








ORIGINAL ARTICLE

SMAS flap for extracapsular dissection of parotid gland tumors: is it necessary?



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HIGHLIGHTS

- SMAS separate the cutaneous and subcutaneous layer from the parotid tissue.
- There are no differences between who received SMAS and who did not.
- Gender, localization, and facial palsy are related with the aesthetic satisfaction.

KEYWORDS

SMAS flap;
Frey syndrome;
Auriculotemporal
nerve syndrome;
Parotid tumor;
Extracapsular
dissection

Abstract

Objective: The aim of this retrospective article is to evaluate postoperative outcomes after extracapsular dissection for small benign superficial parotid neoplasms (<3 cm) in patients who received Superficial Musculoaponeurotic System (SMAS) flap and in patients who did not receive it.

Methods: Two groups were created and statistically compared regarding Frey's syndrome and aesthetic satisfaction by data collected through the POI-8 validated questionnaire and through an aesthetic satisfaction scale ranging from 1 to 10. The difference between these two groups was the utilization of SMAS flap. SMAS flap was harvested in one of these two group, meanwhile was not used in the other.

Results: The p-value analysis between group 1 and group 2 on these complications, resulted statistically not significant. Also, the aesthetic satisfaction resulted not statistically significant between group 1 and group 2. Gender, localization, and facial palsy resulted statistically correlated with the aesthetic satisfaction (p -value < 0.05).

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Conclusion: In conclusion, there is no statistical difference in the use of SMAS flap for benign parotid neoformations of the superficial lobe, with a diameter of less than 3 cm for which extracapsular dissection is adopted as a surgical technique.

Level of evidence: 3.

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Introduction

Benign tumours of the parotid gland represent 60%–80% of all salivary glands' tumours.¹ Historically, the preferred surgical treatment for benign parotid tumours has been superficial parotidectomy.² Instead, in the last years, extracapsular dissection has been preferred as treatment of choice for benign masses of the superficial portion of the parotid gland with a diameter of less than 3 cm.³ Both superficial parotidectomy and extracapsular dissection are not free from complications: in fact, depression of the skin, salivary fistula, transient or persistent facial nerve paralysis, capsular rupture and Frey's syndrome are widely reported in international literature.^{3–7} For small benign masses of the superficial parotid's portion, extracapsular dissection has been adopted to reduce these surgical complications, obtaining lower rate of complications than superficial parotidectomy.^{3–6} Frey Syndrome (FS) or auriculotemporal nerve syndrome was described for the first time by Lucy Frey in 1923⁸ as the appearance of redness, sweating and heat in the parotid region following a salivary stimulus. It is caused by an aberrant regeneration of injured secretomotor parasympathetic fibres of the auriculotemporal nerve after parotidectomy.^{9,10} Thanks to the use of Superficial Musculoaponeurotic System (SMAS) flap developed by Owsley,¹¹ there has been reduction of cosmetic and functional postparotidectomy complications.¹² In fact, the SMAS flap is a biological barrier capable of separate the cutaneous and subcutaneous layer from the underlying parotid tissue and

can also be used for filling the cavity formed after the tumor removal.¹³ Although the use of the SMAS flap for superficial parotidectomy have been widely discussed in literature, it has not been analysed as much for small parotid masses for which an extracapsular dissection can be performed.^{14–16}

The aim of this retrospective article is to evaluate postoperative outcomes after extracapsular dissection for small benign parotid neoplasms (<3 cm) in patients who received SMAS flap and in patients who did not receive it.

Methods

A multi-institutional retrospective study is presented. All patients who presented for evaluation and management of benign tumours of the parotid gland between 2004 and 2008 at two different Italian institutions were eligible for study enrolment. For being enrolled in this study, patients had to meet the following inclusion criteria: (1) Diagnosis of benign parotid tumour; (2) Extracapsular dissection performed; (3) Complete clinical preoperative and postoperative documentation; no previous parotid surgeries; (4) SMAS flap reconstruction for group 1 and no SMAS flap reconstruction for group 2; (5) Surgery performed by senior surgeons with experience in salivary glands surgery.

Two groups were created and statistically compared regarding Frey's syndrome and aesthetic satisfaction. The difference between these two groups was the utilization of SMAS flap. SMAS flap was harvested in one of these two

QUESTIONNAIRES

POI-8

If you have had any of these complications, how much would you rate the severity in a range 0-5?

4. Change in facial appearance due to glandular tissue loss	0	1	2	3	4	5
5. Frey's syndrome	0	1	2	3	4	5

0 = no problem 5 = very much

AESTHETIC SATISFACTION

How good was the aesthetic outcome?

1 2 3 4 5 6 7 8 9 10

1 = very bad 10 = excellent

Fig. 1 Questionnaires used for the assessment of Frey's Syndrome and aesthetic satisfaction.

group, meanwhile was not used in the other. The decision on the use of SMAS flap was related to the surgeon who performed surgery.

From these two groups, the presence and the severity of the Frey's syndrome and of skin depression due to glandular tissue loss and its related aesthetic satisfaction were analysed by data collected through the POI-8 validated questionnaire (specifically through questions n. 4 and n. 5¹⁷ and through an aesthetic satisfaction scale ranging from 1 to 10 (Fig. 1). Both questionnaires were given to patients before surgery, at 1 month from the surgery and at 1 year post surgery.

Data were recorded in a dedicated Excel file. Statistical analysis was performed using the software R. Descriptive statistics recorded absolute and relative frequencies for categorical data, mean and standard deviation for continuous quantitative variables. Bivariate analysis was performed, using two-tailed Student *t*-test for quantitative variables and Chi-Square test for categorical data. The type of surgical treatment was used as primary predictor variable (SMAS flap vs. no SMAS flap). The primary outcome variables were the post-operative Frey syndrome assessment and the post-operative surgical site depression due to loss of tissue assessment. The secondary outcome variables included the post-surgical aesthetic satisfaction, the stupor assessment reported by the patient, and the size of the lesion. The level of significance was set at $\alpha = 0.05$.

Results

Clinical documentation of 290 patients was analysed. Of these, 82/290 patients met all the inclusion criteria and formed the sample group. Patients were then divided in two groups: the first group (50 patients) with patients who received the SMAS flap; the second group (32 patients) with patients who did not. The excluded patients (208) did not match all the inclusion criteria (48 malign neoplasms, 16 relapses, 78 > 3 cm, 66 without a complete clinical documentation).

Data from 82 patients were collected (as resumed in Table 1): 40 males and 42 females. The mean age was 45.34 (range 27–68). In 24% of patients, lesions were located in the lower pole, and in the remaining 76% were located in the upper pole. The average size of neoplasms was 1.83 cm (ranged 0.8–3 cm). The first analysis was carried out on the number of complication that onset after surgery: Frey syndrome, skin depression due to glandular tissue loss and the facial nerve injury. A total of 7 patients complained with Frey syndrome (3 from group 1 and 4 from group 2), 7 patients complained with skin depression (4 from group 1 and 3 from group 2) and 10 patients reported a facial nerve transient palsy, fully recovered after 1 year (5 patients from each group). Analysing POI-8 questionnaire results, we obtained the average perception of the severity of each complication. Finally, we evaluated the overall aesthetic satisfaction at one year after surgery between group 1 and group 2. We performed the analysis between the groups and obtained the following results: in group 1 Frey syndrome had a mean severity score of 3.3 and the skin depression had a mean severity score of 1.0. In group 2 Frey syndrome had a mean severity score of 3.0 and

the skin depression had a mean severity score of 1.3. The *p*-value analysis between group 1 and group 2 on these complications, resulted statistically not significant (Table 2). Also, the aesthetic satisfaction resulted not statistically significant between group 1 and group 2.

Finally, statistical analysis was performed on the continue variable (aesthetic satisfaction). Gender, localization, and facial palsy were used as discriminant. These three factors resulted statistically correlated with the aesthetic satisfaction (*p*-value < 0.05). In fact, resulted that the patients with lesions on the upper pole had worse aesthetic satisfaction than the one with lesions on the lower pole (*p*-value = 0.0090). Concerning about the gender resulted that males were less satisfied than females (*p*-value = 0.0050). Finally, patients with transient facial nerve palsy had values of aesthetic satisfaction lower than the other (*p*-value = 0.033).

Discussion

Pleomorphic Adenoma (PA) is a benign tumour and is considered the most common salivary gland neoplasm, although in some recent papers, the incidence of Warthin's tumour surpassed the incidence of PA. It accounts for about 60% of all salivary gland neoplasms and involves major salivary glands in 85% of cases and minor salivary glands in 15%. It is known as a mixed tumour, because of its dual origin from epithelial and myoepithelial elements. In contrast to myoepithelioma (firstly described as a variant of the PA), a PA can present as a chondroid or an osteoid formation. It mostly occurs in the superficial lobe of parotid glands. Fourth to fifth decades of life are mostly affected, but it can occur over a wide age range.^{3,6,18–20} Ultrasonography (US) is a low-cost modality with high sensitivity in detecting masses in the superficial lobe of the parotid gland. Its inability to show part of the deeper parotid lobe is overcome by Computerized Tomography (CT) and/or Magnetic Resonance Imaging (MRI) which can be particularly useful, as complementary studies, for correct surgical planning. In our institutions CT is used only for patients who cannot undergo to an MRI. Fine-Needle Aspiration Biopsy (FNAB) is also indicated by some Authors.^{21–23} The current mainstay of treatment for benign parotid neoplasms is surgical excision.^{24,25} Surgery begins with the preauricular incision extended cervically. At this point it is possible to prepare two distinct layers, skin and SMAS, as well as include them in a single layer. The SMAS is a layer of muscle fibre and connective tissue located between skin and parotid fascia. It continues anteriorly with the zygomatic muscles; above with the temporo-parietal fascia and below with platysma muscle. The SMAS flap dissection begin with a horizontal incision 1 cm below the zygomatic arch and continues with a vertical incision in the preauricular region, up to the platysma muscle, 5 cm from the bottom of the mandibula. Once the SMAS flap has been harvested, surgery of the parotid gland become challenging because of the VII cranial nerve, which emerges at the stylomastoid foramen, enters the gland, and branches out inside the parotid gland, defining the superficial and the deep lobe. It often must be identified and dissected when performing parotidectomy. Many Authors sustain that in some cases of extracapsular dissection, the identification and dissection along the facial

Table 1 Patients demographic data.

	Name	Sex	Age	Mass dimension (cm)	Localization	SMAS flap
1	F.G.	F	42	2.5	Sup.	Yes
2	S.G.	F	37	1.7	Sup.	Yes
3	M.V.	M	51	3	Sup.	Yes
4	R.R.	F	48	1.2	Inf.	Yes
5	C.T.	F	31	1.6	Inf.	Yes
6	M.T.F.	F	57	2.1	Sup.	Yes
7	A.P.	M	52	1.4	Sup.	Yes
8	L.C.	F	29	1.3	Inf.	Yes
9	S.R.	F	32	2.1	Inf.	Yes
10	I.A.	F	41	1.7	Sup.	Yes
11	S.C.	M	48	1.3	Sup.	Yes
12	F.V.	M	49	1	Sup.	Yes
13	J.C.D.C.	F	38	1.2	Sup.	Yes
14	L.R.	M	32	1.2	Sup.	Yes
15	G.M.	M	35	1.5	Sup.	Yes
16	N.S.	F	32	2.7	Sup.	Yes
17	A.P.	M	51	0.9	Inf.	Yes
18	E.S.	M	54	1.8	Inf.	Yes
19	M.G.C.	F	58	1.7	Sup.	Yes
20	A.A.	F	60	1.7	Sup.	Yes
21	A.P.	F	48	1.5	Sup.	Yes
22	R.R.	F	60	1.5	Sup.	Yes
23	S.C.	F	52	1.5	Sup.	Yes
24	F.B.	M	55	1.4	Sup.	Yes
25	F.M.B.	F	30	1.9	Sup.	Yes
26	M.S.	F	36	1.2	Sup.	Yes
27	M.D.C.	F	58	2.8	Sup.	Yes
28	D.G.	F	40	1.5	Sup.	Yes
29	G.D.S.	M	62	2.9	Sup.	Yes
30	M.L.P.	F	51	1.9	Sup.	Yes
31	E.S.	M	47	2	Sup.	Yes
32	D.C.	M	48	3	Sup.	Yes
33	M.S.	F	60	2.2	Sup.	Yes
34	A.B.	M	68	0.8	Sup.	Yes
35	A.D.	M	54	1.5	Sup.	Yes
36	A.F.	M	28	1.3	Sup.	Yes
37	V.F.	M	30	2.4	Sup.	Yes
38	C.C.	F	55	2.2	Sup.	Yes
39	F.D.N.	M	40	2	Sup.	Yes
40	A.T.	F	27	2	Inf.	Yes
41	A.S.	M	64	1	Sup.	Yes
42	M.P.	F	58	1.5	Sup.	Yes
43	F.P.	M	31	1.7	Sup.	Yes
44	V.S.	M	28	1.9	Inf.	Yes
45	E.G.	F	34	2.1	Sup.	Yes
46	A.V.	M	47	2	Sup.	Yes
47	L.B.	M	52	1.4	Sup.	Yes
48	F.R.	M	53	1.8	Sup.	Yes
49	L.T.	M	43	2.7	Sup.	Yes
50	F.F.	M	62	1.6	Sup.	Yes
51	L.N.	M	61	1.3	Inf.	No
52	S.A.	M	41	2.7	Sup.	No
53	T.N.	F	56	2.2	Inf.	No
54	W.H.	F	48	1.8	Sup.	No
55	I.A.	M	38	2.4	Sup.	No
56	D.R.	F	42	1.2	Inf.	No
57	P.P.	F	56	1.8	Sup.	No

Table 1 (Continued)

	Name	Sex	Age	Mass dimension (cm)	Localization	SMAS flap
58	E.R.	M	53	2.3	Inf.	No
59	L.L.	M	44	1.9	Sup.	No
60	I.S.	M	29	1.4	Sup.	No
61	T.P.	F	42	1	Inf.	No
62	F.G.	F	38	2.5	Inf.	No
63	J.K.	M	56	2.2	Sup.	No
64	S.T.	F	31	1.2	Sup.	No
65	G.B.	F	44	1.6	Sup.	No
66	P.L.	M	28	3	Sup.	No
67	F.R.	F	56	1.6	Inf.	No
68	C.V.	M	39	0.8	Sup.	No
69	F.G.	M	44	2.1	Inf.	No
70	Q.V.	F	58	2.4	Sup.	No
71	N.M.	M	41	2.8	Sup.	No
72	G.G.	F	43	1	Sup.	No
73	S.S.	F	34	1.9	Inf.	No
74	B.N.	F	67	3	Sup.	No
75	T.O.	F	34	0.9	Inf.	No
76	F.E.	M	41	1.6	Sup.	No
77	P.O.	M	49	2.2	Sup.	No
78	A.D.	F	33	2.2	Sup.	No
79	B.V.	M	29	2.7	Inf.	No
80	N.M.	F	36	1.1	Inf.	No
81	R.R.	M	42	2.6	Sup.	No
82	B.N.	F	67	2	Sup.	No

Table 2 p-values of Frey's Syndrome, Facial nerve transient palsy and loss of glandular tissue between patients who received SMAS flap and patients who did not during extracapsular dissection of parotid benign, small, superficial neoplasm.

Complications	Severity Score	Surgery technique		p-value
		Group 1	Group 2	
Frey's Syndrome	0	47	28	0.568
	1	0	0	
	2	2	0	
	3			
	4			
	5			
Facial nerve transient palsy	Yes	5	5	0.501
	No	45	27	
Loss of tissue	0	46	29	0.631
	1	4	2	
	2	0	1	
	3	0	0	
	4	0	0	
	5	0	0	

nerve can be avoided. At our institutions we believe that even in cases of extracapsular dissection of PA, the nerve should be identified, and dissection performed along its branches close to the mass to avoid permanent damage to the nerve itself. In fact, one of the major complications of the extracapsular dissection is the permanent palsy of some of the branches of the nerve. In our study, in support of this, we report a high number of transient paralyses, compared

to no cases of permanent palsy of the facial nerve. Surgery proceeds with the removal of the mass included in a rim of parotid gland tissue. After the procedure is completed, SMAS flap can then be used to reconstruct the surgical site, by a suture to the zygomatic periosteum and parotid-masseteric fascia.^{11,12} Even in the presence of normal anatomy and normal surrounding parotid tissue, dissection of the branches of the facial nerve requires patience and special attention both

to detail and to landmarks.²⁶ When the course of a nerve is distorted and attenuated by a tumour, preservation of facial nerve fibres can be very difficult. Experience shows that most of the primary salivary tumours of the parotid are found directly adjacent to at least one branch of the facial nerve, and rarely, if ever, will the surgeon feel that dissection of the nerve has been useless; also, for these reasons, we believe that the most conservative operation should be extracapsular dissection with the identification and dissection along the nerve's branches adjacent to the mass. Furthermore, in the event of recurrence, the risk to the facial nerve increases exponentially, particularly in the relatively frequent event of a multi-nodular relapse of a pleomorphic adenoma.²⁷ Enucleation alone is, therefore, inadequate for tumours of the parotid gland, on account both increased risk of facial nerve lesions and the increased risk of recurrence. Some Authors believe that the only exception to this rule could be Warthin's tumours especially when presenting posterior to the facial nerve.²⁸ In all other cases many Authors adopt superficial parotidectomy as a gold standard for every parotid mass. Superficial parotidectomy, however, is not free from complications. We can include, for example, the presence of an unsightly scar especially in women and other functional complications such as Frey's syndrome, facial paralysis, haematoma, and fistula. For this reason, the introduction of the face-lift by Appiani and Delfino in 1984²⁹ produces less skin scarring. This surgical approach alone, however, cannot eliminate the depression of the skin after the removal of a tumour. The removal of the tumour leaves a cavity which results in a facial asymmetry with unpleasant aesthetic outcomes. Furthermore, the lack of interface between the muscle-aponeurotic residual parenchyma and skin predisposes to the onset of salivary fistula and Frey Syndrome. Frey's syndrome or auriculotemporal nerve syndrome was described for the first time by Lucy Frey in 1923⁸ and is characterised by the appearance of redness, pain, sweating and heat in the parotid region following gustatory stimulus. This is caused by an abnormal post-parotidectomy reinnervation of the auriculotemporal nerve that eventually causes improper innervation to the sweat glands of the skin. To prevent this type of syndrome, a barrier must be formed between the postganglionic parasympathetic nerve fibres and sweat glands of skin flap, thereby preventing this type of connection.^{9,10,12,30-32} The percentage of this syndrome in the literature varies widely. This could be due to the fact that most of the time there is a late onset of this syndrome compared to the short-term post-operative follow-up reported. The studies about the prevention of Frey syndrome were all focused on the reliquates after superficial parotidectomy intervention. In our study we instead focused on the extracapsular dissection intervention. Specifically, we aimed to investigate the usefulness of the SMAS flap after extracapsular dissection of small parotid tumors. The data used for this study were taken from two Italian hospitals, but unfortunately, they are scarce due to the strict inclusion criteria adopted. In fact, it should be considered that only patients treated surgically by senior surgeons with experience in salivary gland surgery were taken into consideration, and only patients with a long follow-up period. Therefore, we urge other centers to publish their cases way to enrich the international literature and also we are continuing to

collect data to be able to expand our studies on this topic in the future.

Although the very small number of patients of our study, the results highlighted very useful data. In particular it resulted that there are no statistical differences between patients who received SMAS flap and those who did not. To note that highest values of aesthetic satisfaction were collected in the group that received the SMAS flap. Is interesting underlying that, according to other studies, males patients mostly complained of less aesthetic satisfaction.³ Also, the localization of the neof ormation in the upper pole was found to be more influential in terms of aesthetic satisfaction, perhaps due to the smaller presence of subcutaneous tissue that could be used to mask the defect.

Conclusion

In conclusion, can be stated that, according to the results of this study, there is no statistical difference in the use of SMAS flap for benign parotid neof ormations of the superficial lobe, with a diameter of <3 cm for which extracapsular dissection is adopted as a surgical technique.

Authors' contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Ettore Lupi, Fabrizio Bozza, Flavia Maesa, and Alessandro Piccirilli. The first draft of the manuscript was written by Valerio Facchini, Walter Colangeli and Edoardo Covelli. The article was supervised by Roberto Becelli and Filippo Giovannetti, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Conflicts of interest

The authors declare no conflicts of interest.

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The number of authors exceed seven because on this study each listed author, contributed to the conception and design as stated in the following "Conflict of Interest Statement".

Informed consent was obtained from all patients in the study.

The authors confirm that the data supporting the findings of this study are available within the article.

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