

# Regional Flap in Head and Neck Reconstruction- Part I: Philosophy, Submental and Supraclavicular Flaps

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## Abstract

**Background:** Regional (pedicled) flaps for reconstruction of intra-oral defects are acquiring increasing recognition as a safe, reliable choice in selected cases after oral cancer ablation (extirpation). The lower technical demands and suitability for elderly/high-risk patients together with specific features that may resolve the seemingly intractable dilemmas with other approaches, are providing a valuable tool in this challenging area of surgery.

**Aim:** The aim of this paper is to describe our experience with the regional (pedicled) (submental, supraclavicular) flaps with a focus on reliability, function, cosmesis, donor site morbidity and oncological safety.

**Methods and results:** Reconstructive techniques using distal flaps are described in 12 patients. In 8, engraftment was complete, in 3 there was partial necrosis and in 1 case, complete rejection of the flap.

**Conclusion:** Regional (pedicled) flaps are thin, and pliable with good cosmetic and functional results. They can be accomplished in a one-stage reconstruction with minimum morbidity of donor site.

**Keywords:** Pedicled; Submental flap; Supraclavicular flap; Head and neck reconstruction; Oral cancer

## Introduction

Regional flaps have been extensively used since the 1970s. In principle, tissue is lifted from a donor site and moved to a recipient site without disruption of blood supply. The donor site is an exact anatomically defined region of tissue which is capable of sustaining its own blood supply. Of pedicled flap techniques for reconstruction of defects in the oropharyngeal area, most frequently used, are pectoral, submental, supraclavicular and temporal, frontal flaps less frequently and the same for trapezoidal, pedicled flap m. latissimus dorsi. The benefits of pedicled flaps include lower technical demands obviating the need for microsurgical anastomosis and shorter operating time. For this reason, they are most indicated in elderly and at risk patients. The disadvantages are their narrower scope and in some cases poorer marginal blood supply than free flaps and their practical utility only for reconstruction of soft tissue. They may also be less aesthetically acceptable owing to a greater range of operation scars but mostly because of good color and texture match to the face, they are less conspicuous and more acceptable than free flaps. Submental and supraclavicular flaps in particular, are thin and pliable with good cosmetic and functional results. A further technical advantage is the possibility of one-stage reconstruction with minimum morbidity at the donor site. Supraclavicular flaps in particular are now considered the gold standard for reconstruction of soft tissue defects of the head and

neck. On the basis of our experience, we use different pedicled flaps according to the scale, location and depth of the defect.

The supraclavicular flap is best indicated for its almost identical texture and safe distance for surface defects which are located in the anterior part of the neck. For surface defects of the palate, alveoli and face we can also use the supraclavicular flap but as a delay due to the limited arc of rotation to these locations. In contrast, we choose the submental flap on the upper pedicle without limit to its reach and blood supply, for mid size defects of the upper jaw and palate. We indicate the submental flap on the lower pedicle for moderately deep defects of oropharynx, floor of the oral cavity and tongue. In case of positive submandibular lymph node, we choose the pectoral flap without the skin island. The pectoral flap with the skin island is fully indicated for deep defects of the floor of the oral cavity, tongue and oropharynx with the assumption of positive regional lymph node metastases.

## Methods

The group consisted of 12 patients, 7 men and 5 women of middle age, treated from 2015-2016 at the Clinic for Oral and Maxillofacial Surgery, the University Hospital, Olomouc (Table 1). Nine patients were treated primarily for squamous cell carcinoma of the orofacial region, and 3 for low - grade adenocarcinoma of the small salivary gland. Submental flap for reconstruction was used in 7 patients. In 4 patients, we did immediate reconstruction of the defect of the base of the tongue and oral cavity, in the other 3, we performed this technique

for palate reconstruction (Figures 1 and 2). In 5 patients, we used the supraclavicular flap. In 3 of these patients, we did reconstruction of two secondary defects localised in the neck and in one case, supraclavicular flap for a secondary defect, was used for full thickness reconstruction of the cheek (Figure 3 and 4). In one patient, we used this technique for reconstructing the floor of the oral cavity for persisting fistula after extirpation of squamous cell carcinoma of the base of the oral cavity. For better vascular supply, the terminal portion of the flap was transferred after a "delay" [1]. In one case, we reconstructed a defect in the root of the tongue with a supraclavicular flap after extirpation of squamous cell carcinoma.



Figure 1: Submental flap after preparation.



Figure 2: Look to the oral cavity after 8 weeks.

## Surgical Technique

### Submental flap

Design of the flap - the patient lies on his/her back with his/her head in a normal position and the size of skin island is determined by

the pinch test. The flap upper border passes 1 cm along the edge of the mandibular arch, laterally behind the angle of the mandible. Caudally is the boundary of the flap about 6-7 cm from the edge of the mandibular arch. The surgical procedure is carried out in a supine position of patient and usually starts with extirpation of submandibular gland through a caudal incision and identification of the facial artery and vein. The skin island is then sharply circumscribed up to the platysma muscle. The elevation of the flap begins from the contralateral side in the subplatysmal plane and proceeds to the anterior belly of the digastric muscle. After separating the anterior belly of the digastric muscle from the jaw (avoiding damage to the pedicle and, lateral and medial perforators that either go through or pass under the muscle) we separate the muscle from the mylohyoid muscle and at the level of bisecting tendon of digastric muscle, we perform a complete dissection of the anterior part of muscle. This procedure is followed by a platysma muscle dissection the whole flap perimeter up to identification of the marginal mandibular branch of the facial nerve, facial artery and vein below the edge of the mandibular arch.

The complete harvesting of the flap is followed by extirpation of lymphatic tissue in the submental region with probing of the arc of flap rotation.

Submental Flap					
Patient	Histology	Localisation	Complications	Size	Gender
1	Spin. Ca	Floor of O.C.	-	?	M
2	Spin. Ca.	Floor of O.C.	Nodular progression	?	F
3	Spin. Ca	Floor of O.C.	-	5 × 11	M
4	Adeno. Ca	palate	-	5 × 12	F
5	Adeno. Ca	palate	-	5 × 12.5	M
6	Adeno. Ca	palate	Marginal Necrosis	5 × 10	F
7	Spin. Ca.	Floor of O.C.	Total Necrosis	4.5 × 10	M

Table 1(a): Overview of patients reconstructed using submental flaps.

Supraclavicular Flap					
Patient	Histology	Localisation	Complications	Size	Gender
1	Spin. ca	neck	-	8 × 5	M
2	Spin. ca	neck	-	8 × 5	M
3	Spin. ca	cheek	Partial necrosis	5.5 × 4	F
4	Spin. ca	Oropharyngx	Partial necrosis	7 × 4	F
5	Spin. ca	Floor of O.C.	-	7 × 4.5	M

Table 1(b): Overview of patients reconstructed using supraclavicular flaps.

Ligation of proximal facial pedicle is used for defects of the maxilla and palate; for defects of oropharynx and tongue by ligation of the distal facial pedicle, and for defects of the floor of the oral cavity and tongue the pedicles are retained without ligation, not restricting the range of the flap [2-4].

### Supraclavicular flap

The patient is in supine position with slightly supported arm and neck inclined to the contralateral side. The design of the flap on the skin in a donor site is more anterior to the deltoid muscle. On the lateral side of the neck, we mark the position of the trapezius muscle, sternocleidomastoid muscle, external jugular vein and the clavicle. The origin of the supraclavicular artery from the transverse cervical artery lies in the triangular area between external jugular vein and sternocleidomastoid muscle extending parallel to the clavicle.

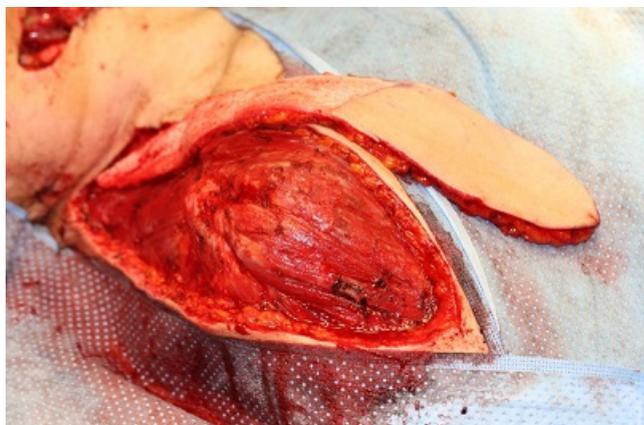


Figure 3: Supraclavicular flap after preparation.



Figure 4: A status after reconstruction of the defect.

Harvesting of the flap proceeds with the fascia of the muscle from lateral to medial, i.e. from the skin margin on the deltoid. Several perforators of the deltoid muscle must be cut in the subfascial plane and incision continues until the area of the acromioclavicular joint (care being taken about joint capsule opening). Approximately in the second third of the elevation, we can see the pedicle (by

transillumination of the lobe). From the middle area of the flap, we perform the dissection medially in the subcutaneous plane, care taken not to damage the platysma muscle and soft tissue around the pedicle. In the supraclavicular fossa, we can expose the superficial transverse cervical artery and deep transverse cervical artery. Both branches can be ligated for better mobility of the flap (Figures 3 and 4).

Before final ligature of these vessels, we prefer to use microclips, and check capillary reflow of the flap in 3-4 minutes. The vascular pedicle consists of - ATC (transverse cervical artery), ASC (supraclavicular artery) and the superficial cervical vein. After the tunnelisation, the mobilized flap can be transferred under the skin tunnel on the lateral side of the neck to the recipient site [5].

### Results

In five patients, there was successful engraftment of the submental flap with very good functional and aesthetic results and with minimal morbidity of donor site. In one case, in the reconstructed palate, there was ischemia and later necrosis of the edges of the flap, with leakage of fluid detected through the nose. The defect was reconstructed using simple suture. In one patient, the third day after surgery, the flap almost totally necrotised. Necrectomy was carried out gradually, after complete separation of the tissue, allowing gradual granulation. In one patient, unfortunately at four months, there was spinal cell carcinoma progression of metastatic lymph nodules localised in the submandibular region. Supraclavicular flap in 4x healed completely, 1x during the postoperative period it was infected with partial loss of the outer part of the flap which was replaced by a bilobed flap from the preauricular region. For one patient after reconstruction of the oropharynx, due to ischemic necrosis of the terminal part, the defect in the root of the tongue healed spontaneously. In all patients after reconstruction using supraclavicular flap, the donor site was closed primarily with minimal morbidity.

### Discussion

There is a consistent increase in publications on pedicled flaps in the reconstruction of post ablation defects in the oropharyngeal area. The submental flap was first described by Martin et al. in 1990 [2,3]. From the anatomical viewpoint, the submental artery, a branch of the facial artery with a continuous course, is mostly used. The main advantages of this flap are minimal donor site morbidity, pliability and good cosmesis at least comparable to free flap reconstruction. However, in obese patients, it can be bulky. The size of the skin island is taken according to the "pinch test", which consists in pressing the skin and subcutaneous tissue in the submandibular region. It is thus defined by the maximum width of the flap which allows the primary closure. The aesthetic outcome is usually very good, which our experience confirms especially for older people where there is significant excess skin and all that remains is an inconspicuous scar of wrinkled skin [6-8]. The extent of the flap is also acceptable, reliably serves to cover defects in tongue and/tongue floor, floor of the mouth, face, and soft and hard palate. It can also be used after ligation of proximal vessel as a reverse flap supplied by the angular artery, allowing a range up to the occipital region without the tendency to venous stasis [9]. It is also possible to harvest a part of the lower jaw for small bone reconstruction defects during preparation of the front part of the digastric muscle at the same time but we have not used this [3]. Indications for reconstructive techniques are limited in tumors with multiple nodular metastases in submandibular regions and some authors consider this contraindicated. In our case, we had one patient after removal of later

stage squamous cell tongue cancer (pT3, N2b, Mx) who unfortunately progressed rapidly to nodal metastases in the submandibular region. Conversely, in patients treated for squamous cell carcinoma in the early stage of the disease and small tumors of the salivary glands with a low tendency to metastasize to the submandibular and deep cervical lymph nodes, we had no relapse. In men, after reconstruction of oral defects without following radiotherapy, there is often adnexes growth in the oral cavity which is uncomfortable. One option is laser therapy, which, after several cycles of growth, stop the adnexa. In the Czech Republic, this treatment is not covered by health insurance, and for some patients it is unaffordable.

We repeat that flap reconstruction techniques in the orofacial region should meet a number of criteria. The flap should match the size of the defect and satisfy functionality. In the facial area, the cosmetic aspect is of paramount importance (skin color, texture). For this aspect alone and less morbidity of donor site, the supraclavicular flap is "rehabilitated" and some authors even prefer it over the forearm flap which is structurally very similar. The supraclavicular flap was introduced relatively recently but probably due to wider use of the pectoral flap was not routinely used [10]. Its current use is credited to Pallua, who reconstructed defects of chest and face with it [5]. The main artery is the arteria supraclavicularis which is a branch of the artery transversa coli based generally from truncus thyroideocervicalis less often from suprascapular or subclavian artery. Given this variability, some authors recommend CT - angiography of this area [11]. We use the Doppler technique not only before and after the performance, but also during the procedure. The maximum length of the flap is about 25 cm to ensure good blood supply and at the same time should provide an adequate range (tongue, sublingual area, palate, occipital region and pharyngoesophageal area) [12]. In our experience, in terms of adequate blood supply, it is safe to prepare the flap to the first third of the deltoid. In the case of reconstruction of distal defects, we use the "delay" technique: about 7 to 14 days prior to surgery the terminal flap is elevated and re-sutured. This ensures better vascular supply of the terminal part, reducing the risk of necrosis [1]. The technique is fairly easy, particularly at the beginning of the deltoid region but we are more cautious in the acromioclavicular area and supraclavicular fossa where the main artery arises [11-16] Lately a modified proces has been described. This uses supraclavicular anterior artery which extends in the axillary area and mimimises donor site morbidity and achieves better aesthetic results [17].

## Conclusion

Submental and supraclavicular flaps are thin, plible, versatile and easily prepared with good cosmetic and functional results. Another advantage is one-stage reconstruction with minimum donor site morbidity. The supraclavicular flap is now considered the gold standard for reconstruction of soft tissue defects of the oropharyngeal area.

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## Author Contributions

RP, ZD: data collection, data analysis, literature search and manuscript writing; PM, PH, PT: data collection and critical reading; all authors: manuscript revision.

## Conflict of Interest Statement

The authors state that there are no conflicts of interest regarding the publication of this article.

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