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Angaben zur Veröffentlichung / Publication details:

Künzel, Julian, Heinrich Iro, Georgios Psychogios, Johannes Zenk, and Michael Koch. 2013. "Closure of defects after resection of tumors of the oral cavity and the pharynx: medium- to long-term oncologic and functional results with the myocutaneous platysma flap." *European Archives of Oto-Rhino-Laryngology* 270 (9): 2537–45. https://doi.org/10.1007/s00405-013-2389-0.

Closure of defects after resection of tumors of the oral cavity and the pharynx: medium- to long-term oncologic and functional results with the myocutaneous platysma flap

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Abstract The aim of this study was to assess the medium- to long-term functional and oncologic results when the myocutaneous platysma flap (MPF) was used for defect reconstruction of the oral cavity and the pharynx in selected patients. The MPF was used in 70 patients for closure of small to medium-sized defects. 37.1 % of the tumors were in the oral cavity, 24.3 % in the oropharynx and 38.6 % in the hypopharynx. Histopathological risk factors, adjuvant therapy, recurrence rates, and survival rates were assessed. Rehabilitation of swallowing and airways function was analyzed. UICC staging was I in 18.6 %, II in 15.7 %, III in 18.6 %, and IV in 47.1 %. Histopathological risk factors were noted in 51.4 and 84.3 % patients received adjuvant treatment. Recurrences were observed in 27.2 %. The 5-year recurrence-free survival rate was 63.1 %, and the disease-specific survival rate was 66.7 %. Permanent tracheostomy closure was achieved in 74.4 %, and complete recovery of swallowing in 57.4 %. Analysis of the functional and oncologic data after defect closure with the MPF showed acceptable results. The MPF should be included in the range of surgical methods for closure of small to medium-sized defects in the head and neck region in selected patients.

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Introduction

The goal when reconstructing defects in the swallowing tract following ablative tumor resection in head and neck surgery is to restore anatomic integrity, with good oncological results, a low mortality rate associated with the procedure, and rapid rehabilitation of the patient's swallowing and respiratory function. In all types of defect, this is nowadays best achieved in a standardized fashion with microvascular pedicle free flaps [1–4]. For small to medium-sized tumors that have penetrated the wall, a full-thickness defect can also be closed using local pedicled flaps such as the myocutaneous platysma flap (MPF). Although various reports have been published on the use of the MPF, there is still some controversy about the advantages and disadvantages of the technique, as well as the specific indications for it. There is still some hesitancy about using the MPF, due to uncertainties regarding its reliability. Flap-related complications have been reported at rates ranging from 10 to 45 % [7–23]. Most of the published reports have concentrated on the anatomy of the MPF, the surgical technique, and the blood supply to the flap [5–7, 12–15, 23], and only a few publications have discussed the oncologic and functional results [9, 12, 15, 16, 22, 24].

The indications, the surgical technique of flap raising, the observed postoperative complications and the success rates regarding defect closure using the MPF at our institution have been published before [25]. The aim of the present retrospective study was to assess the medium- to long-term oncologic and functional outcomes with the use of the MPF to reconstruct oral and pharyngeal defects in the same patient cohort of 70 patients. The oncologic and functional results after using the platysma flap were arranged and discussed with comparable data available in the literature considering the different tumor sites.

Patients and methods

A total of 70 patients received defect coverage with an MPF following tumor resection in the head and neck region between 1998 and 2009. The patients consisted of 66 men (94.3 %) and four women (5.7 %), aged 37–86 years (mean 56.5 years) with a first diagnosis of a head and neck squamous cell carcinomas. The MPF was indicated after ablative surgery in small to medium-sized defects, which were defined as full-thickness defects and where primary defect coverage was not possible. The flap size varied from 3×5 to 6×12 cm, according to a size of the area of the supraclavicular skin ranging from 15 to 72 cm^2 [15, 23, 25]. The tumors were located in the oral cavity (OC: lateral border of the tongue, undersurface of the tongue, floor of the mouth, buccal mucosa), in the oropharynx (OP: lateral wall, posterior wall) and hypopharynx (HP: lateral wall, posterior wall, anterior wall with circumscribed infiltration of laryngeal structures such as the lateral thyroid and aryepiglottic fold). Contraindications for the use of the MPF have been prior chemoradiation, prior radical neck dissection, large 3-dimensional defects and subtotal defects of the pharyngeal wall.

Preoperative staging examinations included ultrasonography of the head and neck, contrast computed tomography (CT) of the neck and chest, and panendoscopy with the patient under general anesthesia, including a biopsy for histological analysis. A percutaneous endoscopic gastrostomy (PEG) was carried out either preoperatively, during the panendoscopy or intraoperatively during tumor resection. The indication for placement of a plastic tracheostomy was established intraoperatively, depending on the expected risk of postoperative aspiration. The MPF was raised using the surgical techniques described in various publications [5–7, 13, 14, 19, 20, 23, 25].

Tumor grade G3/G4, more than three positive lymph nodes, perinodal infiltration, lymphatic (L1) or vascular invasion (V1), perineural sheath carcinosis (Pn1), and R1 status were evaluated as histopathological risk factors. The indications for adjuvant treatments such as chemoradiotherapy (CRT), percutaneous radiotherapy (RT), interstitial brachytherapy (iRT), and chemotherapy (CTx), or for a combination of these treatments were established in an interdisciplinary tumor conference. The patients all received regular follow-up examinations in consulting hours specially reserved for tumor patients. pT1/pT2 and pT3/pT4 tumors were combined into groups for analysis of the oncological data. Local, locoregional, and regional recurrences, as well as distant metastases were defined as recurrence events. For evaluation of the functional results relative to rehabilitation of swallowing and respiratory function, the patients were included in a follow-up schedule of at least 3 months after completion of full therapy (surgery plus adjuvant therapy), or at least 6 months after the operation. All patients underwent a clinical screening evaluation concerning tongue mobility and speech ability. If problems like dysphagia or aspiration swallowing jelly or methylene blue were observed, these patients were referred to our department of phoniatry for further evaluation by video endoscopy. Dependent on the individual situation a swallowing training or a swallowing rehabilitation program in a specialized institution was performed. In relation to postoperative swallowing function, the patients were divided into three groups: those with no dysphagia who were able to take complete oral nutrition without a PEG (group 1); those with dysphagia but without aspiration, with or without a need for nutritional substitution via a PEG (group 2); and patients with dysphagia and aspiration who were dependent on PEG nutrition (group 3).

Statistical analysis was carried out using the IBM SPSS Statistics program, version 19.0.0.1. Group comparisons for target variables were carried out using the log rank test, Pearson's Chi-squared test, and the exact Fisher test. Kaplan–Meier event analyses for overall survival (OS), recurrence-free survival (RFS), and disease-free survival (DSS) were used to calculate the corresponding 3-year and 5-year survival estimators. The odds ratios were determined after the relevant preliminary tests, taking into account the small number of recurrences ($n < 25$), and need to be interpreted with the relevant caution. This is reflected in the wide 95 % confidence intervals. The significance level was $P \leq 0.05$.

Results

Oncological data

37.1 % ($n = 26$) were carcinomas of the oral cavity, 24.3 % ($n = 17$) were oropharyngeal carcinomas, and 38.6 % ($n = 27$) were hypopharyngeal carcinomas. Overall, the tumors included stages pT1–pT4 (pT4: one OP carcinoma with isolated infiltrations into the mandible; two HP carcinomas with infiltration of the thyroid). In two patients with pN3 metastases, the MPF was raised ipsilaterally in one case and contralaterally in the other. None of the patients had any confirmed distant metastases between the time of diagnosis and the completion of surgical and adjuvant treatment. The TNM classifications and UICC stages relative to the tumor locations are listed in Table 1.

One or more histopathological risk factors were present in 51.4 % of the patients (G3/G4 27.1 %; L1 24.3 %; perinodal growth 15.7 %; R1 8 %; Pn1 10.0 %; V1 2.0 %).

Table 1 TNM classification (2002) and UICC staging relative to tumor location

TNM/UICC	Location							
	All ($n = 70$)		OC ($n = 26$)		OP ($n = 17$)		HP ($n = 27$)	
	n	%	*n*	%	*n*	%	*n*	%
pT1	19	27.1	11	42.3	2	11.7	6	22.2
pT2	34	48.6	10	38.4	9	52.9	15	55.5
pT3	14	20.0	4	15.4	6	35.3	4	14.8
pT4	3	4.2	1	3.8	–		2	7.4
pN0	28	40.0	16	61.5	5	29.4	7	25.9
pN1	9	12.8	3	11.5	1	5.8	5	18.5
pN2	31	44.3	7	26.9	11	64.7	13	48.1
pN3	2	2.8	–		–		2	7.4
UICC I	13	18.6	10	38.4	1	5.8	2	7.4
UICC II	11	15.7	5	19.2	2	11.7	4	14.8
UICC III	13	18.6	4	15.4	3	17.6	6	22.2
UICC IV	33	47.1	7	26.9	11	64.7	15	55.5

OC oral cavity, *OP* oropharynx, *HP* hypopharynx

Flap-specific complications and mortality

As reported by Koch et al. [25] 97.1 % of the defects were successfully closed using the MPF in this group of patients. Partial flap necrosis with superficial epidermolysis developed in 7.1 % of the patients, but adequate defect coverage was achieved in these cases. Total flap necrosis with a need for a surgical revision occurred in 2.9 % of the patients [25].

A total of six patients (8.6 %) died during the postoperative phase (<2 months; OC: $n = 1$ UICC I; OP: $n = 1$ UICC I, $n = 2$ UICC IV; HP: $n = 1$ UICC I, $n = 1$ UICC IV). The causes of death were pulmonary embolism ($n = 1$; day 12), acute cardiac failure ($n = 1$, day 4), critical illness neuropathy ($n = 1$, day 30) and acute myopericarditis with cardiac infarction and additional apoplexy in a patient with known polycythemia vera ($n = 1$, day 14). Two patients with multiple morbidities, including alcoholic cirrhosis of the liver, died of sepsis in multiple-organ failure (day 14 and week 6). In one of these cases (day 14), there was simultaneous total flap necrosis after defect closure in the hypopharynx. The autopsy findings showed no flap complications in any of the other cases. Another patient with an OC carcinoma died of septic pneumonia shortly after completing adjuvant radiotherapy, with normal swallowing function and no evidence of significant aspiration (month 3).

Adjuvant therapy

Adjuvant therapy was administered in 84.3 % of the patients ($n = 59$), including 53.8 % of those with UICC stage I, 90.9 % of those with UICC II, 100 % of those with UICC III, and 87.8 % of those with UICC stage IV.

No adjuvant therapy was administered in 15.7 % of the patients ($n = 11$), six of whom died (see above) before the start of any adjuvant treatment (UICC I, $n = 3$; UICC IV, $n = 3$). One patient with UICC stage IV oropharyngeal carcinoma declined the recommended chemoradiotherapy, and a regional recurrence developed during the subsequent course (see below). Due to their low risk profile (OC: $n = 3$ UICC I; HP: $n = 1$ UICC I), the other four patients received a tight schedule of clinical check-up examinations. These patients were all still in full remission at the time of writing.

The mean radiation dosage administered in the area of the primary tumor was 61.2 Gy (50; 74) in percutaneous CRT and 59.4 Gy (56; 60) in iRT. In simultaneous CRT, cisplatin and 5-fluorouracil were used as the cytostatics on a standardized basis, although in two cases only monochemotherapy with cisplatin was possible due to concomitant diseases (one patient in full remission, one patient with a local recurrence after 15 months and disease-related death after 18 months).

Course, recurrences, and survival

The mean follow-up period was 39.6 months (3; 120). A total of 19 patients (27.1 %) developed recurrent tumors after a mean of 15.1 months (2; 48).

Table 2 provides a detailed overview on the distribution of recurrences relative to location, pT stage, and histopathological risk factors. Local recurrences were seen after an average of 13.6 months (3; 34), locoregional recurrences after 11.7 months (7; 15) and regional recurrences after 9 months (2; 15). Distant metastases developed after a mean of 23 months (7; 48). Local recurrences were not strictly associated with T-stage (T2: $n = 5$; T3: $n = 4$) histopathologic risk factors like grading (G2: $n = 6$, G3: $n = 3$) and resection state (free margins in all cases). (Loco-) regional recurrences showed no strict association with T-stage and N-stage (No: $n = 1$; N1: $n = 2$, N2: $n = 3$, N3: $n = 1$). With regard to the development of recurrent tumors, there was no statistically significant association with the UICC stage ($P = 0.155$), the presence of histopathological risk factors ($P = 0.509$), or administration of adjuvant therapy ($P = 0.143$).

In all but one of the patients who developed recurrences, adjuvant therapy had been carried out beforehand. Recurrent tumors were seen significantly more often in patients with pT3/pT4 tumors than in those with pT1/pT2 tumors ($P = 0.038$). A patient with a pT3/pT4 tumor was 3.394 times more likely to develop a recurrence than a patient with a pT1/pT2 tumor (Odds Ratio: 3.394).

The Kaplan–Meier estimators for OS, RFS, and DFS are listed separately by location in Table 3. Figure 1 shows the

Table 2 Distribution of recurrences relative to location, pT stage, and histopathological risk factors

	Location							
	All		OC		OP		HP	
	n/Σ	%	n/Σ	%	n/Σ	%	n/Σ	%
Total patients with recurrence events	19/70	27.1	7/26	27.0	6/17	35.3	6/27	22.2
Recurrence events	No of recurrence events by location							
Local	9/70	12.9	4/26[a]	15.4	3/17	17.6	2/27	7.4
Locoregional	3/70	4.3	–		–		3/27[b]	11.1
Regional	4/70	5.7	2/26[c]	7.7	2/17[d]	11.8	–	
Distant metastases	8/70	11.4	3/26[c,a]	11.5	2/17	11.8[d]	3/27[b]	11.1
T status/risk factors	Distribution of T status and risk factors in patients with recurrence events							
pT1/pT2	11/19	57.9	4/7	57.1	4/6	66.7	3/6	50
pT3/pT4	8/19	42.1	3/7	42.9	2/6	33.3	3/6	50
Risk factors	11/19	57.9	4/7	57.9	4/6	66.7	3/6	50

HP hypopharynx, *OC* oral cavity, *OP* oropharynx

[a] $n = 1$ OC carcinoma with regional recurrence and distant metastases

[b] $n = 2$ HP carcinomas with locoregional recurrence and distant metastases

[c] $n = 1$ OC carcinoma with local recurrence and distant metastases

[d] $n = 1$ OP carcinoma with regional recurrence and distant metastases

Table 3 Five-year overall survival (OS) and recurrence-free survival (RFS) rates, and 3-year and 5-year disease-free survival (DSS) rates relative to tumor location

Kaplan–Meier	Location			
	All (%)	OC (%)	OP (%)	HP (%)
5-year OS	46.2	53.5	38	50.2
5-year RFS	63.1	50.7	52.4	73
3-year DSS	74.3	82.5	69.2	70.6
5-year DSS	66.7	70.7	55.4	70.6

5-year Kaplan–Meier DSS for all tumors, and Fig. 2 shows it separately by location. The DSS was not significantly associated either with the pT stage or with the UICC stage ($P = 0.109$ and $P = 0.189$, respectively), nor with the histopathological risk profile ($P = 0.149$), nor with adjuvant therapy ($P = 0.435$).

Functional data for swallowing and respiratory function

In patients with oral cavity carcinomas, the clinical evaluation showed that a relevant tongue fixation with impaired motility was not observed. The speech ability was satisfying in all patients. We did not observe any bulking with constriction of the lumen in the OP and HP or at the border to the laryngeal orifice in particularly.

Tracheotomies were carried out in 67.1 % of the patients ($n = 47/70$) and PEGs were placed in 75.7 % ($n = 53/70$). For the evaluation of swallowing function and airways rehabilitation, only those patients were included who had a follow-up of ≥3 months after completion of treatment or ≥6 months since surgery; these were 87.1 % of all patients (61/70; OC, $n = 24$; OP, $n = 14$; HP, $n = 23$).

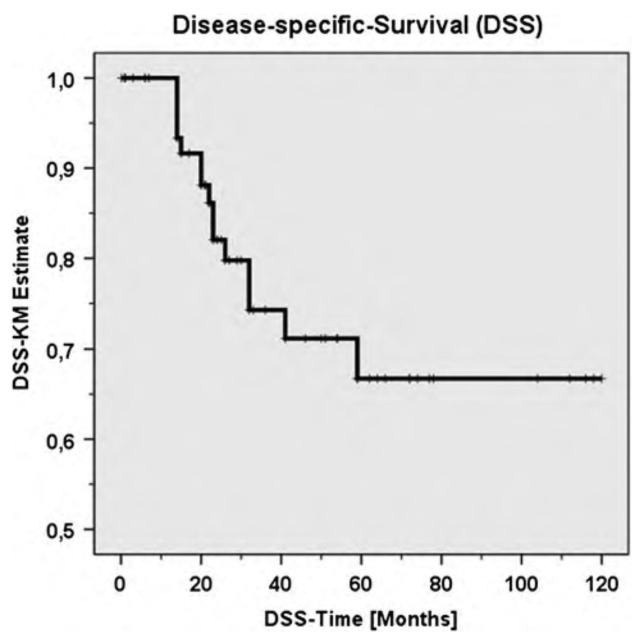

Fig. 1 Kaplan–Meier plots for 5-year disease-free survival, all locations

Airways rehabilitation ($n = 61$)

Table 4 shows the course after primary tracheostomy placement, classified by tumor location. The average time

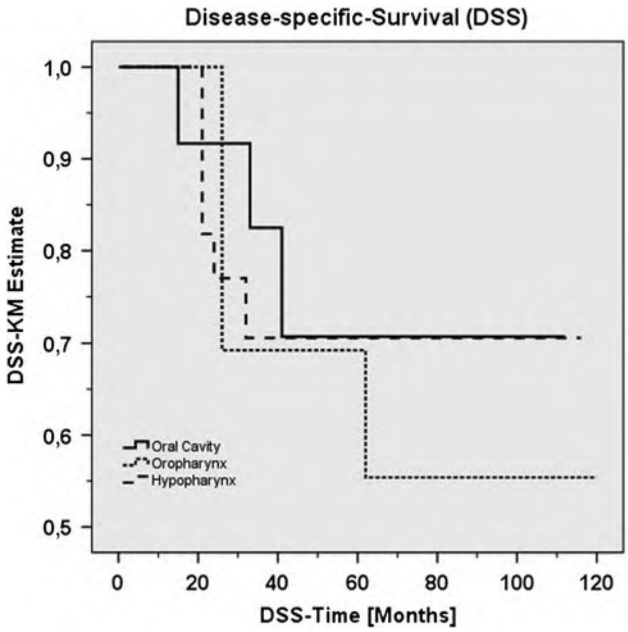

Fig. 2 Kaplan–Meier plots for 5-year disease-free survival, by location

to decannulation followed by tracheostomy closure was 281 days (8; 630) for OC carcinoma, 82 days (20; 290) for OP carcinoma, and 320 days (29; 1320) for HP carcinoma. Comparison of the times to decannulation for the individual locations showed that the means with the 95 % confidence intervals (OC 28; 534, OP 52; 604, and HP 252; 735) overlapped markedly due to wide variance in the individual values. Testing for statistical significance was therefore not meaningful, although there was a trend toward longer times to decannulation and tracheostomy closure in patients with HP carcinoma.

In 25.6 % of the patients ($n = 10/39$), the tracheostomy was not closed at the time of data collection. These were patients with OP carcinoma ($n = 2$) and HP carcinoma ($n = 8$). The causes in patients with OP carcinoma were postradiotherapy esophageal stenosis with aspiration ($n = 1$) and regional recurrence after 8 months with persistent aspiration ($n = 1$). In the patients with HP carcinoma, the causes were tumor recurrence ($n = 4$), postradiotherapy esophageal stenosis ($n = 1$), functional swallowing disturbance shortly after completion of adjuvant therapy ($n = 1$), and marked postradiotherapy aryepiglottic edema ($n = 1$). One patient did not wish the tracheostomy to be closed despite normal swallowing function, possibly due to potential pension claims.

Following tracheostomy closure, repeat tracheotomies were needed in four patients during the subsequent course (for coverage of a radiation ulcer defect, $n = 1$; dyspnea with bilateral recurrent nerve paresis with glottic edema, $n = 1$; tumor recurrence, $n = 2$).

Rehabilitation of swallowing function (n = 61)

Table 5 gives detailed information on the frequency of PEG placement, which was carried out in 78.7 % of the patients. At the time of data collection, it had been possible to remove the PEG after completion of treatment in 50 % of the patients.

After completion of surgical and adjuvant treatment, 57.4 % of the patients were able to take adequate oral nutrition without use of a PEG (group 1, see Table 5). PEG placement was carried out in 24 patients in group 1 (68.6 %). The other 11 patients (31.4 %) did not receive a PEG. The PEGs that had been placed were removed again in all but one of the patients in group 1. One patient with an OC carcinoma kept the PEG at his own request for nutritional substitution despite normal swallowing function.

A total of 26.2 % of the patients had dysphagia with no signs of aspiration (group 2, see Table 5). PEG placement was carried out in 87.5 % of the patients in group 2, required in these cases for various degrees of nutritional substitution. One patient with OC carcinoma had the PEG removed again despite persistent dysphagia (inadequate compliance). In all, two patients with OC carcinoma never required a PEG at any time, but had persistent dysphagia for solid food alone during the course.

Aspiration problems with dysphagia occurred in 16.4 % of the cases (group 3, see Table 5). Nutrition was carried out exclusively via the PEG in six of these patients, and the PEG was used in addition to oral nutrition in three cases.

Table 4 Course after primary tracheostomy placement relative to tumor location

Respiratory function	Location							
	All ($n = 61$)		OC ($n = 24$)		OP ($n = 14$)		HP ($n = 23$)	
	n/Σ	%	n/Σ	%	n/Σ	%	n/Σ	%
TS	39/61	63.9	6/24	25.0	12/14	85.7	21/23	91.3
TS decannulated/closed	29/39	74.4	6/6	100.0	10/12	83.3	13/21	61.9
TS permanent	10/39	25.6	–		2/12	16.7	8/21	38.1

OC oral cavity, *OP* oropharynx, *HP* hypopharynx, *TS* tracheostomy

Table 5 Swallowing function and course after percutaneous endoscopic gastrostomy placement relative to tumor location

Swallowing function	Location							
	All ($n = 61$)		OC ($n = 24$)		OP ($n = 14$)		HP ($n = 23$)	
	n/Σ	%	n/Σ	%	n/Σ	%	n/Σ	%
PEG placement	48/61	78.7	14/24	58.3	13/14	92.9	21/23	91.3
PEG removed	24/48	50.0	8/14	57.1	6/13	46.2	10/21	47.6
PEG persistent	24/48	50.0	6/14	42.9	7/13	53.8	11/21	52.4
Group 1	35/61	57.4	16/24	66.6	7/14	50.0	12/23	52.2
Group 2	16/61	26.2	8/24	33.3	5/14	35.7	3/23	13.0
Nutrition without PEG	3/16	18.8	3/8	37.5	–		–	
PEG substitution	13/16	81.3	5/8	62.5	5/5	100.0	3/3	100.0
Group 3	10/61	16.4	–		2/14	14.3	8/23	34.8
Nutrition without PEG	–		–		–		–	
PEG substitution	10/10	100.0	–		2/2	100.0	8/8	100.0

HP hypopharynx, *OC* oral cavity, *OP* oropharynx, *PEG* percutaneous endoscopic gastrostomy

Table 6 shows the major causes of longer-term dysphagia and aspiration relative to the tumor location.

Discussion

The primary goal of adequate defect closure was achieved with the MPF in this group of patients in 97.1 % of cases [25]. These results, which are comparable with those reported by Szudek et al. [8] (in a meta-analysis including 190 patients with a success rate of 95 %), show that when appropriately indicated, the MPF is a valuable alternative in reconstructive head and neck surgery. The perioperative mortality rate of 8.6 % in the present study is also comparable with data published by other groups, such as Verschuur et al. [15] and Alvarez et al. [15, 24].

There have only been a few studies describing the long-term functional and oncological results after defect closure with the MPF in the head and neck region [9, 12, 15, 16, 22, 24]. The aim of the present retrospective analysis was to report on our experience with the use of the MPF in head and neck surgery. The results were stratified according to the different subsites firstly to meet the heterogeneity of the published data, secondly to show that the MPF is a highly versatile flap suited for the different requirements in functionally different locations (OC, OP, HP) and thirdly to achieve that our results are better comparable with the relevant literature data.

The 5-year DSS for all tumor locations was 66.7 %. Against the background of the fact that 47.1 % of these tumors are in stage UICC IV, there was no significant association between DSS and the grouped UICC stage. However, the primary tumor status was significantly associated with the development of a recurrence (pT1/2 vs. pT3/4; $P = 0.038$). Apart from the publications by Julieron et al. and Alvarez et al. [16, 24], there are no other published studies directly comparable with the present oncological data after the use of the MPF for defect closure.

Table 6 Causes of long-term dysphagia and aspiration relative to tumor location

Swallowing function	Causes of dysphagia			
	Postradiotherapy esophageal stenosis (%)	Mucositis/ xerostomia (%)	Motility disturbance (%)	Recurrence (%)
Group 2 ($n = 16$)				
OC ($n = 8/16$)	$n = 1$ (12.5)	$n = 1$ (12.5)	$n = 5$ (62.5)	$n = 1$ (12.5)
OP ($n = 5/16$)	–	–	$n = 2$ (40)	$n = 3$ (60)
HP ($n = 3/16$)	$n = 1$ (33.3)	–	$n = 1$ (33.3)	$n = 1$ (33.3)
Group 3 ($n = 10$)				
OC	–	–	–	–
OP ($n = 2/10$)	$n = 1$ (50)	–	–	$n = 1$ (50)
HP ($n = 8/10$)	$n = 4$ (50)	$n = 1$ (12.5)	–	$n = 3$ (37.5)
Groups 2 + 3 ($n = 26$)	$n = 7/26$ (26.9)	$n = 2/26$ (7.7)	$n = 8/26$ (30.8)	$n = 9/26$ (34.6)

OC oral cavity, *OP* oropharynx, *HP* hypopharynx

The literature also does not include any studies reporting the oncological results after defect closure with the MPF in OC or OP carcinoma. Direct comparisons with the literature are only possible for carcinoma of the posterior hypopharyngeal wall [16, 24]. Literature comparisons were, therefore, extended to include review studies not specifically concerned with results using the MPF [26–33].

For OC carcinoma, overall 5-year survival rates of 59 % for UICC stage III and 47 % for UICC stage IV were reported by Boyle et al. [26] (in a review study including 595 patients who received multimodal therapy), and a 5-year DSS of 79 % was reported by Sasaki et al. [27] (304 patients, after primary surgical and adjuvant therapy; 44.4 % of the tumors were in UICC stages III/IV). In the present study, 42.3 % of patients with OC carcinoma were in UICC stages III/IV (see Table 1); the 5-year overall survival rate of 53.5 % and the 5-year DSS of 70.7 % in the present study are therefore well comparable with these data. The recurrence rate of 27 % is also comparable with the recurrence rate of 31 % reported by Sasaki et al. [27].

For OP carcinoma, Röösli et al. [28] reported a 5-year DSS of 78.9 % (159 patients; after surgery and adjuvant therapy, with 84.2 % of the tumors in UICC stages III/IV), and a significantly better DSS was seen for tumors in UICC stage III in comparison with stage IV tumors. Udoff et al. [29] noted a 5-year DSS of 56 % with UICC stage III tumors and 43 % for UICC stage IV tumors (105 patients, after primary surgical therapy and adjuvant radiotherapy, with UICC III/IV in 91 % of cases). The 5-year DSS of 55.4 % in the present study was comparable for this tumor location, with a similarly high proportion of advanced tumor stages (UICC III/IV in 82.4 % of cases; see Table 1). The recurrence rate in the present group of patients was comparable with the 35 % rates reported by Röösli et al. [28] and Udoff et al. [28, 29].

With regard to the data on treatment for HP carcinoma, 5-year DSS rates of 35 % are reported by Hall et al. [30] (494 patients, after multimodal curative therapy, UICC stage IV in more than 50 % of cases), 48 % by Hoffmann et al. [31] (a multicenter study, after surgical and adjuvant therapy, 75 % UICC III/IV), and 45 % by Clark et al. [32] (138 patients, after surgery and adjuvant therapy). Steiner et al. [33] reported a 5-year OS rate of 71 % for patients with UICC stage I/II tumors and 47 % for those with UICC stages III/IV after transoral laser resection of HP carcinoma.

One of the few studies in the literature that provides oncological data after defect closure with the MPF in HP carcinoma is that by Julieron et al. [16], reporting a 5-year DSS of 38 % (77 patients, 15 with MPF, after surgery and adjuvant radiotherapy) after treatment for carcinomas of the posterior HP wall. Alvarez et al. [24] report a 5-year OS of 20.5 % after defect closure in the same location (36 patients, including 23 with MPF, after surgery and adjuvant therapy, UICC III/IV in 91.8 % of cases). Comparison of the present results with those in the literature shows that both the 5-year DSS of 70.6 % and the OS of 50.2 % in the present patients (with UICC stages III/IV in 77.7 % of cases; see Tables 1 and 3) are better than in these other publications. The recurrence rates in the present group of patients are also markedly lower than those reported by Hall et al. [30] and Julieron et al. [16] at 50 and 46 %.

Overall, the results presented here after primary resection of tumors in the upper digestive tract show that defect closure with the MPF, in combination with adjuvant therapy, offers a highly interesting and oncologically adequate alternative option when suitably indicated.

Additional arguments emerge when one looks at the functional aspects. Due to the small volume and good plasticity of the MPF, functional disturbances caused by major tissue debulking can largely be avoided. In all patients tongue mobility and speech ability were not significantly disturbed. Overall, 57.4 % of the present patients were able to take full oral nutrition, without a PEG, after completing treatment (group 1). Here again, hardly any other publications are available for direct comparison. Koch et al. report good swallowing rehabilitation after defect closure with the MPF in a total of 88 % of cases; however, a differentiated analysis relative to the tumor location was not carried out. In addition, only 13.9 % ($n = 5/36$) of the primary tumors were located in the hypopharynx [9]. In an analysis of the results after treatment for T1/T2 carcinomas in the floor of the mouth or lateral border of the tongue in which the defect was closed using the MPF, Vriens et al. [12] report almost undisturbed oral nutrition in only 41 % of the patients. The dysphagia, with long-term impairment of the ability to take solid food, was regarded as a consequence of restricted tongue mobility. In the present study, 66.6 % of the patients had almost undisturbed food intake, with no dependency on a PEG, after treatment for OC carcinoma (group 1). Tracheostomies that had been carried out were all closed in these cases. Tongue motility can be preserved after use of the thin MPF for partial reconstruction of the floor of the mouth or tongue, as in other types of flap transplant [25]. Sensory disturbances due to mucosal defects in the oral cavity do not appear to impair deglutition decisively and seem to be capable of being compensated for in the long-term. In agreement with the findings of Koch et al. [9], defect reconstruction with the MPF, particularly in the area of the oral cavity, thus appears to be promising in relation to functional aspects.

Following completion of treatment for oropharyngeal carcinoma, 50 % of the present patients were able to take full oral nutrition (group 1), although 35.7 % of the tumors in this location were in group 2 and only 14.3 % in group 3. Tracheostomies were capable of being closed again in

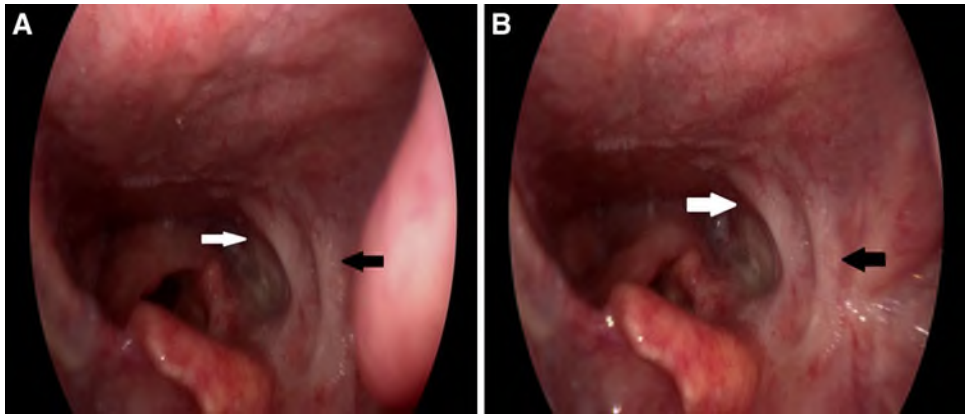

Fig. 3 MPF flap was sutured into a defect which included arytenoid fold, lateral thyroid part of cartilage and the anterior and lateral pyriform sinus of the left side. The pictures demonstrate the situation after 3 years. Picture **a** shows situation in respiration and picture **b** in phonation state of vocal folds. *White arrow* inferior border of MPF; *Black arrow* superior border of MPF

83.3 % of the cases. Impaired sensory function in the region of the pharynx, probably more severe in these cases, might be responsible for the slightly poorer, but still generally satisfactory functional results in comparison with the oral cavity. We also state that a loss of sensibility in small to medium-sized areas is not of the same importance as it may be in large 3-dimensional and/or circumferential defects.

Patients in the present study had dysphagia in 47.8 % of cases following treatment for hypopharyngeal carcinoma, with 13 % being in group 2 and 34.8 % in group 3. In comparison with the results reported by Julieron et al. [16] in which 42 % of patients with hypopharyngeal carcinoma had dysphagia 1 year after defect reconstruction with the MPF and adjuvant radiotherapy, and with 17 % of these patients requiring permanent PEG nutrition, the patients in the present study had a higher rate of such cases. However, 87.5 % of the patients in group 3 had postradiotherapy esophageal stenoses or tumor recurrences, so that the poorer function here cannot solely be regarded as a functional result of the surgery carried out (see Tables 5, 6). The rate of persistent tracheostomies in the present study for tumors in this location was in the same range, at 38.1 %, as the 14–66 % rates reported by other authors [16, 22]. In addition, there seems to be a tendency for the mean time to decannulation and tracheostomy closure to be longer in patients with hypopharyngeal carcinoma, in comparison with patients with tumors located in the oral cavity and oropharynx. In general, a difficult and long rehabilitation process has to be expected after resection for hypopharyngeal carcinoma with larynx preservation and reconstruction of the swallowing tract. The loss of both sensory and motor innervation in the pharyngeal wall resulting from surgical measures and the effects of adjuvant radiotherapy, as well as the vicinity of the laryngeal orifice, appear to play a role here in the generally poorer functional results after resection for hypopharyngeal carcinoma [22]. Anatomy-equivalent reconstruction with a thin flap such as the MPF appears to be particularly advantageous in the region of the hypopharynx (Fig. 3a, b). As in the studies by Julieron et al. [16], Suárez et al. [22], and Alvarez et al. [24], the hypopharyngeal carcinomas seen in the present group of patients, with and without infiltration of the lateral thyroid, appear to be an interesting indication for using the MPF. Julieron et al. [16] pointed out that there are no major differences in the postoperative results for swallowing rehabilitation between the MPF and the radial flap in the reconstruction of hypopharyngeal wall defects. Despite the problems with hypopharyngeal carcinoma described, the functional results after defect closure with the MPF are within an acceptable range and are comparable with the results reported by other authors, even when different flap closure techniques are taken into consideration.

Conclusions

The MPF is suitable as a thin flap for defect closure in the oral cavity, oropharynx, and hypopharynx, and particularly in the region bordering the laryngeal orifice. Small to medium-sized defects can be closed with good long-term functional results, due to the small volume of the flap. When the correct indication is observed, the MPF shows no compromise in relation to tumor control, with at least comparable survival rates. On the basis of the oncological and functional results, which are comparable with the literature data, the MPF appears to be a useful alternative option in the context of balanced defect closure in the head and neck region and should form part of the repertory of head and neck surgeons working in the field of oncology.

Acknowledgments The authors would like to thank Mr. Philipp Grundtner for his valuable support in the statistical analysis of the data.

References

1. Soutar DS, Scheker LR, Tanner NS, McGregor IA (1983) The radial forearm flap: a versatile method for intra-oral reconstruction. Br J Plast Surg 36(1):1–8

2. Schusterman MA, Miller MJ, Reece GP, Kroll SS, Marchi M, Goepfert H (1994) A single center's experience with 308 free flaps for repair of head and neck cancer defects. Plast Reconstr Surg 93(3):472–478
3. Chen KT, Mardini S, Chuang DC, Lin CH, Cheng MH, Lin YT et al (2007) Timing of presentation of the first signs of vascular compromise dictates the salvage outcome of free flap transfers. Plast Reconstr Surg 120(1):187–195
4. Wong CH, Wei FC (2010) Microsurgical free flap in head and neck reconstruction. Head Neck 32(9):1236–1245
5. Futrell JW, Johns ME, Edgerton MT, Cantrell RW, Fitz-Hugh GS (1978) Platysma myocutaneous flap for intraoral. Am J Surg 136(4):504–507
6. Ariyan S, Cuono CB (1980) Myocutaneous flaps for head and neck reconstruction. Head Neck Surg 2(4):321–345
7. Ruark DS, McClairen WC Jr, Schlehaider UK, Abdel-Misih RZ (1993) Head and neck reconstruction using the platysma myocutaneous flap. Am J Surg 165(6):713–719
8. Szudek J, Taylor SM (2007) Systematic review of the platysma myocutaneous flap for head and neck reconstruction. Arch Otolaryngol Head Neck Surg 133(7):655–661
9. Koch WM (2002) The platysma myocutaneous flap: underused alternative for head and neck reconstruction. Laryngoscope 112(7 Pt 1):1204–1208
10. Su T, Zhao YF, Liu B, Hu YP, Zhang WF (2006) Clinical review of three types of platysma myocutaneous flap. Int J Oral Maxillofac Surg 35(11):1011–1015
11. Grützenmacher S, Steinmeier E, Hosemann W (2005) The use of the platysma myocutaneous flap for reconstruction in the head-neck area—a retrospective study. Laryngorhinootologie 84(10): 733–737
12. Vriens JP (1995) A reappraisal of the platysma myocutaneous island flap.a follow-up study of the functional outcome after reconstruction of the floor of the mouth. Int J Oral Maxillofac Surg 24(3):212–215
13. Conley JJ, Lanier DM, Tinsley P Jr (1986) Platysma myocutaneous flap revisited. Arch Otolaryngol Head Neck Surg 112(7):711–713
14. Coleman JJ 3rd, Jurkiewicz MJ, Nahai F, Mathes SJ (1983) The platysma musculocutaneous flap: experience with 24 cases. Plast Reconstr Surg 72(3):315–323
15. Verschuur HP, Dassonville O, Santini J, Vallicioni J, Poissonnet G, Laudoyer Y et al (1998) Complications of the myocutaneous platysma flap in intraoral reconstruction. Head Neck 20(7): 623–629
16. Julieron M, Kolb F, Schwaab G, Marandas P, Billard V, Lusinchi A et al (2001) Surgical management of posterior pharyngeal wall carcinomas: functional and oncologic results. Head Neck 23(2):80–86
17. Friedman M, Schild JA, Venkatesan TK (1990) Platysma myocutaneous flap for repair of hypopharyngeal strictures. Ann Otol Rhinol Laryngol 99(12):945–950
18. Ariyan S, Chicarilli ZN (1986) Replantation of a totally amputated ear by means of a platysmamusculocutaneous "sandwich" flap. Plast Reconstr Surg 78(3):385–389
19. McGuirt WF, Matthews BL, Brody JA, May JS (1991) Platysma myocutaneous flap: caveats reexamined. Laryngoscope 101(11):1238–1244
20. Esclamado RM, Burkey BB, Carroll WR, Bradford CR (1994) The platysma myocutaneous flap. Indications and caveats. Arch Otolaryngol Head Neck Surg 120(1):32–35
21. Wang R, Jiang Y, Fan S, Chen J, Wu X, Zhao Y (1999) Repair of stricture of cervical esophagus with platysma myocutaneous flaps. Chin Med J 112(2):132–135
22. Suárez Nieto C, Lorenzo Gallego L, Galán Cortés JC (1983) Reconstruction of the posterior wall of the pharynx using a myocutaneous platysma flap. Br J Plast Surg 36(1):36–39
23. Tosco P, Garzino-Demo P, Ramieri G, Tanteri G, Pecorari G, Caldarelli C, Garzaro M, Giordano C, Berrone S (2012) The platysma myocutaneous flap (PMF) for head and neck reconstruction: a retrospective and multicentric analysis of 91 T1–T2 patients. J Craniomaxillofac Surg 40(8):e415–e418
24. Alvarez JC, Suárez C, Sota E, Rodrigo JP, Fernández JA, Llorente JL et al (1997) Tumours of the posterior pharyngeal wall: the use of the platysma flap. Clin Otolaryngol Allied Sci 22(3):246–250
25. Koch M, Künzel J, Mantsopoulos K, Zenk J, Iro H (2011) Defect closure after oral and pharyngeal tumor resection with the superiorly pedicled myocutaneous platysma flap: indications, technique, and complications. Eur Arch Otorhinolaryngol, Dec 24. PubMed PMID: 22197891
26. Boyle J, Patel S, Shah JP (2003) Management of oral and oropharyngeal cancers. Oral Dis 9(3):109–111
27. Sasaki M, Aoki T, Karakida K, Otsuru M, Takahashi M, Akamatsu T et al (2011) Postoperative follow-up strategy in patients with oral squamous cell carcinoma. J Oral Maxillofac Surg 69(6):e105–e111
28. Röösli C, Tschudi DC, Studer G, Braun J, Stoeckli SJ (2009) Outcome of patients after treatment for a squamous cell carcinoma of the oropharynx. Laryngoscope 119(3):534–540
29. Udoff RA, Elam JC, Gourin CG (2010) Primary surgery for oropharyngeal cancer. Otolaryngol Head Neck Surg 143(5):644–649
30. Hall SF, Groome PA, Irish J, O'Sullivan B (2008) The natural history of patients with squamous cell carcinoma of the hypopharynx. Laryngoscope 118(8):1362–1371
31. Hoffman HT, Karnell LH, Shah JP, Ariyan S, Brown GS, Fee WE et al (1997) Hypopharyngeal cancer patient care evaluation. Laryngoscope 107(8):1005–1017
32. Clark JR, de Almeida J, Gilbert R, Irish J, Brown D, Neligan P, Gullane PJ (2006) Primary and salvage (hypo) pharyngectomy: analysis and outcome. Head Neck 28(8):671–677
33. Steiner W, Ambrosch P, Hess CF, Kron M (2001) Organ preservation by transoral laser microsurgery in piriform sinus carcinoma. Otolaryngol Head Neck Surg 124(1):58–67