

# Long-term outcome and subjective quality of life after surgical treatment of lower lip cancer

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## Abstract

**Objectives** Squamous cell carcinoma of the lower lip represents a common type of cancer with a favourable prognosis. Different types of defect reconstruction after ablative surgery are described for maintenance of patients' quality of life.

**Materials and methods** The study retrospectively evaluates the outcome of 105 patients treated for lower lip cancer. Oncological data as well as individual quality of life were investigated.

**Results** Cervical lymph node metastases rarely occurred (7.6 %) and were correlated to larger-sized tumours ( $p=0.041$ ). Only five patients (4.8) died related to the tumour disease, especially after lymph node metastasis and tumour recurrence ( $p<0.001$ ). The 5-year rates for recurrence-free, overall and disease-specific survival were 84.5, 61.2 and 93.9 %. Tumour recurrence correlated with a resection margin of less than 0.75 cm ( $p=0.089$ ). With view to postoperative quality of life, the modified Bernard-Fries technique showed the most unfavourable results, particularly referring to sensibility, paraesthesia, lip pursing

and mouth opening compared to a stair-step and/or Abbe reconstructions.

**Conclusions** Squamous cell carcinoma of the lower lip shows a very favourable prognosis. Neck dissection seems often negligible particularly in small tumours. Patients' functional quality of life after lip surgery depends on the size of the primary and the used technique. Stair-step and/or Abbe reconstructions should be preferred to a Bernard-Fries technique in comparable defect sizes.

**Clinical relevance** Proper treatment of lower lip cancer provides favourable prognosis and preserves patients' functional and aesthetic quality of life.

**Keywords** Lip cancer · Resection margin · Lymph node metastasis · Reconstruction technique · Quality of life

## Introduction

Up to one third of all malignant oral tumours are carcinomas of the lip [1]. Most lip carcinomas are squamous cell carcinomas and occur at the lower lip due to the higher risk of sun exposure. In comparison to other carcinomas of the oral cavity, lip cancer shows a favourable prognosis [1]. Lymph node metastases are mainly found in the submental and submandibular area with an overall incidence of about 10–20 % for lower lip localization [1–3]. The need for a prophylactic neck dissection is not yet clarified. At the moment, carcinomas of the lip are mainly treated surgically by resection and immediate reconstruction with different types of local flaps depending on the defect size. Small lesions are easily treated with a wedge excision and primary closure. Larger defects of more than one third of the lip that are not suitable for primary closure require reconstruction with local flaps from adjacent tissues or the opposing lip like Karapandzic, stair-step or Abbe/Estlander flap repair [4]. The stair-step technique is a

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modified bilateral lip advancement flap with rectangular-shaped excisions running in the mental crease. The Abbe flap describes a 180° pivoted triangular-shaped full-thickness flap from the opposite lip nurtured by the pedicled labial artery. Bernard reconstruction of the lip with modifications according to Fries, Webster or others is apt for tumours of two thirds or even more. This technique bases on bilateral cheek advancement with excision of nasolabial Burow's triangles [5, 6]. Recently, combination of the stair-step technique and the Abbe flap has been proposed for reconstruction of similarly sized lip defects with the rationale of preserving the commissure and lip function [7]. Very large defects may require free flap reconstruction, sometimes as composite free tissue transfer [4]. As every technique shows its functional and aesthetic advantages and disadvantages, the current investigation evaluates patients' individual quality of life after lip reconstruction additionally to the documentation of the oncological aspects and outcome.

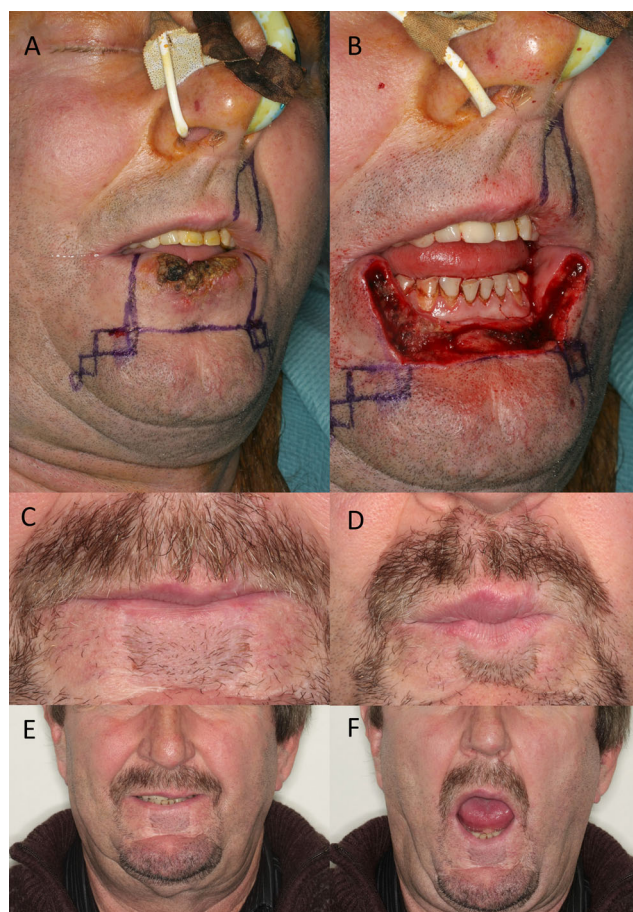
## Material and methods

### Patients

The retrospective study includes 105 patients (71 males, 34 females) with a squamous cell carcinoma of the lower lip who were operated between 2001 and 2012 at the Departments of Oral and Maxillofacial Surgery and Otorhinolaryngology of the University Hospital Regensburg. Clinical data were retrospectively obtained from the charts, the hospital database Systemanalyse und Programmentwicklung (SAP®) and the tumour centre of Regensburg University.

The mean age of the patients was 72.7 years (range 39–97). Pre-surgically all patients were clinically investigated for the primary tumour and the presence of obvious neck nodes. Computed tomography was performed for 74 patients after bioptical diagnosis of a squamous cell carcinoma. In all patients, the carcinoma was primarily resected with tumour-free margins (R0). For defects up to one third of the lip, a wedge excision and primary closure or a stair-step advancement flap was mainly performed. For defects up to two thirds of the lip, an Abbe flap alone or combined with a stair step technique (Fig. 1) was often used. A modified Bernard-Fries technique was also chosen in larger tumours of two thirds or even more. The used techniques are shown in Table 1. In 34 patients, a selective neck dissection was performed. In most cases ( $n=23$ ), levels I–III were dissected; in seven cases, only level I; and in four cases, levels I–V were dissected. Neck dissection was bilateral in 22 cases, in 12 patients only the ipsilateral neck was operated.

All patients were staged according to UICC TNM criteria of 2009 (seventh edition) [8]. Pathological TNM-stage was decisive. For neck node classification,



**Fig. 1** Patient sample of a combined Abbe/stair-step reconstruction of a carcinoma involving two thirds of the lip. **a** Lip carcinoma and marking of incision line. **b** Defect situation. **c, d** Situation after 16 months: Upper and lower lip show comparable length. Lip competence without tension and lip pursing. **e, f** Situation after 28 months: smiling and mouth opening

clinical and radiographical stage (e.g. cN0) was used when no neck dissection was performed.

The mean follow-up period was 3.5 years (min 0.2, max 10.2) and was measured from the date of surgery until death or end of follow-up. Overall survival (OS), disease-specific survival (DSS) and recurrence-free survival (until date of recurrence—RFS) were evaluated.

**Table 1** Surgical technique depending on tumour size (T stage)

Technique	T1	T2	T3	Total
Wedge closure	34	2	0	36
Stair-step	19	4	0	23
Abbe	8	2	1	11
Stair-step/Abbe	3	6	0	9
Bernard-Fries	7	9	3	19
Estlander	1	1	0	2
Others (RFF, Karapandzic, Gilles)	3	2	0	5
Total	75	26	4	105

For evaluating individual patients' quality of life after lip surgery, a dichotomized questionnaire (answer yes or no) addressing pain, sensitivity, lip competence and pursing, eating and drinking ability, pronunciation, denture wear, mouth opening and aesthetic outcome satisfaction was designed and applied to the patients. All patients received the questionnaire at the same time with a mean period of 3.47 years (min 0.05, max 8.77) after surgery.

### Statistics

Data were analysed with SPSS for Windows, version 20.0 (SPSS, IBM, Ehningen, Germany). Relationships between parameters were examined using Pearson's chi-square test ( $p < 0.05$ ) and Fisher's exact probability test ( $p < 0.05$ ) for dichotomised variables. Univariate survival curves were calculated with the Kaplan-Meier method, distributions were compared by means of the log-rank test.

### Results

Histopathologically 75 (71.4 %) tumours were classified as pT1, 26 (24.8 %) as pT2 and 4 (3.8 %) tumours as pT3. Four patients presented histologically confirmed lymph node metastases (all N2) at the time of tumour diagnosis and primary surgery, another four patients developed positive (delayed) neck nodes as recurrence. With view to the localization of metastasis, level I was involved in all cases. Furthermore, metastases affected level II ( $n=5$ ), level III ( $n=3$ ), level IV ( $n=2$ ), level V ( $n=2$ ) and level VI ( $n=1$ ). Five cases of neck node metastasis occurred bilateral, especially when the primary was located in the middle of the lip (four out of five). In three patients with a carcinoma of the lateral lip, neck node metastasis occurred ipsilateral. Overall neck metastasis (initially and secondary, 7.6 % of cases) was statistically associated ( $p=0.041$ ) with larger tumour size (T2/3) as shown in Table 2. In two patients, distant metastases occurred as skin metastases in the neck area.

Detailed histological information about the width of resection margin was available of 39 patients. In 14 patients, minimal resection margin was more than 0.75 cm, 25 patients

ended up with a minimal resection margin of less than 0.75 cm.

Twenty-six tumours were histologically classified as low-grade (G1), 71 tumour as intermediate-grade (G2) and 8 carcinomas were classified as high-grade (G3) malignancies. No single carcinoma presented lymphangiosis or haemangiosis. Grading did not correlate ( $p > 0.05$ ) with tumour size; however, neck involvement was higher in high-grade tumours (2/6, 25.0 %) compared to intermediate- (5/66, 7.0 %) and low-grade (1/26, 3.8 %) malignancies although not reaching statistical significance ( $p=0.136$ ).

### Overall survival and recurrence

Overall, 14 patients suffered from tumour recurrence (eight local, six neck and two distant) after surgery. With view to the neck nodes, two recurrences occurred out of the four patients with initial neck node positivity after neck dissection, four neck recurrences were diagnosed in patients with initial N0 status, although neck dissection had been performed in three of these four cases. Local tumour recurrence was not associated ( $p > 0.05$ ) with tumour size and tumour grade, whereas neck recurrence more often occurred with T2/T3 (4/6, 66.7 %) tumours compared to T1 (2/6, 33.3 %,  $p=0.091$ ) tumours, independently of tumour grade ( $p > 0.05$ ). Tumour recurrence was associated with histological resection margin although not reaching statistical significance. No recurrence occurred when the resection margin was more than 0.75 cm ( $n=14$ ), whereas 5/25 (20 %) recurrences were documented when the histological resection margin was less than 0.75 cm ( $p=0.092$ ).

The 5-year recurrence-free survival (RFS) of all patients was 84.5 %. Neither tumour size nor tumour grade statistically influenced RFS. However, a resection margin of less than 0.75 cm was significantly associated with worse recurrence-free survival ( $p=0.05$ , Fig. 2a).

Overall, 37 patients died during the follow-up period resulting in a 5-year overall survival (OS) of 61.2 %. Five patients (4.8 %) died cancer-related, following neck and distant metastases ( $n=2$ ), advanced neck metastases ( $n=2$ ) and due to extended surgery ( $n=1$ ). The 5-year disease-specific survival (DSS) was 93.9 %. DSS was strongly associated with tumour size, lymph node involvement and recurrence (Fig. 2b–d,  $p < 0.001$ ), whereas tumour grade and resection margin did not influence DSS ( $p > 0.05$ ). A 5-year DSS dropped to 33.3 % for the patients with initial neck metastasis and 42.9 % for all patients with primary or secondary neck involvement.

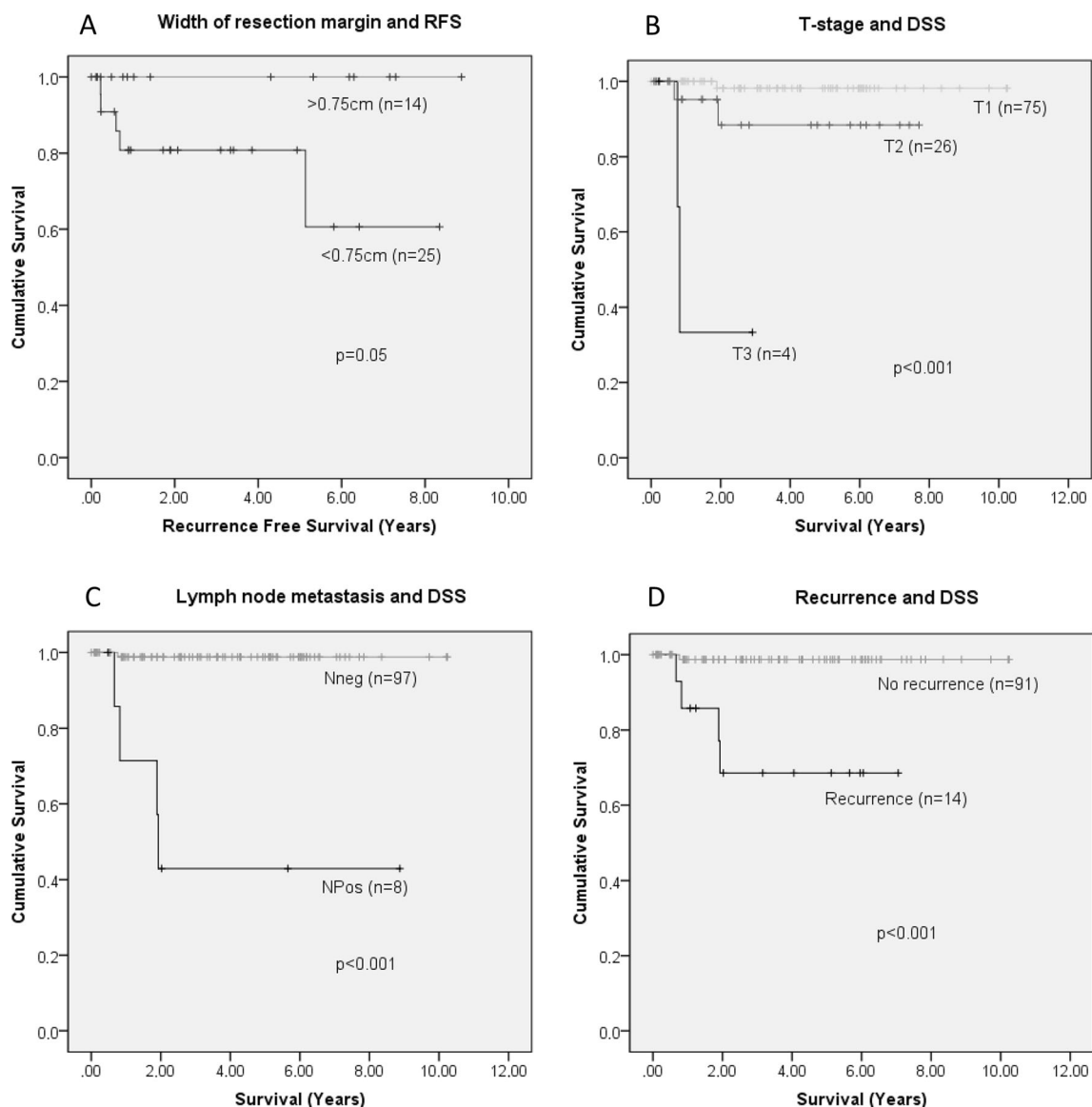
### Quality of life

Fifty-five 55 patients out of the 68 patients who were still alive at the time of evaluation (80.9 %) responded to the questionnaires addressing patients' functional and aesthetical quality

**Table 2** Association of cervical lymph node metastases and tumour size

	Nneg	Npos	Total
T1	72 (96.0 %)	3 (4.0 %)	75
T2/T3	25 (83.3 %)	5 (16.7 %)	30
Total	97	8	105

N lymph node; neg negative; pos positive  
 $p=0.041$



**Fig. 2** Kaplan-Meier survival curves for **a** width of resection margin and recurrence-free survival (*RFS*). **b** Tumour size (*Tstage*) and disease-specific survival (*DSS*). **c** Cervical lymph node metastases and *DSS*. **d** Tumour recurrence and *DSS*

of life. Table 3 presents the results of the survey. The modified Bernard-Fries technique showed the most unfavourable results, particularly referring to sensibility, paraesthesia and lip pursing. Overall, 47.3 % of patients reported limited sensibility after surgery; however patients after Bernard-Fries closure had a hypaesthesia in 72.7 % ( $p=0.086$ ). Interestingly, primary closure also presented high rates of paraesthesia (68.8 %). Patients with advanced tumour size reported more problems with ingestion compared to those with small tumours ( $p=0.057$ ). Lip pursing was stronger limited after resection of T2/3 tumour (37.5 %) compared to smaller carcinomas (19.4 %,  $p=0.22$ ). Lip pursing was strongly restricted after Bernard-Fries reconstruction (90.1 %) compared to the other techniques (31.8 %,  $p=0.002$ ). And also, pronunciation was stronger impaired after Bernard-Fries (45.5 vs. 23.3 %). Most

of the patients (84.0 %) were able to wear dentures including those after Bernard-Fries reconstruction. Subjective mouth opening was limited in 66.7 % after surgery of a T2/3 tumour compared to only 37.5 % after excision of a T1 carcinoma ( $p=0.071$ ). With view to the used technique, mouth opening was most often restricted after Bernard-Fries (63.6 %). Overall, 80 % of the patients were satisfied with the aesthetic outcome of the operation independently of tumour size and surgical technique.

## Discussion

Our results emphasize the favourable prognosis of lip cancer with a 5-year disease-specific survival rate of 94 % [1, 9, 10].



**Table 3** Functional and aesthetical quality of life after lip reconstruction in correlation to T stage and surgical technique

	T stage		Surgical technique						Total
	T1	T2/3	Primary closure	Stair-step	Abbe	Abbe/stair-step	Bernard-Fries	Others	
<b>Pain</b>									
No	24	13	9	8	3	7	9	1	37
Yes	16	2	7	5	1	1	2	2	18
<b>Hyposensibility</b>									
No	22	7	9	10	2	5	3	0	29
Yes	18	8	7	3	2	3	8*	3	26
<b>Paraesthesia</b>									
No	13	6	5	7	0	4	3	0	19
Yes	27	9	11	6	4	4	8	3	36
<b>Loss of saliva</b>									
No	28	8	12	9	2	5	7	1	36
Yes	12	7	4	4	2	3	4	2	19
<b>Loss of beverage</b>									
No	29	12	12	11	2	7	8	1	41
Yes	11	3	4	2	2	1	3	2	14
<b>Ingestion disorder</b>									
No	39	12	16	12	3	7	10	3	51
Yes	1	3*	0	1	1	1	1	0	4
<b>Disorder lip pursing</b>									
No	25	6	14	6	3	6	1	1	31
Yes	15	9	2	7	1	2	10**	2	24
<b>Comprehensive pronunciation</b>									
No	29	10	13	10	2	6	6	2	39
Yes	10	5	3	3	2	1	5	1	15
<b>Limited subjective mouth opening</b>									
No	25	5	12	7	2	4	4	1	30
Yes	15	10*	4	6	2	4	7	2	25
<b>Maximal mouth opening</b>									
>4 cm	19	7	7	5	3	6	5	0	26
<4 cm	21	8	9	8	1	2	6	3	29
<b>Denture use</b>									
Possible	32	10	13	10	1	7	8	3	42
Not possible	5	3	1	3	2	1	1	0	8
<b>Aesthetics</b>									
Satisfied	32	12	13	12	2	7	8	2	44
Not satisfied	8	3	3	1	2	1	3	1	11

\* $p < 0.1$ ; \*\* $p < 0.05$ 

Most patients presented with early-stage tumours, only 4 % of our patients had a T3-sized carcinoma at initial diagnosis, not more than 4 % presented cervical lymph node metastases. Although all tumours were resected with histologically tumour-free margins, 14 patients (13.3 %) suffered from tumour recurrence which is a little bit lower than former results [9, 11]. One finding of this study was that the resection margin is the strongest predictor of tumour recurrence. No tumour

recurred when the primary lesion was excised with more than 0.75 cm margin histologically. Although case number of the histological margin documentation was low ( $n=39$ ) in this study, the importance of a clear margin had already been stated before [11, 12]. However, a threshold of the tumour-free margin is not clearly recommended. In an Australian study on T1 and T2 lip carcinomas, a resection margin of  $<2$  mm was defined as closed margin [11]; another investigation of De

Visser et al. on 72 patients reported a local recurrence rate of 2.8 % (two patients) when the clinically visible resection margin was at least 3 mm controlled by intraoperative frozen section analysis [12]. According to our results, a 3-mm tumour-free resection margin seems not enough.

There is an ongoing discussion about the need for a neck dissection in lip cancer. Some authors report occult metastases for lower lip cancer in up to 20 % and therefore recommend a prophylactic selective neck dissection [3]. In the largest study to date on more than 1000 lip carcinomas, overall incidence of neck metastases was 10 % [13]. Out of these, 6 % were initially diagnosed and 4 % occurred during follow-up. Cervical metastasis was associated with a tumour size of more than 3 cm, commissure involvement and with high-grade histology. Because of the low incidence of metastasis, the authors conclude that prophylactic neck dissection is not generally justified. Vanderlei et al. recently investigated T2N0 lip carcinomas and found neck node metastasis in 10 % of tumours smaller than 3 cm, whereas the rate of metastasis raised to about 45 % for tumours bigger than 3 cm in size [14]. The significance of commissure involvement for positive neck nodes is also confirmed in another large study on 617 lip cancer patients [9]. So, currently, elective treatment of the neck is considered for advanced tumour size (>3 cm), commissure involvement and locally recurrent tumours as these patients may also present cervical neck nodes in up to 26 % [2, 9, 13–15]. In our study, only eight patients developed histologically diagnosed neck node metastases either at initial diagnosis ( $n=4$ ) or delayed during follow-up ( $n=4$ ). Neck involvement was more frequent with increased tumour size (T2 and T3); however, three positive neck nodes occurred with a T1 tumour. Definition of nodal involvement was difficult in this investigation as only one third of the patients received a neck dissection for available pN status. However, only one patient out of those who did not receive a neck dissection developed lymph node metastasis of the regional neck. Grading did not influence neck metastasis in the present study, maybe due to the limited case number of neck involvement. So, also according to our results, it seems reasonable to omit neck dissection in smaller (<3 cm) lip carcinomas if pre-surgical imaging does not suggest neck metastasis. Nevertheless, if a patient develops cervical lymph node metastasis, prognosis becomes unfavourable with an increasing risk of distant metastasis independently from the performance of an initial neck dissection.

There are different techniques to reconstruct the lip after tumour excision. In the present study, wedge excision with primary closure and the stair-step technique were mainly used for small lip defects up to one third, whereas an Abbe flap, often combined with a stair-step advancement, was used for tumour sizes of one third to two thirds. The modified Bernard-Fries technique with cheek advancement was also performed for bigger-sized carcinomas, often two thirds and more of the

lip. The latter technique in particular shows some negative aspects with view to the patients' quality of life. Patients operated by a Bernard-Fries technique more often (73 %) ended up with a hypaesthesia of the lip compared to other methods, e.g. the stair-step method (23 %). This observation has recently been described by others [7, 16, 17]. The major disadvantage of the Bernard-Fries technique is the lack of orbicularis oris continuity. The reconstructed lip is extremely short, tight and subtle lip functions are no longer possible [18]. This phenomenon is strongly reflected in our results where only one patient (9 %) was able to purse the lips after Bernard-Fries closure whereas this lip function was significantly better after Abbe reconstruction or a combined Abbe/stair-step technique (both 75 %). Also, comprehensive pronunciation was stronger impaired after Bernard-Fries. It seems important to reconstruct the resected orbicularis muscle by a functional tissue matching the lost one. Therefore, the upper lip with its orbicularis muscle serves as the best donor site and a full thickness Abbe switch flap restores the lower orbicularis oris muscle. Electromyographic investigations demonstrated a constant improvement of the lip sphincter function after Abbe reconstruction during the first year [19]. The most important disadvantage of an Abbe reconstruction is of course the patient's inconvenience of mouth closure before the release of the pedicle. As expected, subjective patients' mouth opening was more often limited after excision of larger tumours and also after Bernard-Fries reconstruction. Adequate mouth competence without loss of saliva or beverage was achieved by all techniques. Most of the patients are able to wear dentures after different types of lip reconstruction. Overall, 80 % of the patients were satisfied with the aesthetic outcome of the reconstruction, independently of the used technique.

The present investigation has several limitations. First of all, patients with lip cancer rarely show neck node metastasis and—fortunately—very few patients die tumour-related. This aggravates statistical reliable statements about long-term survival or parameters associated with lymph node metastasis. Another limitation is that data of histological safety margin was only available for 39 of all 105 patients. For comparison of different surgical techniques, patients with similar defect sizes should be compared. Patients with larger lip defects are supposed to present a more unfavourable quality of life than patients with smaller-sized tumours, irrespectively of the used surgical technique. Therefore, we concentrated on comparison of the two techniques, Abbe/stair-step and modified Bernard-Fries, which were performed in larger lip defects of up to two thirds and more. Also, patients' perceptions are different. Some patients feel comfortable with advanced tumours and describe a good quality of life after tumour resection despite considerable functional limitations, whereas others feel unhappy with very few functional restrictions.

In conclusion, squamous cell carcinoma of the lower lip shows a much better overall prognosis compared to other squamous cell carcinomas of the oral cavity. A resection margin of more than 0.75 mm seems reasonable for recurrence-free survival. Regional neck node metastases are rare and neck dissection seems negligible particularly in small tumours. Nevertheless, positive neck nodes are the strongest negative predictor for survival. Patient's functional quality of life after lip surgery depends on the size of the primary tumour and the used technique. Restoration of the lip sphincter function by an Abbe flap, where appropriate combined with a stair-step technique, should be preferred to a Bernard-Fries technique for lip defects of up to two thirds.

**Conflict of interests** The authors declare that they have no conflict of interests.

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