



## The submental island flap for the treatment of intraoral tumor-related defects: No effect on recurrence rates



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### SUMMARY

**Objectives:** The submental island flap has become increasingly popular in the treatment of intraoral defects following tumor ablation. However, there was concern that the elevation of the pedicled flap might interfere with the efficiency of level I-lymph node dissection and decrease the oncological prognosis of the patients.

**Materials and methods:** In a prospective clinical study over five years the outcome of 45 consecutive patients with intraoral cancer of various T-stages treated with submental island flaps was evaluated and compared to 45 patients with a T-status analogous oral cancer treated with free radial forearm flaps. **Results:** All submental island flaps beside three were successful (93.3%). The obtained functional results were pleasing and the donor morbidity low. Patients treated with submental island flaps exhibited no enhanced risk of local tumor recurrence or lymph node metastasis ( $p < 0.86$ ). In contrast, the operation time, time of intensive care and hospitalization were reduced ( $p < 0.001$ ).

**Discussion:** We conclude that the submental island flap is an effective and predictable option of small and medium-sized oral defect treatment. It is a valuable alternative to free flap soft tissue reconstructions such as radial forearm or perforator flaps. It seems particularly beneficial to patients with relevant comorbidities as often present in the oral cancer population. The application of the submental island flap does not reduce the oncological prognosis of oral cancer patients.

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### Introduction

An appropriate treatment of intraoral defects caused by the resection of oral cancer is most important for the functional rehabilitation and the preservation of an individual's quality of life. In the last decades the transfer of free flaps from various anatomic regions and composed of diverse tissues has greatly enlarged the surgical options of intraoral defect management [1]. However, free tissue transfer is frequently related to a significant operative trauma, e.g. due to donor site morbidity and extended operation times required for microvascular anastomosis [1,2]. Regional, pedicled transplants may also provide satisfactory oral functions without the necessity of microvascular anastomosis thus reducing the surgical trauma considerably. The submental island flap (SMI-flap) can be used as an axial pattern pedicled fasciocutaneous flap of the submental region perfused by the submental artery and vein, which arise from the facial artery and vein [3,4]. Technically, the

flap can be harvested in combination with neck dissection surgery and placed into the oral cavity for primary treatment of soft tissue defects [5,6]. Although several clinical studies have demonstrated low donor site morbidities and pleasing functional results of the SMI-flap for intraoral rehabilitation, there is serious concern that in oral cancer patients the elevation of the SMI-flap may conflict with submandibular lymph node dissection, thus reducing the individual oncological prognosis [5,6].

It was our a priori-hypothesis that utilization of the SMI-flap is not related to an altered prognosis in certain oral cancer patients. In order to test this hypothesis we prospectively observed the clinical and oncological outcomes in a 5-year series of primary oral cancer patients free of regional lymph node metastasis which were treated with SMI-flaps. We compared the results to a group of patients with oral cancer of the same intraoral region and analogous T-status. Those patients were treated with a free radial forearm (FRF)-flap, another well-established concept of oral soft tissue rehabilitation.

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## Patients and methods

All patients included in this study suffered from primary oral squamous cell carcinoma and were diagnosed and treated in an academic maxillofacial unit according to the guidelines of the German national cancer association [7] and in agreement with an interdisciplinary local tumor board. Our study was approved by the local ethics committee (AZ: 3/5/10).

Briefly, in all patients the oral carcinoma was resected completely including safety margins of at least 5 mm. A complete three-dimensional resection of the tumor (R0-status) was documented postoperatively by histological examination of the tumor specimen. Simultaneously, all patients underwent ipsi- or bilateral selective neck dissection at least of the levels I–IV. Intraoral defects were treated simultaneously by either regional pedicled flaps or by microvascular reanastomized free flap reconstructions. Temporary tracheostomy was performed only in cases of posterior tumor localization or extended tumor size.

According to national guidelines, all patients with either a positive lymph node status (N<sub>1-3</sub>) and/or those with advanced oral tumor sizes (T<sub>3,4</sub>) received adjuvant therapy [7]. Radiochemotherapy included cisplatin and 5-FU administration.

All patients were included into a standardized post-therapeutic follow up protocol [7]. Briefly, clinical consultations were performed every month and regional ultrasound investigations every two months during the first year after completion of initial tumor therapy. After two years the clinical consultations were performed every three months and ultrasound examinations every six months. In total, patients were followed-up for five years after primary treatment.

### Patients with submental island (SMI-) flap

Between April 2009 and August 2014 45 consecutive patients were treated with a SMI-flap following intraoral cancer resection. We applied two criteria for utilization of the SMI-flap: The first criterion was a clear neck situation (N0-neck status), which was assessed preoperatively by clinical examination and regional imaging (Doppler ultrasound and CT-scans) and intraoperatively by frozen sections of regional suspicious lymph nodes. The second criterion was the defect size, which was to expect smaller than 24 cm<sup>2</sup> (4 × 6 cm) because of our intention to treat the submental donor site defect by primary closure of the submental skin.

Technically, during submandibular neck dissection the submental artery and vein were identified and isolated for flap elevation. The marginal branch of the facial nerve was identified by electric stimulation and preserved. Opposite to other groups [8] we included in all patients the anterior belly of the digastric muscle in conjunction with the overlying fasciocutaneous tissue into the flap in order to preserve the terminal course of the submental vessels and perforators [9]. The transposition of the pedicled flap into the oral cavity was performed after completion of intraoral tumor resection and analysis of frozen tissue sections (Fig. 1a–f).

### Patients with free radial forearm (FRF-) flap

For comparative analyses a second group of patients with primary oral cancer was established. 45 patients were selected from a total of 166 oral cancer patients who were treated with a free radial forearm flap between March 2009 and August 2014. Matching criteria were T-status, N-status, identical intraoral tumor location, age and gender of the patient. FRF-flap harvesting was performed in a two-team approach simultaneously to neck dissection and oral tumor resection to save as much operation time as possible. Microvascular anastomosis was performed end-to-end

commonly using the superior thyroid artery or the facial artery; venous anastomosis was performed with branches of the internal jugular vein. The forearm donor site was treated with a split thickness skin graft simultaneously harvested from the upper thigh.

### Flap perfusion and hemodynamics

The intra- and postoperative perfusion of both types of the flaps was controlled by systematic clinical examinations and by a combination of laser Doppler flowmetry and light spectrophotometry (O<sub>2</sub>C, LEA Medizintechnik, Gießen, Germany) [10].

### Statistical methods

The observation period for both groups was up to 5 years. Beside personal and clinical information several parameters of oncological interest were collected. Statistical analyses were performed using the software SPSS Statistics 20.0. (IBM Germany, Ehningen, Germany). In order to analyse parameters of clinical or prognostic interest, descriptive analyses, comparative analyses and survival analyses were performed. For comparative analyses Wilcoxon ranksum tests were performed because a parametric distribution of the unpaired data was not to expect. Survival was calculated according to Kaplan–Meyer; the influence of relevant parameters was observed by a backward stepwise Cox regression analysis. For all analyses the level of significance was defined at 5% ( $p < 0.05$ ).

## Results

### Demographic results

In the 45 patients treated with SMI-flap the average age was 61.9 (maximum 86) years; in the 45 patients with FRF-flap the average age was 62.6 (maximum 77) years. In both groups there were more males than females included. All regions of the oral cavity were affected from oral cancer; most patients suffered from T<sub>2</sub> oral carcinoma of the oral floor and mandibular alveolar process (Figs. 2 and 3). In each group, 19 patients (42.2%) underwent postoperative adjuvant therapy. Twelve patients (26.7%) with SMI-flap received combined radio-chemotherapy and 7 patients (15.6%) received radiotherapy alone; 15 patients (33.3%) with FRF-flap received radio-chemotherapy and 4 patients (8.9%) received radiotherapy alone (Fig. 3). The average period of observation was for patients with SMI-flap 1241 days and for patients with FRF-flap 1233 days.

### Clinical and functional results

In all patients a complete resection of the carcinoma was accomplished (R<sub>0</sub>-status). In those patients preoperatively designated for treatment with SMI-flaps no affected lymph nodes of the levels Ia and Ib were identified intraoperatively by frozen sections neither by final postoperative histological examination; therefore in no case an abortion of the submental flap reconstruction concept was required. However, in the final histological examination in four patients (8.8%) of this group occult lymph node metastases of the levels II or III were found. This resulted in an additional dissection of level V in those patients, but did not affect the concept of intraoral defect treatment. Similarly, patients treated with FRF-flaps exhibited no affected lymph nodes in the levels Ia and Ib; however, in eight patients (17.8%) occult lymph nodes of the level II, III and IV were identified. This resulted also in an additional dissection of level V but had no consequence on the selected concept of intraoral defect treatment (Fig. 3).

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