three flaps were fasciocutaneous and 2 flaps were buried de-epithelialized fat/fascia flaps. Of the former group, additional soft tissue was harvested to allow for correction of both the surface and underlying contour defects. Mean flap size was 151 cm^2, and the most common arterial anastomoses were the facial artery (3 patients [60%]) and superior thyroid artery (2 [40%]). All but 1 patient underwent dual vein anastomoses.

There were no partial or total flap losses, and there were no donor site complications. All patients were able to walk without assistance by discharge except patient 3; he required a walker and later underwent total hip arthroplasty for severe degenerative joint disease unrelated to the malignant tumor or intervention.

All patients underwent OTTT as described by Byrne et al,[10] with modifications by the senior author (M.A.F.). All tendon transfers were accomplished using a transfacial (3 patients) or combined transfacial/transoral (2 patients) route if exposure was not adequate through resection defect. Four patients received a concomitant orbicularis oris sling using tensor fascia lata.

As part of a comprehensive approach to facial rehabilitation, all patients were treated with procedures in addition to the free tissue transfer and OTTT. Other facial reanimation procedures included cable graft in 4 patients; 3 of these patients underwent grafting to at least 2 facial nerve distal branches from the main trunk using a portion of the nerve to the vastus lateralis. One patient received cable grafting with a portion of the great auricular nerve. All patients had correction of lagophthalmos with gold weight placement, ectropion repair with tarsal strip, and midforehead brow-lift, with the majority of orbital and periorbital procedures performed secondarily under local anesthesia or sedation. Patient 1 underwent tarsorrhaphy after experiencing cicatricial lagophthalmos in the setting of massive orbital recurrence of the tumor 5 months postoperatively.

Postoperative complications included urinary retention and cardiac ST-segment changes necessitating intensive care unit admission in patient 4. Mean hospital length of stay was 8 days (range, 4-12 days).

Four patients underwent postoperative radiotherapy, 2 of whom had conventional full-course treatment; 1 patient received intensity-modulated radiotherapy; and the fourth patient underwent split-course therapy. One patient received postoperative cetuximab following recurrence. There were no complications of radiotherapy, reconstructive failures, or trismus. One patient died of recurrent disease, and the remainder were living

Table. Operative Results

Patient	Pathologic Category	Length of Follow-up, mo	Complications	Symmetry at Rest	Corner-of-Mouth Movement	Eye Closure	Oral Competence
1	T4aN0M0 cutaneous SCCa	13	None	Yes	Yes	Poor (orbital recurrence)	Yes
2	T4aN2bM0 high-grade adenocarcinoma	15	None	Yes	Yes	Good	Yes
3	T4aN0M0 high-grade adenocarcinoma	11	None	Yes	Yes	Good	Yes
4	Recurrent T4aN2bM0 cutaneous SCCa	5	ST-segment depression; urinary retention	Yes	Yes	Good	Yes
5	Recurrent dermatofibrosarcoma protuberans	7	None	Yes	Yes	Good	Yes

Abbreviation: SCCa, squamous cell carcinoma.

without detectable disease at a mean follow-up of 10.2 months.

Postoperative form and function were evaluated at subsequent outpatient visits (**Table**). All patients achieved midfacial symmetry at rest as well as dynamic corner-of-mouth movement on the affected side. Functionally, all patients achieved full eye closure and oral competence. Two patients requested cosmetic revision procedures, with 1 patient receiving contralateral forehead botulinum toxin injection and contralateral melolabial fold injectable filler at the time of flap contouring. Another patient chose melolabial fold revision to correct exaggerated nasolabial fold at the time of elective flap debulking. No other patients required or requested flap debulking procedures or OTTT revision.

COMMENT

Radical parotidectomy results in a significant soft-tissue defect in most patients due to loss of bulk. When considered with the postoperative paralysis resulting from facial nerve sacrifice, patients endure considerable cosmetic and functional deficits. Ocular treatment and oral competence are 2 areas of significant concern when planning postoperative care. Not to be minimized are the psychosocial and aesthetic stigmata of patients with facial soft-tissue defects, malignant tumors, and/or facial paralysis.[3,11] An ideal procedure would provide adequate tumor resection with immediate facial symmetry and dynamic facial rehabilitation in a single-stage procedure without compromising resection, postoperative surveillance, or adjuvant treatments.

Parotidectomy soft-tissue defect augmentation has been performed by various techniques, including sternocleidomastoid or platysma muscle flaps,[12] temporoparietal fascia flaps,[13] superficial musculoaponeurotic system transposition flaps,[14] autogenous free fat grafts,[15] and acellular human dermal matrix graft (Alloderm; LifeCell Corporation).[16] Regional muscular and fascia flaps lack sufficient bulk for adequate reconstruction of total parotidectomy defects and risk atrophy, neural injury, and secondary soft-tissue defects.[12] Fat transfer and dermal grafts, whether autogenous or allogeneic, also fail to provide stable, adequate bulk for total parotidectomy defects and can be complicated by fat liquefaction, seroma, and long-term or radiation-induced resorption.[17,18] Free tissue transfer provides stable vascularized tissue that can be easily contoured to match the defect and achieve a high degree of long-term symmetry, even in the setting of postoperative radiotherapy. If skin is resected, as in the case of aggressive cutaneous malignant tumors, free fasciocutaneous tissue transfer is ideal for reconstruction, simultaneously providing vascularized tissue coverage and cutaneous coverage resistant to the potential deleterious effects of postoperative radiotherapy. For these reasons, free tissue transfer is becoming the preferred technique for repair of soft-tissue defects after parotidectomy.[5,19]

Various free tissue flaps have been described to augment parotidectomy defects, including lateral arm,[20] parascapular,[21] gastrocnemius,[22] and groin.[23] Recently, radial forearm and ALT free flaps have gained favor for parotidectomy[5,24] and lateral temporal bone defects.[19] Anterolateral thigh tissue provides an ideal reconstructive tool for defects produced during parotidectomy. The flap can be harvested easily with a 2-team approach and minimal donor site morbidity.[25] Furthermore, the ability to harvest skin and soft tissue in various configurations and quantities allows the surgeon to easily sculpt and optimize facial symmetry (**Figure 1**). Reflecting this diversity, the ALT can be harvested as a fasciocutaneous, myocutaneous, subcutaneous, or adipofascial flap. The donor site also provides access to the tensor fascia lata and the motor nerve to the vastus lateralis, both of which can be harvested for facial reanimation procedures. Our group preferentially uses ALT for reconstruction at the time of resection along with other facial reanimation procedures.

Soft-tissue reconstruction of parotidectomy defects has been challenged in the past on the premise that tumor surveillance could be compromised by the reconstruction, and the very technique of free tissue transfer carried a significant risk of flap failure and additional morbidity. Cannady et al[26] recently described their multi-institutional experience with microvascular flap reconstruction of parotidectomy defects. They reported a 100% success rate and argued that surveillance of primary site and regional nodal beds can be accomplished by computed tomography scanning, magnetic resonance imaging, and/or positron emission tomography in areas not ac-

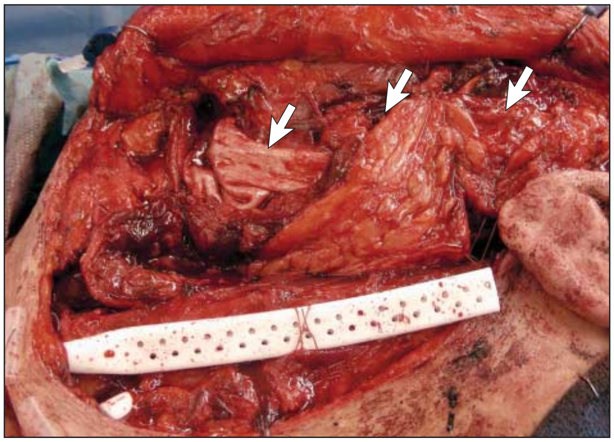

Figure 1. Anterolateral fat/fascia flap contoured within the parotid bed (arrows).

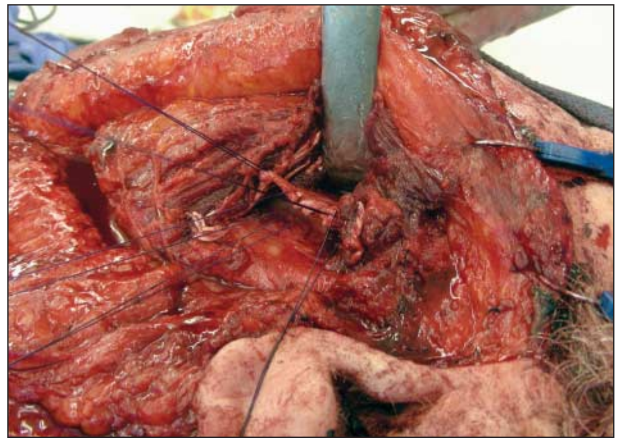

Figure 2. Transfacial approach to temporalis tendon with suspension sutures in place.

cessible to clinical examination. In our population, the single recurrence was readily apparent on clinical examination because it was adjacent to the reconstructive site and therefore easily detected. We agree with Canady et al that clinical surveillance coupled with imaging should detect any recurrences within the reconstructive bed.

Rehabilitation of complete facial paralysis after nerve transection depends on nerve grafting procedures, static suspension procedures, regional myofascial procedures, and/or free tissue transfer. Restoration of neural input provides the patient the best chance of long-term functional recovery. Success depends on the presence of viable neural fibers or transfer of innervated muscular free flap, and results may not be noticeable for 12 months.[9] In many cases of radical operations, a patient with a functional or near-functional nerve preoperatively must adapt to a dense paralysis postoperatively, whether or not neural reconstitution is performed. Virtually any effort aimed at immediate reconstitution of facial form and function is beneficial as a patient copes with the new disability. Reversible static procedures and regional myofascial procedures such as the OTTT can be accomplished at the time of resection and provide the patient immediate facial symmetry and even movement. This benefit, coupled with the minimal morbidity and ease of reversal, if needed, make the OTTT an ideal adjunct to free tissue transfer in the reconstruction of radical parotidectomy defects.

Temporalis muscle transposition was developed as a dynamic muscular sling for facial paralysis. First described in 1952 by McLaughlin,[27] the muscular belly was transferred over the zygomatic arch as a fulcrum for dynamic corner-of-mouth movement with temporalis contraction. The original descriptions resulted in undesirable temporal and zygomatic asymmetry. The procedure has seen a resurgence in popularity in recent years, with several modifications providing an orthodromic force vector while eliminating the asymmetry and much of the morbidity of the original procedure.[10,28] In parotidectomy defects, access to the coronoid via the transfacial approach simplifies the procedure and reduces operative time by eliminating the need for intraoral incisions (**Figure 2**). Original descriptions of the technique aimed at melolabial fold reconstitution with corner-of-mouth movement. It is now recognized that long-standing orbicularis paralysis results in asymmetry, oral incompetence, and dental exposure. We currently approach the OTTT as a 2-fold procedure with dynamic melolabial fold reconstitution and oral sphincter rehabilitation in the form of a tensor fascia lata sling from the temporalis tendon to the midline orbicularis oris.

All patients in our study underwent OTTT and 4 were treated with tensor fascia lata sling. Notably, our nasolabial dissection technique spares perioral neurovascular pedicles (similar to the Karapandzic technique) when nerve grafting is concomitantly performed. All patients demonstrated voluntary corner-of-mouth movement and had good oral competence following the procedure (**Figure 3**). Of note, there were no wound complications or trismus after radiotherapy, illustrating the safety of this procedure and stability of vascularized free tissue with postoperative radiotherapy. Orthodromic temporalis tendon transfer provides an immediate, safe, and reliable regional myofascial transfer that is potentially reversible in the event of significant neural recovery.

Nerve grafting provides the opportunity for mimetic facial motion and facial tone; nevertheless, grafting in the setting of radical parotidectomy is controversial. Some[29] have suggested that postoperative radiotherapy can negatively affect facial nerve recovery and that the advanced age and poor prognosis of some patients with aggressive cutaneous or parotid malignant tumors do not support neural grafting.

Although their study was limited by retrospective design and selection bias, Gidley et al[30] found no deleterious effects on facial nerve functional recovery after interpositional nerve grafting and postoperative radiotherapy. Similarly, Brown et al[31] concluded that radiotherapy was not a negative prognostic indicator in facial nerve recovery after grafting. The vascularized tissue afforded by the ALT flap in our technique may also theoretically shield the nerve from deleterious effects of radiotherapy. We therefore recommend facial nerve interpositional grafting when possible in properly selected patients.

In this setting, we advocate cable grafting with a branch of the motor nerve to the vastus lateralis. This nerve has multiple branches and is intimately associated with the ALT pedicle (**Figure 4**). Because of its location, sacri-

Figure 3. Postoperative facial symmetry at rest (A and B) and with dynamic movement (C) in patient 2.

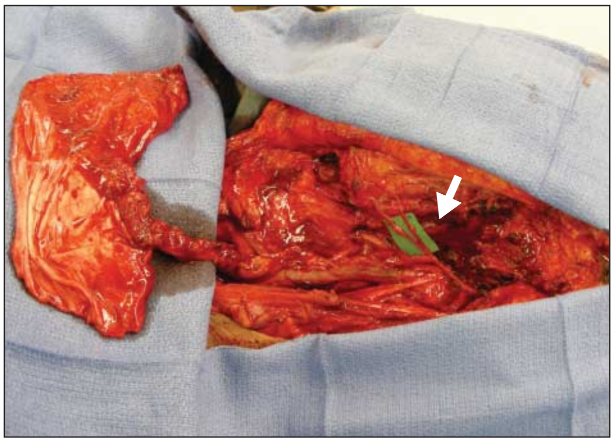

Figure 4. Harvested anterolateral thigh fat/fascia flap (left) with nerve to vastus lateralis branches (arrow).

fice is routinely necessary during ALT harvest without impairing postoperative ambulation.[32] Graft length is equivalent to sural nerve, lateral femoral cutaneous nerve, or median antebrachial cutaneous nerve grafts (unpublished data available from the authors on request), and the branching pattern is favorable. This graft can also be harvested without an additional surgical site and with minimal additional operative time. Although not specifically studied in humans, there is animal evidence[33,34] that matching motor or sensory modality when nerve grafting may augment rapidity and quality of neural regeneration and overall functional recovery.

Four of our patients underwent nerve grafting using the motor nerve to the vastus lateralis, and 1 patient received a graft using the great auricular nerve. The average motor nerve to the vastus lateralis graft length was 10.3 cm. One patient had notable reinnervation of depressor musculature at 10 months and had continued to regain lower facial motion at 12 months. No synkinesis has been noted. However, our follow-up time is too short to comment on the degree and quality of neural recovery. Cable grafting with a branch of the nerve to the vastus lateralis provides the potential for facial tone reconstitution and mimetic functional recovery at nominal increases in operative time and no additional morbidity.

Although patient age and comorbidities may be concerns for extension of operative time to perform free tissue transfer, nerve grafting, and muscular slings, the 2-team paradigm greatly reduces any potential increase in operative time. With this approach, there is simultaneous extirpation and flap raising, allowing for almost immediate microvascular anastomosis once margins are cleared. A transfacial approach to the temporalis tendon and coronoid allows rapid freeing of the tendon. Additionally, tensor fascia lata and the nerve to the vastus lateralis can be harvested during ALT flap elevation or before donor site closure while microvascular anastomosis is proceeding.

All patients with facial nerve paralysis require a comprehensive approach addressing all areas of the face, including the contralateral side. Although a description of full treatment of facial paralysis is beyond the scope of this article, it is important to note that all our patients underwent at least 3 additional procedures for facial nerve rehabilitation, and paramount in this approach is adequate eye protection.

CONCLUSIONS

Oncologically sound resection, restoration of facial symmetry, and immediate dynamic facial rehabilitation were accomplished in a single-stage procedure using our method of simultaneous reconstruction with ALT free flap, OTTT, and cable grafting when indicated. The ALT flap is a versatile and reliable platform for soft-tissue volume restoration while also providing access to fascia and motor nerves without introducing additional morbidity. Orthodromic temporalis tendon transfer additionally provides for immediate facial symmetry and restoration of oral competence with early corner-of-mouth movement. Patients undergoing extirpation of malignant tumors requiring facial nerve sacrifice can undergo immediate free tissue contour reconstruction and facial reanimation procedures with no additional morbidity.

Accepted for Publication: October 30, 2011.
Correspondence: Michael A. Fritz, MD, Head and Neck Institute, Department of Otolaryngology–Head and Neck Surgery, Cleveland Clinic, 9500 Euclid Ave, Desk A71, Cleveland, OH 44195 (fritzm1@ccf.org).
Author Contributions: *Study concept and design:* Revenaugh, Knott, and Fritz. *Acquisition of data:* Revenaugh, Knott, Scharpf, and Fritz. *Analysis and interpretation of data:* Revenaugh, Knott, Scharpf, and Fritz. *Drafting of the manuscript:* Revenaugh and Knott. *Critical revision of the manu-*

script for important intellectual content: Revenaugh, Knott, Scharpf, and Fritz. *Statistical analysis:* Revenaugh. *Obtained funding:* Revenaugh. *Administrative, technical, and material support:* Revenaugh, Knott, Scharpf, and Fritz. *Study supervision:* Knott, Scharpf, and Fritz.

Financial Disclosure: None reported.

Previous Presentation: This study was presented at the American Academy of Facial Plastic and Reconstructive Surgery; September 24, 2010; Boston, Massachusetts.

REFERENCES

1. Patel RV, Frankel A, Goldenberg G. An update on nonmelanoma skin cancer. *J Clin Aesthet Dermatol*. 2011;4(2):20-27.
2. Rowe DE, Carroll RJ, Day CL Jr. Prognostic factors for local recurrence, metastasis, and survival rates in squamous cell carcinoma of the skin, ear, and lip: implications for treatment modality selection. *J Am Acad Dermatol*. 1992;26(6):976-990.
3. Theriault C, Fitzpatrick PJ. Malignant parotid tumors: prognostic factors and optimum treatment. *Am J Clin Oncol*. 1986;9(6):510-516.
4. Nitzan D, Kronenberg J, Horowitz Z, et al. Quality of life following parotidectomy for malignant and benign disease. *Plast Reconstr Surg*. 2004;114(5):1060-1067.
5. Cannady SB, Seth R, Fritz MA, Alam DS, Wax MK. Total parotidectomy defect reconstruction using the buried free flap. *Otolaryngol Head Neck Surg*. 2010;143(5):637-643.
6. Jin X, Teng L, Xu J, et al. Anterolateral thigh adipofascial flap for the restoration of facial contour deformities. *Microsurgery*. 2010;30(5):368-375.
7. Bron LP, Traynor SJ, McNeil EB, O'Brien CJ. Primary and metastatic cancer of the parotid: comparison of clinical behavior in 232 cases. *Laryngoscope*. 2003;113(6):1070-1075.
8. Garcia-Serra A, Hinerman RW, Mendenhall WM, et al. Carcinoma of the skin with perineural invasion. *Head Neck*. 2003;25(12):1027-1033.
9. Malik TH, Kelly G, Ahmed A, Saeed SR, Ramsden RT. A comparison of surgical techniques used in dynamic reanimation of the paralyzed face. *Otol Neurotol*. 2005;26(2):284-291.
10. Byrne PJ, Kim M, Boahene K, Millar J, Moe K. Temporalis tendon transfer as part of a comprehensive approach to facial reanimation. *Arch Facial Plast Surg*. 2007;9(4):234-241.
11. Ryzenman JM, Pensak ML, Tew JM Jr. Facial paralysis and surgical rehabilitation: a quality of life analysis in a cohort of 1,595 patients after acoustic neuroma surgery. *Otol Neurotol*. 2005;26(3):516-521.
12. Gooden EA, Gullane PJ, Irish J, Katz M, Carroll C. Role of the sternocleidomastoid muscle flap preventing Frey's syndrome and maintaining facial contour following superficial parotidectomy. *J Otolaryngol*. 2001;30(2):98-101.
13. Rubinstein RY, Rosen A, Leeman D. Frey syndrome: treatment with temporoparietal fascia flap interposition. *Arch Otolaryngol Head Neck Surg*. 1999;125(7):808-811.
14. Curry JM, Fisher KW, Heffelfinger RN, Rosen MR, Keane WM, Pribitkin EA. Superficial musculoaponeurotic system elevation and fat graft reconstruction after superficial parotidectomy. *Laryngoscope*. 2008;118(2):210-215.
15. Conger BT, Gourin CG. Free abdominal fat transfer for reconstruction of the total parotidectomy defect. *Laryngoscope*. 2008;118(7):1186-1190.
16. Sachsman SM, Rice DH. Use of AlloDerm implant to improve cosmesis after parotidectomy. *Ear Nose Throat J*. 2007;86(8):512-513.
17. Chandarana S, Fung K, Franklin JH, Kotylak T, Matic DB, Yoo J. Effect of autologous platelet adhesives on dermal fat graft resorption following reconstruction of a superficial parotidectomy defect: a double-blinded prospective trial. *Head Neck*. 2009;31(4):521-530.
18. Davis RE, Guida RA, Cook TA. Autologous free dermal fat graft: reconstruction of facial contour defects. *Arch Otolaryngol Head Neck Surg*. 1995;121(1):95-100.
19. Rosenthal EL, King T, McGrew BM, Carroll W, Magnuson JS, Wax MK. Evolution of a paradigm for free tissue transfer reconstruction of lateral temporal bone defects. *Head Neck*. 2008;30(5):589-594.
20. Teknos TN, Nussenbaum B, Bradford CR, Prince ME, El-Kashlan H, Chepeha DB. Reconstruction of complex parotidectomy defects using the lateral arm free tissue transfer. *Otolaryngol Head Neck Surg*. 2003;129(3):183-191.
21. Biglioli F, Autelitano L. Reconstruction after total parotidectomy using a de-epithelialized free flap. *J Craniomaxillofac Surg*. 2007;35(8):364-368.
22. Hyodo I, Ozawa T, Hasegawa Y, Ogawa T, Terada A, Torii S. Management of a total parotidectomy defect with a gastrocnemius muscle transfer and vascularized sural nerve grafting. *Ann Plast Surg*. 2007;58(6):677-682.
23. Baker DC, Shaw WW, Conley J. Reconstruction of radical parotidectomy defects. *Am J Surg*. 1979;138(4):550-554.
24. Côté D, Harris JR, Guillemaud J, et al. Free tissue transfer flap reconstruction of parotidectomy defects: outcomes analysis and the utility of three-dimensional laser surface scans. *J Otolaryngol Head Neck Surg*. 2010;39(5):561-565.
25. Hanasono MM, Skoracki RJ, Yu P. A prospective study of donor-site morbidity after anterolateral thigh fasciocutaneous and myocutaneous free flap harvest in 220 patients. *Plast Reconstr Surg*. 2010;125(1):209-214.
26. Cannady SB, Dean N, Kroeker A, Albert TA, Rosenthal EL, Wax MK. Free flap reconstruction for osteoradionecrosis of the jaws—outcomes and predictive factors for success. *Head Neck*. 2011;33(3):424-428.
27. McLaughlin CR. Permanent facial paralysis; the role of surgical support. *Lancet*. 1952;2(6736):647-651.
28. Boahene KD. Dynamic muscle transfer in facial reanimation. *Facial Plast Surg*. 2008;24(2):204-210.
29. Iseli TA, Harris G, Dean NR, Iseli CE, Rosenthal EL. Outcomes of static and dynamic facial nerve repair in head and neck cancer. *Laryngoscope*. 2010;120(3):478-483.
30. Gidley PW, Herrera SJ, Hanasono MM, et al. The impact of radiotherapy on facial nerve repair. *Laryngoscope*. 2010;120(10):1985-1989.
31. Brown PD, Eshleman JS, Foote RL, Strome SE. An analysis of facial nerve function in irradiated and unirradiated facial nerve grafts. *Int J Radiat Oncol Biol Phys*. 2000;48(3):737-743.
32. Casey WJ III, Rebecca AM, Smith AA, Craft RO, Hayden RE, Buchel EW. Vastus lateralis motor nerve can adversely affect anterolateral thigh flap harvest. *Plast Reconstr Surg*. 2007;120(1):196-201.
33. Chu TH, Du Y, Wu W. Motor nerve graft is better than sensory nerve graft for survival and regeneration of motoneurons after spinal root avulsion in adult rats. *Exp Neurol*. 2008;212(2):562-565.
34. Moradzadeh A, Borschel GH, Luciano JP, et al. The impact of motor and sensory nerve architecture on nerve regeneration. *Exp Neurol*. 2008;212(2):370-376.