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MAIN ARTICLE

Free fat grafting in superficial parotid surgery to prevent Frey's syndrome and improve aesthetic outcome

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Abstract

Background: Frey's syndrome and cosmesis are important considerations in parotid surgery. Placement of an interpositional barrier can prevent these complications; however, surgical technique and efficacy remain controversial.

Methods: A prospective case series was collected comprising all patients undergoing primary superficial parotidectomy for benign pathology with abdominal free fat grafting between June 2007 and December 2010, performed by a single surgeon. A survey was also distributed to otorhinolaryngology consultants across Australia to assess current practice.

Results: Twenty-eight patients were included. No patient had clinical symptoms of Frey's syndrome. Seventy-five per cent of patients were completely satisfied with their aesthetic outcome, 18 per cent scored 4/5 and the remaining 7 per cent (2 patients) scored 3/5. The survey revealed that 79 per cent of respondents did not use interpositional grafts.

Conclusion: Abdominal free fat is ideal for grafting as it is an effective, safe, simple, accessible, fast and inexpensive method of providing an interpositional graft.

Key words: Parotid Gland; Sweating, Gustatory; Aesthetics; Grafting; Fat, Abdominal

Introduction

Superficial parotidectomy is the mainstay of treatment for benign tumours arising from the superficial lobe of the parotid gland. Intact tumour removal and preservation of the facial nerve are the main goals of parotid surgery.[1] Less emphasis has traditionally been placed on preventing Frey's syndrome and minimising the cosmetic defect that results from this procedure. These two complications can be potentially avoided by the placement of an interpositional barrier between the parotid bed and the overlying skin. The aim is to prevent the aberrant innervation of the overlying skin's sympathetic sweat glands by the severed parasympathetic auriculotemporal nerve fibres of the parotid, whilst providing bulk to the area and hence preserving facial contour.[2] Ideally, any procedure should be effective, safe, simple, accessible, fast and inexpensive. Reported operative options include the sternocleidomastoid flap,[3–5] sub-superficial musculoaponeurotic system plication or flap,[6,7] temporoparietal fascial flap,[8,9] autologous tissue grafts with microvascular repair,[10,11] implants,[12] allogenic dermis,[13,14] dermal fat grafts[15,16] and free fat grafts.[17,18] Each has its advantages and disadvantages; however, there is a paucity of literature on which procedure is best.

The current paper aimed (1) to assess the suitability and outcomes of abdominal free fat interpositional grafting following superficial parotidectomy, and (2) to compare its use to other postulated procedures.

Materials and methods

We collected a prospective case series comprising all patients undergoing primary superficial parotidectomy for benign pathology, with subsequent abdominal free fat grafting, performed between June 2007 and December 2010 by a single surgeon.

Exclusion criteria were malignant pathology, revision cases, total parotidectomy and parotidectomy requiring a neck dissection.

Three months after the operative date, patients were asked whether they had experienced clinical symptoms of Frey's syndrome, specifically heat, flushing or sweating in the operative area whilst eating. They were also asked to rate their aesthetic satisfaction on a

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simple analogue scale from 1 to 5, with 5 indicating complete satisfaction. The starch iodine test was not used to objectively assess the presence of Frey's syndrome.

Patients were followed up for a minimum of six months.

To gauge current practice in superficial parotid surgery, an electronic survey was e-mailed to 100 oto-rhinolaryngology consultants working in Australia, who were either generalists or had a specific interest in head and neck surgery. The survey contained seven questions and is shown as Table I, along with responses.

Operative procedure

The surgical technique involved a modified Blair incision (Figure 1), sub-superficial musculo-aponeurotic system dissection, superficial parotidectomy and grafting of abdominal free fat (Figure 2) harvested from a sub-umbilical incision. All patients were given antibiotics at the point of induction of anaesthesia, and one dose of dexamethasone intra-operatively. All patients had a drain placed at the parotidectomy site which stayed in situ for a minimum of 24 hours, or longer if indicated. The donor site was closed primarily with no drain. Patients did not receive post-operative antibiotics.

TABLE I
SURVEY RESULTS: CURRENT SUPERFICIAL PAROTID PRACTICE

Question	Respondents (*n* (%))
1 How much of your clinical practice is head & neck surgery?	
– Minimal (0–25%)	12 (29)
– Minority (25–50%)	21 (50)
– Majority (50–75%)	8 (19)
– Almost all (75–100%)	1 (2)
2 Approximately how many superficial parotidectomies do you perform per year?	
– 0–5	4 (10)
– 6–10	14 (33)
– 11–15	7 (17)
– 16– 20	5 (12)
– Over 20	12 (28)
3 What type of incision do you use for your superficial parotidectomies?	
– Modified Blair	38 (90)
– Rhytidectomy (face lift)	4 (10)
– Other	0 (0)
4 Do you use interpositional grafts overlying the facial nerve in superficial parotidectomies?	
– Yes	4 (9)
– No	33 (79)
– Occasionally	5 (12)
5 What is the reasoning for your answer to question 4?	(Free text)
6 If you do use an interpositional graft, what do you use?	
– Sternocleidomastoid flap	8 (66)
– Superficial musculo-aponeurotic plication or flap	2 (17)
– Free fat graft	0 (0)
– Dermal fat graft	0 (0)*
– Synthetic grafts or implants	2 (17)
7 Are there any other comments you would like to make?	(Free text)

*One surgeon used either a sub-superficial musculo-aponeurotic system plication/flap or a dermal fat graft. Free text = responses were in free text format

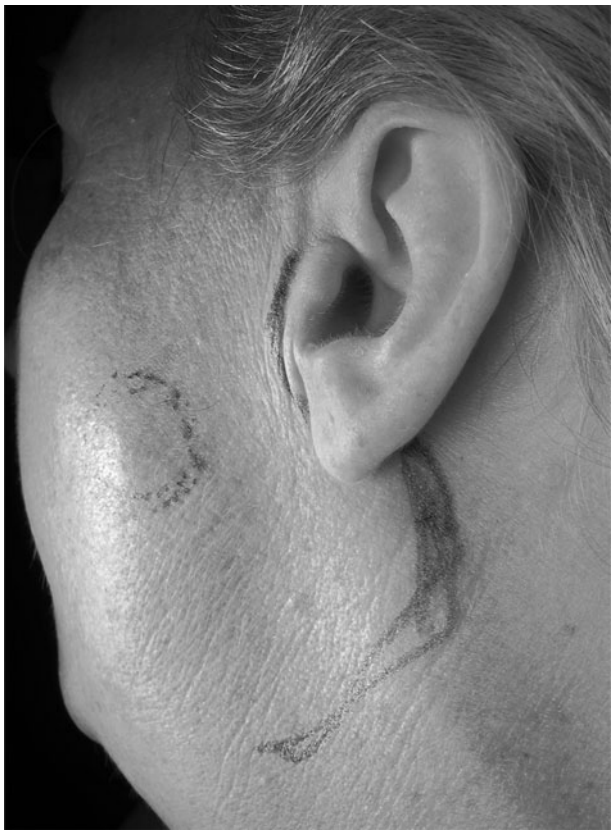

FIG. 1
Pre-operative photograph showing mass and incision line.

FIG. 2
Intra-operative photograph showing placement of abdominal fat graft and drain.

Results

A total of 28 patients were included in the series, 16 women and 12 men, with ages ranging from 29 to 79 years and an average age of 51.5 years. The majority of patients were hospitalised for 2 days; only one case

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had a prolonged stay due to excessive drainage output, being discharged on day 3. The majority of cases were pleomorphic adenomas (22 patients; 79 per cent), followed by Warthin tumour (5 patients; 18 per cent) and muco-epidermoid cyst (1; 3 per cent).

Complications related to the surgery included two patients with weakness of the marginal mandibular branch of the facial nerve, lasting two weeks in one case and three months in the other. Two cases developed minor seromas, which were treated successfully with repeated transcutaneous aspiration. No patient had complications at the graft donor site.

Satisfaction scores at three months revealed that the majority of patients were completely satisfied with their aesthetic result. As shown in Table II, 21 patients gave a score of 5/5 (75 per cent), 5 gave a score of 4/5 (18 per cent) and 2 gave a score of 3/5 (7 per cent).

Regarding objective cosmetic outcome, six patients (21 per cent) were deemed by the operative surgeon to be under-filled or to have uneven contouring. Two patients elected to receive secondary hyaluronic acid fillers (Restylane; Q-Med, Watford, UK); interestingly, both patients were female smokers in their 40s, and gave 3-month satisfaction scores of 3/5 and 4/5, respectively.

No patient developed clinical symptoms of Frey's syndrome.

The electronic survey was returned by 42 otorhinolaryngology consultants, giving a response rate of 42 per cent. Thirty-eight (91 per cent) respondents performed 6 or more superficial parotidectomies per year, with 38 (90 per cent) performing the procedure through a modified Blair incision. Thirty-three respondents (79 per cent) did not use interpositional grafts; reasons for not using a graft were heterogeneous but included negligible incidence of Frey's syndrome, lack of benefit, lack of evidence, concern for increased complication rates, and difficulty in detection of recurrence. Only four respondents (10 per cent) routinely utilised an interpositional graft, with five (12 per cent) doing so occasionally. Most respondents used a graft with the primary intent of improved cosmesis, and with the additional benefit of preventing Frey's syndrome. Of those respondents using interpositional grafts, the majority (67 per cent) used sternocleidomastoid flaps, while two (17 per cent) used synthetic grafts or implants, and another two (17 per cent) used subsuperficial musculo-aponeurotic system plication or flaps (one of these respondents also occasionally used dermal fat). No surgeon used free fat grafting.

TABLE II
SURVEY RESULTS: PATIENT SATISFACTION

Score	Patients (*n* (%))
1	0
2	0
3	2 (7)
4	5 (18)
5	21 (75)

See text for an explanation of survey scoring.

Discussion

Whilst facial nerve preservation in parotid surgery is paramount, the prevention of Frey's syndrome and conservation of normal facial contour should also be important considerations.

Our survey of Australian otorhinolaryngologists indicated that the majority did not routinely use an interpositional barrier when performing superficial parotid surgery. Although reasons given were heterogeneous, the majority indicated that Frey's syndrome and cosmetic outcome were not concerning issues in their practice. Of those who did perform interpositional barrier surgery, this was mainly for cosmesis, with most respondents electing to use a sternocleidomastoid flap. Interestingly, no respondent reported using free fat grafts.

In our series of 28 patients, the use of a free fat graft following superficial parotidectomy prevented clinical symptoms of Frey's syndrome in all patients and had a satisfactory aesthetic result in the majority (Figure 3). This favourable result came with only minor additional complications that resolved with simple interventions and no complication to the graft donor site. These results suggest that free fat grafting may be an ideal method which both prevents Frey's syndrome and improves cosmetic outcomes following superficial parotid surgery for benign disease.

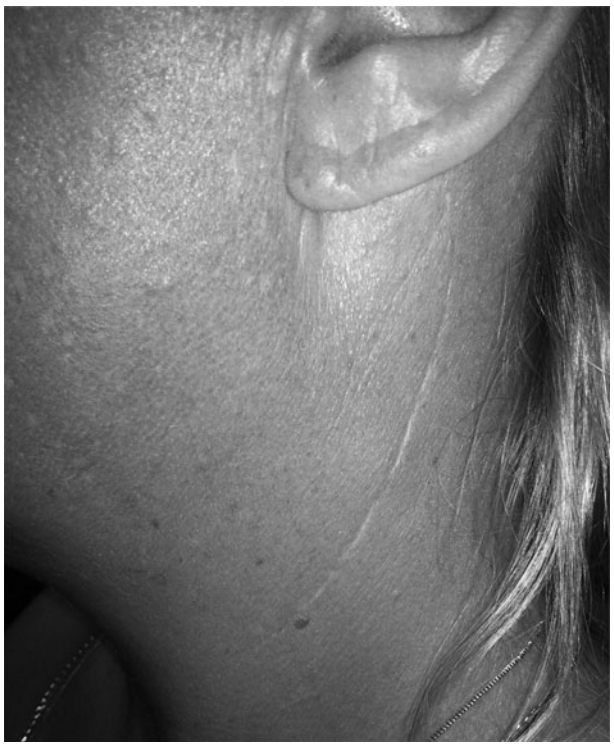

FIG. 3
Post-operative photo showing minimal cosmetic defect.

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When no prophylactic surgical intervention is performed, the reported incidence of Frey's syndrome is very variable. Most publications indicate that between 10 and 40 per cent of patients develop clinical symptoms of Frey's syndrome within a year of surgery; however, the starch iodine test has been reported as positive in up to 90 per cent of patients.[19–23] Frey's syndrome can be medically managed, but currently all such treatments are temporising measures. First-line medical therapy involves injection of botulinum toxin A; however, long-term follow up has shown high recurrence rates which may necessitate further, regular treatment.[19,24] Surgical options include re-elevation of the skin flap and placement of an interpositional graft, or excision of the affected area of skin and skin-grafting. These procedures carry the risks associated with re-operation, together with potential facial nerve damage and further scarring. Transcanal tympanic neurectomy may also be performed to disrupt the parasympathetic fibres of Jacobson's nerve, with good success; however, this procedure has the potential for tympanic membrane perforation, damage to middle-ear structures and xerostomia.[22]

Dermal fillers such as hyaluronic acids or biosynthetic polymers (e.g. poly-L-lactic acid, calcium hydroxylapatite and polymethylmethcrylate) can also be used after the healing process is complete, to improve cosmetic outcome.[25] Fillers have not been reported to have a role in the prevention of Frey's syndrome and may not be adequate for large defects. They generally increase costs and may require repeated application due to reabsorption. The use of an interpositional graft does not preclude the use of fillers at a later date. No publications have addressed the delayed use of dermal fillers after superficial parotidectomy.

A meta-analysis by Curry *et al.*[2] revealed that preventative surgery is likely to decrease the likelihood of Frey's syndrome and improve facial asymmetry; however, their results were inconclusive as to which procedure is superior.

In 1893, Neuber[26] reported the use of autologous free fat transfers for the repair of orbital defects. Autologous fat transfers have long been used in head, neck and facial plastic reconstructive surgery. Other otolaryngological indications include sinus cavity obliteration, plugging of temporal bone defects in otological procedures, and vocal fold medialisation.[27] Abdominal free fat grafts have previously been used successfully in parotid surgery.[15,17,18] Fat is a favourable graft material following parotidectomy as it has a similar texture and consistency to parotid tissue. It is readily accessible, with multiple potential donor sites that leave minimal, well hidden incision scars. Potential sites for fat harvesting include the sub-umbilicus, groin, left lower abdomen and thigh. The decision will be influenced by surgeon and patient preferences, as well as the presence of previous surgery. Sub-umbilical fat harvesting is technically simple and fast, with minimal additional cost. This technique can yield an abundance of tissue as a single graft, which can easily be manipulated to suit the defect created. It adds approximately 15 to 30 minutes of operative time, causes minimal additional blood loss, and does not lengthen hospital stay.[15,18] In the present study, sub-umbilical fat harvesting was simple, effective and without complications, and was utilised in all cases.

The main controversy regarding fat allografting is the potentially unpredictable reabsorption rate. Reported reabsorption rates vary from 20 to 90 per cent.[28–30] Due to the limitations of performing volumetric assessment from two-dimensional imaging, there is minimal literature that quantifies the extent of free fat graft reabsorption and assessment of long-term results. Fontdevila *et al.*[31] used computed tomography measurements to volumetrically analyse free fat grafting to the cheek in human immunodeficiency virus infected patients, and found no trend toward reabsorption at 12 months. Many factors can affect graft reabsorption rate. Ischaemia, longer harvest to implant time, infection, haematoma formation, graft manipulation, and greater graft size and number can all decrease volume in the short term, whilst adipocyte and lipid reabsorption can affect longer term volume loss. In our study, there was little fat reabsorption after six months of follow up.

To counter the unpredictability of reabsorption, over-correction of the defect by 15–30 per cent has been reported.[17,18] Dermis fat grafts have been used with the intention of keeping the sub-dermal vascular plexus intact, and theoretically should maximise volume retention.[15,16] However, dermis fat grafts may still have variable reabsorption[27] and can require a longer operating time.[17]

The use of free fat grafts can cause complications. The free fat graft can become infected and undergo extensive necrosis, with formation of a seroma. In our study, the only complications relating to free fat grafting were temporary marginal mandibular weakness in two patients and seroma development in a further two patients, the latter treated successfully with needle aspiration. An increased prevalence of auricular numbness has also been reported.[18] Creating a donor site invariably carries a theoretical increased risk of donor site wound infection, bleeding, cellulitis, pain and scarring. However, in our series no patient suffered complications to the donor site. Other publications performing similar procedures have also found a similar low risk profile.[17,18] There is concern that a fat graft may interfere with detection of recurrence. Our experience of recurrence with this procedure was limited as we only operated on benign disease, which has very low recurrence rates and requires long follow up to detect recurrence.[32] However, one would expect recurrent disease to be very distinct from fat, from a clinical, imaging and pathological perspective; thus, surveillance should not be impeded.[18]

Numerous other interpositional graft techniques have also been described for superficial parotidectomies.

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A sub-superficial musculo-aponeurotic system dissection results in a thicker flap that may reduce the incidence of Frey's syndrome; this hypothesis is supported by numerous studies[2,33–35] but is still debated.[6,7,36,37] Sub-superficial musculo-aponeurotic system dissection may provide a better cosmetic result.[6,7,37,38] Additionally, sub-superficial musculo-aponeurotic system dissection allows the development of a superficial musculo-aponeurotic system flap, which can then be rotated or plicated to fill defects.[33,39,40] However the amount of tissue is small and can be deficient in places where the tumour is abutting the skin. In this situation, an additional, thicker interpositional graft may be used effectively. Temporoparietal fascia flaps have been reported to be associated with a statistically significant reduction in the prevalence of Frey's syndrome and an improvement in aesthetic results.[8,9] However, temporoparietal fascia flaps involve superior extension of the parotidectomy incision, and carry the additional risks of injury to the frontal branch of the facial nerve, atrophy of the temporalis, zygomatic arch fullness and alopecia.

The use of a sternocleidomastoid flap after parotid surgery for the prevention of Frey's syndrome, with associated improved cosmesis, has been widely published albeit with varying results. Following use of such a flap, the reported prevalence of subjective symptoms of Frey's syndrome varies from 0 to 40 per cent.[5,41] Bianchi *et al.*[4] found that using a sternocleidomastoid or sub-superficial musculo-aponeurotic system flap enabled significantly better aesthetic results, compared with patients not receiving such a flap; however, the result was reliant on performing partial superficial parotidectomy. A systematic review of the use of sternocleidomastoid flaps was unable to reach any firm conclusions due to the heterogeneity, small sample size and bias of all of the studies included.[3] Sternocleidomastoid flaps have the advantages of being well vascularised and not involving further skin incisions; however, their use does risk injury to the facial and accessory nerves.

Acellular human dermis has also been used as an implant.[13] This is derived from cadaveric skin that has had its cellular and antigenic components removed. Sinha *et al.*[14] found that the use of Alloderm (LifeCell, Bridgewater, New Jersey, USA) implants significantly reduced the incidence of Frey's syndrome and had good cosmetic results. Athavale *et al.*[42] reported an overall complication rate of 13 per cent, and suggested that acellular dermal implants reacted poorly with salivary tissue and had higher complication rates when used following superficial parotidectomy. In addition, these implants are very expensive: the use of Alloderm can currently result in an additional cost of approximately US$1000 per procedure.[13]

Synthetic implants such as expanded polytetrafluoroethylene and polygalactin 910-polydioxanone mesh have also been used. These implants are non-reabsorbable and hence should provide a permanent barrier with a more predictable and long-lasting cosmetic result. Dulguerov *et al.*[12] found that these synthetic implants significantly reduced the objective and subjective incidence of Frey's syndrome, but were associated with a very high prevalence of salivary fistulae and wound collections. Synthetic implants also carry the risk of extrusion.

- **Superficial parotidectomy can cause Frey's syndrome and cosmetic deformity**
- **Both can be avoided by using an interpositional barrier**
- **The majority of Australian otolaryngologists do not routinely use interpositional grafts**
- **Abdominal free fat is ideal for such grafting: it is effective, safe, accessible, cheap, and quickly and easily obtained**

The use of a rhytidectomy (face lift) incision, in addition to a free fat interpositional graft, has also been reported, with good success.[17,18] Although not utilised in our study, the use of this incision could potentially further improve cosmetic outcome, especially for females. However, this technique is not recommended for males, as it could translocate hair-bearing skin into the ear canal, nor is it recommended for patients with lesions in the anterior parotid, as surgical exposure is restricted.

Our study was limited by the small number of patients, relatively short follow-up time and lack of a control arm for comparison. The starch iodine test could have been used to objectively assess the presence of Frey's syndrome. However, this test is often not clinically relevant: even if the test is positive, if a patient suffers no symptoms then no intervention is required. Aesthetic outcome is difficult to measure objectively; studies assessing this aspect of superficial parotid surgery will inherently be biased, as patients electing to have an interpositional graft will have higher concern for cosmetic outcome than those not choosing this procedure. Future studies may use image-derived volumetric assessment in order to better delineate facial asymmetry.

Conclusion

When performing superficial parotidectomy, every effort should be made to reduce the risk of facial nerve injury and Frey's syndrome and to minimise post-operative facial asymmetry. We suggest that placement of an interpositional graft should be offered to patients undergoing superficial parotidectomy for benign pathology, especially those concerned about the risk of Frey's syndrome and poor cosmesis. Abdominal free fat is ideal for interpositional grafting as it is effective, safe, accessible and inexpensive and can be quickly and simply obtained. Free fat grafting

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has a low risk profile and appears to be advantageous compared with other proposed methods, as reported in the literature and found in the current study.

References

1 Albergotti W, Nguyen S, Zenk J, Gillespie MB. Extracapsular dissection for benign parotid tumours: a meta-analysis. *Laryngoscope* 2012;**122**:1954–60
2 Curry J, King N, Reiter D, Fisher K, Heffelfinger R, Pribitkin E. Meta-analysis of surgical techniques for preventing parotidectomy sequelae. *Arch Facial Plast Surg* 2009;**11**:327–31
3 Sanabria A, Kowalski L, Bradley P, Hartl D, Bradford C, de Bree R *et al*. Sternocleidomastoid muscle flap in preventing Frey's syndrome after parotidectomy: a systematic review. *Head Neck* 2012;**34**:589–98
4 Bianchi B, Ferri A, Ferrari S, Copelli C, Sesenna E. Improving esthetic results in benign parotid surgery: statistical evaluation of facelift approach, sternocleidomastoid flap, and superficial musculoaponeurotic system flap application. *J Oral Maxillofac Surg* 2011;**69**:1235–41
5 Asal K, Köybaşioğlu A, Inal E, Ural A, Uslu S, Ceylan A *et al*. Sternocleidomastoid muscle flap reconstruction during parotidectomy to prevent Frey's syndrome and facial contour deformity. *Ear Nose Throat J* 2005;**84**:173–6
6 Bonanno P, Palaia D, Rosenberg M, Casson P. Prophylaxis against Frey's syndrome in parotid surgery. *Ann Plast Surg* 2000;**44**:498–501
7 Taylor S, Yoo J. Prospective cohort study comparing subcutaneous and sub-superficial musculoaponeurotic system flaps in superficial parotidectomy. *J Otolaryngol* 2003;**32**:71–6
8 Ahmed O, Kolhe P. Prevention of Frey's syndrome and volume deficit after parotidectomy using the superficial temporal artery fascial flap. *Br J Plast Surg* 1999;**52**:256–60
9 Cesteleyn L, Helman J, King S, Van de Vyvere G. Temporoparietal fascia flaps and superficial musculoaponeurotic system plication in parotid surgery reduces Frey's syndrome. *J Oral Maxillofac Surg* 2002;**60**:1284–97
10 Elliott R, Weinstein G, Low D, Wu L. Reconstruction of complex total parotidectomy defects using the free anterolateral thigh flap: a classification system and algorithm. *Ann Plast Surg* 2011;**66**:429–37
11 Valentini V, Cassoni A, Marianetti TM, Battisti A, Terenzi V, Iannetti G. Anterolateral thigh flap for the reconstruction of head and neck defects: alternative or replacement of the radial forearm flap? *J Craniofac Surg* 2008;**19**:1148–53
12 Dulguerov P, Quinodoz D, Cosendai G, Piletta P, Marchal F, Lehmann W. Prevention of Frey syndrome during parotidectomy. *Arch Otolaryngol Head Neck Surg* 1999;**125**:833–9
13 Sachsman S, Rice D. Use of AlloDerm implant to improve cosmesis after parotidectomy. *Ear Nose Throat J* 2007;**86**:512–13
14 Sinha U, Saadat D, Doherty C, Rice D. Use of AlloDerm implant to prevent Frey syndrome after parotidectomy. *Arch Facial Plast Surg* 2003;**5**:109–12
15 Nosan D, Ochi J, Davidson T. Preservation of facial contour during parotidectomy. *Otolaryngol Head Neck Surg* 1991;**104**:293–8
16 Harada T, Inoue T, Harashina T, Hatoko M, Ueda K. Dermis-fat graft after parotidectomy to prevent Frey's syndrome and the concave deformity. *Ann Plast Surg* 1993;**31**:450–2
17 Curry J, Fisher K, Heffelfinger R, Rosen M, Keane W, Pribitkin E. Superficial musculoaponeurotic system elevation and fat graft reconstruction after superficial parotidectomy. *Laryngoscope* 2008;**118**:210–15
18 Conger B, Gourin C. Free abdominal fat transfer for reconstruction of the total parotidectomy defect. *Laryngoscope* 2008;**118**:1186–90
19 de Bree R, van der Waal I, Leemans C. Management of Frey syndrome. *Head Neck* 2007;**29**:773–8
20 Luna-Ortiz K, Sansón-RíoFrío J, Mosqueda-Taylor A. Frey syndrome. A proposal for evaluating severity. *Oral Oncol* 2004;**40**:501–5
21 Mohammed F, Asaria J, Payne R, Freeman J. Retrospective review of 242 consecutive patients treated surgically for parotid gland tumours. *J Otolaryngol Head Neck Surg* 2008;**37**:340–6
22 Linder T, Huber A, Schmid S. Frey's syndrome after parotidectomy: a retrospective and prospective analysis. *Laryngoscope* 1997;**107**:1496–501
23 Owen E, Banerjee A, Kissin M, Kark A. Complications of parotid surgery: the need for selectivity. *Br J Surg* 1989;**76**:1034–5
24 Clayman M, Clayman S, Seagle M. A review of the surgical and medical treatment of Frey syndrome. *Ann Plast Surg* 2006;**57**:581–4
25 Bray D, Hopkins C, Roberts D. A review of dermal fillers in facial plastic surgery. *Curr Opin Otolaryngol Head Neck Surg* 2010;**18**:295–302
26 Neuber G. Fat transplantation [in German]. *Chir Kongr Verhandl Dtsch Gesellsch Chir* 1893;**22**:66
27 Boyce R, Nuss D, Kluka E. The use of autogenous fat, fascia, and nonvascularized muscle grafts in the head and neck. *Otolaryngol Clin North Am* 1994;**27**:39–68
28 Ersek R. Transplantation of purified autologous fat: a 3-year follow-up is disappointing. *Plast Reconstr Surg* 1991;**87**:219–27
29 Matsudo P, Toledo L. Experience of injected fat grafting. *Aesthetic Plast Surg* 1988;**12**:35–8
30 Pinski K, Roenigk HJ. Autologous fat transplantation. Long-term follow-up. *J Dermatol Surg Oncol* 1992;**18**:179–84
31 Fontdevila J, Serra-Renom J, Raigosa M, Berenguer J, Guisantes E, Prades E *et al*. Assessing the long-term viability of facial fat grafts: an objective measure using computed tomography. *Aesthet Surg J* 2008;**28**:380–6
32 Witt R. The significance of the margin in parotid surgery for pleomorphic adenoma. *Laryngoscope* 2002;**112**:2141–54
33 Casler J, Conley J. Sternocleidomastoid muscle transfer and superficial musculoaponeurotic system plication in the prevention of Frey's syndrome. *Laryngoscope* 1991;**101**:95–100
34 Bonanno P, Casson P. Frey's syndrome: a preventable phenomenon. *Plast Reconstr Surg* 1992;**89**:452–6
35 Allison G, Rappaport I. Prevention of Frey's syndrome with superficial musculoaponeurotic system interposition. *Am J Surg* 1993;**166**:407–10
36 Taylor S, Yoo J, Matthews T, Lampe H, Trites J. Frey's syndrome and parotidectomy flaps: a retrospective cohort study. *Otolaryngol Head Neck Surg* 2000;**122**:201–3
37 Wille-Bischofberger A, Rajan G, Linder T, Schmid S. Impact of the SMAS on Frey's syndrome after parotid surgery: a prospective, long-term study. *Plast Reconstr Surg* 2007;**120**:1519–23
38 Teknos T, Nussenbaum B, Bradford C, Prince M, El-Kashlan H, Chepeha D. Reconstruction of complex parotidectomy defects using the lateral arm free tissue transfer. *Otolaryngol Head Neck Surg* 2003;**129**:183–91
39 Rappaport I, Allison G. Superficial musculoaponeurotic system amelioration of parotidectomy defects. *Ann Plast Surg* 1985;**14**:315–23
40 Arden R, Miguel G. Aesthetic parotid surgery: evolution of a technique. *Laryngoscope* 2011;**121**:2581–5
41 Kornblut A, Westphal P, Miehlke A. A reevaluation of the Frey syndrome following parotid surgery. *Arch Otolaryngol* 1977;**103**:258–61
42 Athavale S, Phillips S, Mangus B, Datta J, Sinard R, Netterville J *et al*. Complications of alloderm and dermamatrix for parotidectomy reconstruction. *Head Neck* 2012;**34**:88–93

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