The platysma myocutaneous flap (PMF) for head and neck reconstruction: A retrospective and multicentric analysis of 91 T1–T2 patients

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ABSTRACT

The platysma myocutaneous flap (PMF) was first applied to intraoral reconstructions in 1978. PMF is not only an alternative to microvascular flaps but it also represents an excellent reconstructive choice especially in cases where free tissue transfer cannot be carried out.
Failure and complications rate have been described as varying from 18 to 45% and this is why this flap should not be used in specific cases such as in the presence of cervical metastases and in cases of mandibulectomy and simultaneous reconstruction with alloplastic materials.
The purpose of this study is to examine the experience and results obtained in three different and independent institutes where PMF has been adopted in 91 patients for head and neck cancer reconstructions.
The authors report their departments' separate but simultaneous experiences with PMF for small and middle-size soft tissue defects in a 10-year period.

INTRODUCTION

The platysma myocutaneous flap (PMF) was first used for intraoral reconstruction in 1978 by Futrell (Futrell et al., 1978). The increasing use of microvascular free tissue transfer has led to this flap being used less often, even though it provides satisfactory results with an acceptable level of morbidity. Surgeons' experience over the years has shown that microvascular flaps are not always appropriate, and the PMF is not only an alternative to microvascular flaps but it also represents an excellent reconstructive choice in some cases.
The PMF is readily available, easy to harvest, thin and pliable, promoting three dimensional reconstruction, and there is a limited donor site morbidity with primary closure of the neck (Futrell et al., 1978, Cannon et al., 1982, Coleman et al., 1983, Hurwitz et al., 1983, Ruark et al., 1993, Esclamado et al., 1994 and Koch, 2002). It is large enough to close most head and neck ablative defects up to 70 cm^2 and no special equipment is required (Koch, 2002).
The main limitations of the PMF include its lack of bulk and a partial dependence on the facial artery. The historic recommendation was that of avoiding this flap if a previous neck dissection had been performed or in case the facial artery needed to be ligated (Persky et al., 1983). However McGuirt et al. were the first to reject this and demonstrated significant collateral flow (McGuirt et al., 1991).
When considering complications that can occur when adopting this technique, one has to include total or partial necrosis of the skin island, fistula, dehiscence, haematoma and cellulitis with rates ranging from 18 to 45% (Cannon et al., 1982, Conley et al., 1986, Esclamado et al., 1994, Verschuur et al., 1998 and Szudek and Taylor, 2007).
The purpose of this report is to examine the experience and results obtained in three different and independent institutes where a PMF has been used in 91 patients for head and neck cancer

reconstruction. All of the participating institutes normally carry out and use diverse flap techniques and usually perform microsurgery as well, but here we report our experiences using PMF in patients in which free flaps could not be used.
The authors have reported their departments' separate but simultaneous experiences with PMF for small and middle-size soft tissue defects over a 10-year period.

MATERIALS AND METHODS

Ninety-one (91) non-consecutive patients were retrospectively evaluated by collecting data from three different institutes during the period from 1996 to 2005. Forty-six (46) patients underwent surgery at the Department of Oral and Maxillofacial Surgery of San Giovanni Battista Hospital (University of Turin Hospital, Turin, Italy). Thirty (30) patients were treated at the Department of Otolaryngology of San Giovanni Battista Hospital (University of Turin Hospital, Turin, Italy) and 15 patients at the Department of Otolaryngology of San Giovanni Bosco Hospital in Turin, Italy.
Clinical information was collected from 91 complete patients' records. All subjects were hospitalized for a primary tumour and the residual defects were reconstructed with platysma myocutaneous flaps (PMF).
A global database was created to ensure correct and appropriate data collection. These included general information about the patient, type of tumour, tumour site and stage, type of surgery, adjuvant radiotherapy, complications, healing and follow-up.
Among the patients, 56 were male and 35 were female. Patients' ages ranged from 34 to 77 years.
In this study only T1 and T2 tumours have been included, with clinical N0 neck disease. Eighty (80) tumours were diagnosed as Oral Squamous Cell Carcinoma (OSCC), five tumours as Oral Verrucous Carcinoma (OVCC), four tumours as Oral Leukoplakia OIN III, one tumour was a malignant Composite Hemangioendothelioma (CHE) and one case was diagnosed as Adenocystic Carcinoma.
The PMFs were used to restore small and middle-size soft tissue defects of ventral tongue-floor of the mouth (21 cases), buccal mucosa-trigonum (10 cases), pure buccal mucosa only (13 cases), floor of the mouth only (27 cases), lower jaw gingiva-floor of the mouth (16 cases), tongue (one case) and cheek (three cases).
In our series the use of the PMF was limited to previously non-irradiated patients in whom ipsilateral neck dissection was performed and the facial artery and internal jugular vein were preferably preserved. In particular, the facial artery on PMF side was sacrificed in 35 patients (38.46%) while internal jugular vein and external carotid artery were always preserved (Table 1).

Table 1.

This table shows the site of defect, the number of patients in which the facial artery is saved/ligated, the number and type of complications and the number of patients who underwent radiation therapy.

Site of defect	Total no.	Facialartery		Complicationsrelated to the flap		Othercomplications		RT
		Saved	Legated	Full loss	Skinloss	Fistula	Facialnerveparalysis	
FOM	27	20	7	3	2	1	19	8
Ventraltongue/FOM	21	8	13	5	4	1	16	9
Gingiva/FOM	16	9	7	1	1	–	12	6
Buccal	13	10	3	2	–	–	7	8

Site of defect	Total no.	Facialartery		Complicationsrelated to the flap		Othercomplications		RT
		Saved	Legated	Full loss	Skinloss	Fistula	Facialnerveparalysis	
Buccal/Trigonum	10	6	4	1	2	–	7	4
Cheek	3	2	1	–	1	–	2	3
Tongue	1	1	–	–	–	–	–	
Total	91	56	35	12	10	2	63	38

FOM: floor of the mouth.

Thirty-eight (38) patients underwent postoperative radiotherapy.

A PMF, superiorly or posteriorly-based, was prepared before tumour resection, with or without neck dissection. The incision line was often linked to that for neck dissection and the flap was usually prepared and raised prior to neck dissection. Flap size was designed according to the intraoral defect. After tumour resection, the flap was rotated onto the recipient site and the donor site was always primarily closed. Our three groups performed two different types of PMF rotation: an external flap rotation to reconstruct the cheek, and an internal rotation for reconstruction of the floor of the mouth, tongue and gingiva. Particular attention was paid in suturing the skin island to the muscle and in not stretching the flap during its harvesting.

RESULTS

There were no perioperative deaths. Sixty-nine (69) patients (75.8%) encountered no problems during wound healing process. The flaps were well vascularized and the patients were able to resume oral feeding without swallowing disorders within 15 days.

Flap-related complications were observed in 22 cases (24.2%). Full loss of the flap occurred in 12 patients (13%): six of these healed by secondary intention within 1 month, two cases developed a fistula requiring minor surgical revision under local anaesthesia, one case required surgical revision and reconstruction with local flaps and three cases required a pectoralis major myocutaneous flap.

Partial skin loss occurred in 10 patients (11%). In these cases healing occurred by secondary intention that resulted in an excellent re-epithelialization because of the good blood supply from adjacent tissues. These complications required prolonged nasogastric nutrition for 15 days longer than average.

The facial artery on the side of the PMF was sacrificed in 35 patients but this led to flap loss in only three cases.

Sixty-three (63) patients developed a paralysis of the marginal mandibular nerve after a PMF.

Thirty-eight (38) patients had to undergo postoperative radiation therapy (RT) with no local complications by the end of the treatment. Adequate mouth opening was maintained and oral feeding was continued throughout.

In 10 out of 16 cases with reconstructed gingiva, the PMF was conformed in order to restore oral function with dental prostheses. In this site, PMF healing results may be compared to those described with forearm free flaps in the same area, but only if there is some extra support. The PMF is a flap which requires either alveolar bone (in the case of gingiva reconstruction) or buccinator muscle support (in cheek reconstruction), and is less reliable for reconstruction of softer tissues (i.e. floor of the mouth). This is because pedicled flaps may generally encounter partial necrosis and therefore have a higher risk of fistulisation as opposed to free flaps. This means that a forearm free flap gives overall better results in ‘non-supported’ sites because of its lower risk of local

complication. Where there is bony support a PMF remains a good choice because secondary healing over underlying bone or muscle still gives satisfactory results. Performing a PMF after mandibulectomy and simultaneous reconstruction by means of alloplastic materials may lead to incomplete healing and to an increase in failure rates since granulation would not take place effectively.
Twenty-seven patients who underwent floor of the mouth reconstruction (100%) and 27 patients with a reconstructed tongue (100%) showed adequate speech and swallowing functions with no further need for speech therapy follow-ups.
In one case a PMF was successfully folded (double-paddle skin island) for full thickness reconstruction of the cheek (skin and mucosa) after ablation of a malignant Composite Hemangioendothelioma (CHE).
All reconstructed cheeks showed no limitation of mouth opening (all patients were instructed to 'exercise' on a frequent basis like all other patients who underwent radiation therapy).

No local recurrences or cervical node metastases were found postoperatively with a 5-year follow-up (Table 2).

Table 2.

Rate of necrosis in largest case studies.

Study	Number of cases	Rate of PMF necrosis
Futrell et al. (1978)	14	7.1%
Coleman et al. (1983)	24	29.2%
Cannon et al. (1982)	22	16.7%
Ruark et al. (1993)	41	7.6%
Verschuur et al. (1998)	44	2.3%
Koch (2002)	34	17.6%
Peng et al. (2005)	48	6.25%
Presentstudy	91	13%

In all cases of neck dissection there was no clinical or radiological evidence of cervical metastases.

DISCUSSION

The goal of reconstruction is restoration of form and function to allow a good quality of life. Oral and facial reconstruction after ablative surgery may be achieved in a variety of ways including skin grafts, pedicled myocutaneous flaps and free flaps. Flap choice is related to the patient's condition and to the surgeon's experience and ability.
In the literature, pedicled flaps can be used for medium-size intraoral reconstruction following oral cancer resection. As one of the cervical pedicled flaps, the platysma myocutaneous flap (PMF) was first used for intraoral reconstruction in 1978 (Futrell et al., 1978). This flap offers many advantages: it is thin and pliable, easy to harvest; its location near to the oral cavity allows reconstruction of many intraoral areas including defects of the pharynx, hypopharynx, lower lip and ear (Cannon et al., 1982, Hurwitz et al., 1983, Ruark et al., 1993 and Ariyan, 1997). The disadvantages of the PMF are few, but this flap has not gained widespread acceptance probably due to a lack of its reliability and to a high rate of complications (18–45%). These may include total or

partial necrosis of the skin island, fistula, dehiscence, haematoma and cellulitis (Coleman et al., 1983, Conley et al., 1986, Esclamado et al., 1994, Verschuur et al., 1998 and Szudek and Taylor, 2007).

The blood supply to the PMF has been well described in the past (Kocer et al., 2005). The primary supply derives from the submental artery which branches from the facial artery; additional blood supply comes inferiorly from the cervical transverse vessels, medially from thyroid vessels and laterally from the occipital and posterior auricular vessels. The submental artery has a significant number of anastomoses with the ipsilateral and controlateral mental, labial and sublingual arteries (Rabson et al., 1985 and Uehara et al., 2001) and the blood supply has thus been called "multi-axial" (Ruark et al., 1993).

Because the blood supply to the skin island does not strictly depend on musculo cutaneous perforating vessels, this flap is mostly fascio cutaneous with little muscle. In patients with a thin platysma however, the flap may be technically difficult to set up.

In the past it was recommended to avoid this flap if a previous neck dissection has been performed or if the facial artery has been ligated (Persky et al., 1983).

As pointed out by Uehara et al. the reason for the flap success, in cases which the facial artery was ligated, is the retrograde flow from the distal submental artery anastomoses to either the lingual artery, or the contralateral facial artery (Uehara et al., 2001).

Although there may be some variants in harvesting this flap, in this series different surgeons have used the posteriorly based platysma flap when the sternocleidomastoid muscle, occipital artery and the inferior part of the external jugular vein were preserved (SOHND-supraomohyoid neck dissection and SHND-suprahyoid neck dissection) (Cannon et al., 1982, Coleman et al., 1983, Ariyan, 1997, Mazzola and Benazzo, 2001, Zhao et al., 2001, Baur and Helman, 2002 and Peng et al., 2005). The superiorly based PMF was used by preserving the facial artery and maintaining its continuity through careful dissection of its intra-glandular course.

When looking at the Turin experience in treating more than 500 OSCCs and OVCCs we found that surgeons from independent hospitals used the PMF as a reconstructive option in 18.2% of cases (91 patients). This shows that a considerable number of surgeons, who do not work together, use the PMF frequently.

In our experience there are many advantages in using this flap. It can be harvested with enough tissue to seal and restore most head and neck ablative defects (at least 70 cm^2), it is readily available, easy to harvest, it is thin and pliable, promoting three dimensional reconstruction. Furthermore, it is easy to transfer because of its adequate arc of rotation. Donor site morbidity is low, with neck wound healing by primary closure and an overall acceptable surgical time (Futrell et al., 1978, Koch, 2002, Cannon et al., 1982, Coleman et al., 1983, Ruark et al., 1993 and Esclamado et al., 1994).

Pliability of the flap allows later shaping so as to allow dental prosthetic rehabilitation. For tongue reconstruction (ventral tongue/FOM and tongue), this flap provides good residual mobility, swallowing and speech (Fig. 1 and Fig. 2). In one case, the PMF was successfully folded for cheek reconstruction (Fig. 3).

Whenever possible the plane of elevation should include the sternocleidomastoid fascia, as well the anterior and external jugular veins. This should assure good and adequate venous drainage.

The PMF is not an extremely robust flap, but it possesses a rich blood supply. Muscle loss is rare, but a partial or a total loss of the skin paddle can occur.

In this study we noticed that the flap would frequently become oedematous and blue during the healing process due to a partial obstruction of venous drainage. This oedema and blue tint would typically fade away during the first week postoperatively. It has been shown that the PMF has an inefficient venous drainage through small anterior communicating veins that drain into the superior thyroid vein, anterior jugular vein or facial vein (Agarwal et al., 2004).

The complication rate was as high as 24.2%, but only four cases required actual surgical revision under general anaesthesia. The skin may show partial epidermolysis, but the remaining muscle

underneath the skin creates an excellent bed for re-epithelialization. Minor complications, including fistula formation and skin paddle distress, were successfully managed with supportive therapy alone.
One more consideration to bear in mind is that frequently, during flap harvesting, the marginal mandibular nerve may be sacrificed.
The main contraindications to using this flap are the following: previous surgical scaring or previous neck radiation therapy; need for tissue bulk (because of the flap's thinness); patients with relatively thin skin and a poorly-developed platysma; in case of defects larger than 10×7 cm; whenever there is radiological suspicion of cervical metastases with ECS (extra capsular spread).

CONCLUSION

In conclusion, we have drawn together the authors' different experiences with the use of the PMF which has proved to be a simple and trustworthy flap. It represents a good reconstructive choice for small and middle-size defects even when the facial artery is not preserved. PMF provides acceptable results in cases where free flaps are not practical.
The authors' experience makes it possible to highlight the on-going importance of the PMF, which is still used, even though surgical teams can now technically perform reconstruction of any part of the oral cavity with free flaps.

REFERENCES

1. A. Agarwal, C.D. Schneck, D.J. Kelley
Venous drainage of the platysma myocutaneous flap
Otolaryngol Head Neck Surg, 130 (2004), pp. 357–359

2. S. Ariyan
The transverse platysma myocutaneous flap for head and neck reconstruction
PlastReconstrSurg, 99 (1997), pp. 340–347

3. D.A. Baur, J.I. Helman
The posteriorly based platysma flap in oral and facial reconstruction: a case series
J Oral MaxillofacSurg, 60 (2002), pp. 1147–1150

4. C.R. Cannon, M.E. Johns, J.P. Atkins, W.M. Keane, R.W. Cantrell
Reconstruction of the oral cavity using the platysma myocutaneous flap
Arch Otolaryngol, 108 (1982), pp. 491–494

5. J.J. Coleman, M.J. Jurkiewicz, F. Nahai, S.J. Mathes
The platysma musculocutaneous flap: experience in 24 cases
PlastReconstrSurg, 72 (1983), pp. 315–323

6. J.J. Conley, D.M. Lanier, P. Tinsley
Platysma myocutaneous flap revisited
Arch Otolaryngol Head Neck Surg, 112 (1986), pp. 711–713

7. R.M. Esclamado, B.B. Burkey, W.R. Carroll, C.R. Bradford
The platysma myocutaneous flap: indications and caveats
Arch Otolaryngol Head Neck Surg, 120 (1994), pp. 315–323

8. J.W. Futrell, M.E. Johns, M.T. Edgerton, R.W. Cantrell, G.S. Fitz-Hugh
Platysma myocutaneous flap for intraoral reconstruction
Am J Surg, 136 (1978), pp. 504–507

9. D.J. Hurwitz, J.A. Robson, J.W. Futrell
The anatomic basis for the platysma flap
Plast Reconstr Surg, 72 (1983), pp. 302–314

10.U. Kocer, R. Odzemir, M.G. Ulusoy, A. Uysal, N. Sungur, B. Sahin, *et al.*
Anatomy of the platysma muscle and the evaluation of it for the reconstruction of facial defects
J CraniofacSurg, 16 (3) (2005), pp. 463–470

11.W.M. Koch
The platysma myocutaneous flap: underused alternative for head and neck reconstruction
Laryngoscope, 112 (2002), pp. 1204–1208

12.R. Mazzola, M. Benazzo
Platysma flap for oral reconstruction
ClinPlastSurg, 28 (2001), pp. 411–419

13. W.F. McGuirt, B.L. Matthews, J.A. Brody, J.S. May
Platysma myocutaneous flap: caveats reexamined
Laryngoscope, 101 (1991), pp. 1238–1244

14. L.W. Peng, W.F. Zhang, J.H. Zhao, S.G. He, Y.F. Zhao
Two designs of platysma myocutaneous flap for reconstruction of oral and facial defects following cancer surgery
Int J Oral Maxillofac Surg, 34 (2005), pp. 507–513

15. M.S. Persky, D. Kaufman, N.L. Cohen
Platysma myocutaneous flap for intraoral defects
Arch Otolaryngol Head Neck Surg, 109 (1983), pp. 463–464

16. J.A. Rabson, D.J. Hurwitz, J.W. Futrell
The cutaneous blood supply of the neck: relevance to incision planning and surgical reconstruction
Br J Plast Surg, 38 (1985), pp. 208–219

17. D.S. Ruark, W.C. McClairen, U.K. Schlehaider, R.Z. Abdel-Misih
Head and neck reconstruction using the platysma myocutaneous flap
Am J Surg, 165 (1993), pp. 713–718

18. J. Szudek, M. Taylor
Systematic review of the platysma myocutaneous flap for head and neck reconstruction
Arch Otolaryngol Head Neck Surg, 133 (7) (2007), pp. 655–661

19. M. Uehara, J.H. Lillie, S.L. Brooks
Blood supply to the platysma muscle flap: an anatomic study with clinical correlation
J Oral MaxillofacSurg, 59 (2001), pp. 642–646

20. H.P. Verschuur, O. Dassonville, J. Santini, J. Vallicioni, G. Poissonnet, Y. Laudoyer, *et al.*
Complications of the myocutaneous platysma flap in intraoral reconstruction
Head Neck, 20 (1998), pp. 623–629

21. Y.F. Zhao, W.F. Zhang, J.R. Zhao
Reconstruction of intraoral defects after cancer surgery using cervical pedicle flaps
J Oral Maxillofac Surg, 59 (2001), pp. 1142–1146