

**INDIVIDUALIZED SURGICAL MANAGEMENT IN THE HEAD AND NECK
REGION**

PhD Thesis

Zoltán Lóderer, MD

Department of Oral and Maxillofacial Surgery

University of Szeged

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1. INTRODUCTION

1.1. Head and neck oncology

1.1.1. Ethiopathogenesis and risk factors

The development of tumorous lesions is initiated with chronic particular environmental or lifestyle habits, inducing irreparable DNA damage. The DNA damage causes an imbalance in the regulation of cell cycle, and overexpression of tumor-promoter oncogenes and suppression or inactivation of tumor-suppressor genes can be observed. These processes lead to uncontrolled cell proliferation, development of malignant neoplasm, and consequently invasion and metastasis into remote organs.

Excessive smoking and alcohol consumption are the most common trigger factors of head and neck cancers. However, particular viral infection (e.g. HPV, HIV) and genetic factors also contributes to the development of oral malignancies.

1.1.2. Diagnosis and staging

Detailed clinical history and following the methodology of the current guideline for the diagnosis of HNC are indispensable in a good clinical practice. Accurate staging is crucial for determining the appropriate and individualized therapeutic management. The following staging process is recommended in HNCs:

1. clinical history and physical examination
2. histological staining
3. radiological imaging
4. functional study
5. special aspects

The TNM classification is an internationally accepted system for tumour staging. Stage at the diagnosis predicts survival rates and guides management. The eighth edition of TNM classification was published in January, 2017, and completed with novel subdivision.

1.1.3. Management

Treatment depends on primary tumour location and extension. A multidisciplinary professional team, so called onco-team, should decide the potential treatment option for each patient. Surgery is the preferred option for HNCs and involves resection of tumor with an appropriate safety margin and subsequent reconstruction, completing with neck dissection in certain cases. Surgical interventions is completed commonly with radiotherapy (external or brachytherapy) or neo-/adjuvant chemotherapy.

2. MAIN GOALS

The main goals of our clinical investigation were to optimize and to individualize the patient care at Department of Oral and Maxillofacial Surgery, and to examine the microcirculatory dynamics of radial forearm free flaps.

3. MATERIALS AND METHODS

This clinical investigation (Ethical Committee No. 44/2014) was undertaken between April 2014 and February 2018 and was approved by the Regional and Institutional Human Medical Biological Research Ethics Committee, University of Szeged, Hungary.

3.1. Microcirculatory investigation of radial forearm free flaps

All flaps were monitored with non-invasive laser-Doppler flowmetry intraoperatively, and postoperatively. The first measurements were taken after the flap was prepared, then 1 h after reperfusion and continued hourly for up to 12 h, in the centre of the forearm flap skin island and in the deltoid region provided the control site. The measurements were taken after active warming of the skin, at 35°C and 44°C, and data were recorded for more than 2 min at each measurement point.

3.2. Case I.

The tumor and parts of the involved facial muscles and nerve were excised surgically from a 42-year-old patient after a third relapse of basal cell carcinoma in the left midface. The preoperative CT imaging demonstrated that the tumor invaded the maxillary sinus, the orbital floor and the surrounding soft tissues. The resection results in an extended tissue defect, consequently reconstructive surgical difficulty.

3.3. Case II.

A 21-year-old female patient with progressive haemifacial atrophy causing a substantial facial asymmetry (diagnosed when she was 5 years old) presented to our clinic in 2015. Physical examination showed extensive alopecia, localized hyperpigmentation, and severe atrophy of the skin and the underlying subcutaneous tissues on the left side of the face between the zygomatic arch, body of the mandible, nasolabial fold, and ear.

4. RESULTS

4.1. Microcirculatory investigation of radial forearm free flaps

As evidenced by laser-Doppler flowmetry, baseline perfusion values were similar at the flap areas (in situ, before harvesting) and at the control sites (at 35°C and 44°C). During reperfusion, however, significantly higher tissue perfusion values (at corresponding time-points) at 35°C. Heat provocation (to 44°C) induced increases significantly in tissue perfusion only at the control areas, whereas this effect was missing in the flaps during reperfusion. In some cases, where circulatory failure of the flap developed, the venous or arterial thrombosis can be differentiated with the oscillation pattern registered by laser-Doppler flowmetry.

4.2. Case I.

The tissue defect was reconstructed with an anterolateral thigh chimeric type I fascio-myocutaneous flap, where the facial palsy was restored with a segmental branch of the femoral

nerve and the involved mouth corner elevator muscles for the segmented vastus lateralis muscle. The 6-month follow-up revealed a good esthetic outcome, the soft tissue defect reconstruction with good functional activity of the reconstructed facial nerve and with acceptable mimic movements.

4.3. Case II.

Considering the body type and the expectations of the patient, the profunda artery perforator flap was applied for the reconstruction and esthetic improvement of the facial region. The facial asymmetry attenuated following the convalescence period.

5. DISCUSSION

5.1. Commonly used free flaps for the reconstruction of the head and neck region

Oral soft tissues include tongue, floor of mouth, buccal mucosa and the retromolar region. These regions are not involved separately, so the reconstructive management is usually determined by the extent of surgical resection. These procedures often result in severe defects not only in the craniofacial bones, but also in the soft tissue coverage and function of the mimetic muscles, and the complexity of these lesions necessitates the use of different types of tissues with different functions for the reconstruction.

Small defects within the oral cavity can be closed with local mucosal flaps. Regional flaps can be effective in importing tissue, but are not generally considered as a first choice. Microsurgical techniques and reconstruction with free flaps provide the mainstay of oral soft tissue reconstructions as they allow importation of large volumes of healthy tissue from sites distant to prior surgical or radiotherapy fields.

5.2. Individualized planning during the reconstructive surgical management in the head and neck region

The literature provides only a limited number of recommendations as concerns the management of basal cell carcinoma with an extensive tissue defect. Various local flaps, such as a paramedian forehead flap, a lateral cheek rotation flap or a platysma myocutaneous flap, can be applied for the reconstruction of large maxillofacial defects after malignant lesion resection. However, a study suggested that a better functional and esthetic result can be achieved through the use of pedicled flaps. Facial paralysis after maxillofacial surgery has a great impact on the social interaction of the patient. The aim of dynamic facial reconstruction is to achieve a symmetrical and coordinated smile, an enhanced cheek tone, improved speech and the ability to eat. The dynamic reconstruction of facial palsy demands careful patient selection and an appropriate surgical technique if excellent results are to be expected. The myocutaneous ALT flap can readily be obtained and may provide a good amount of muscle for filling of the tissue defect, together with the chance to reconstruct the bony defect in the craniofacial region. Donor site morbidity, such as reduced sensitivity around the scar, is a common complaint of the patients. However, the donor site defect both esthetically and functionally in our case was minimal, and the quadriceps function was not affected.

The main goal of surgical treatment in PHA is to restore the facial contour and resolve facial asymmetry. Slight deformities can be treated with autologous lipotransfer, whereas microvascular flap procedures provide long-term contour correction in severe cases. The selection of the proper flap is based on the amount and shape of the soft tissue defect, but sometimes on the expectations of the patient as well. In the case of severe defects, a combined approach using soft tissue and bone augmentation is commonly required. Microvascular flaps combined with orthognathic surgery and/or bone augmentation are considered the gold standard in the restoration of facial asymmetry. Multiple microvascular free flaps have been used successfully in the treatment of PHA, including omentum, rectus, latissimus, serratus, deep inferior epigastric perforator (DIEP), anterolateral thigh (ALT), or parascapular flaps. The

largest disadvantage of musculocutaneous flaps is the inactivity-related tissue atrophy that is difficult to predict, which results in failure to fill the atrophied soft tissues. Inframammary extended circumflex scapular (IMECS) flap has a robust blood supply with low anatomic variability; it can provide the appropriate size; and during the operation, the structure or extension can be modified, as necessary. The primary arguments against an IMECS flap in this case were (1) the asthenic body type of the patient, which would have resulted in a 4- to 5-mm thinner flap than a PAP flap; (2) the visible scar on the back; and (3) the position of the patient during the operation, which would not allow the simultaneous work of 2 surgical teams. Because our patient refused to undergo surgical methods that would leave visible scars at the donor sites (eg, IMECS or thoracodorsal artery perforator flap) and the use of the DIEP flap was not feasible because of her body type, another solution had to be found. The posteromedial thigh region is a relatively novel donor site in reconstructive surgery. Just a few publications can be found regarding the use of PAP flaps in the maxillofacial region. However, these have shown a survival rate similar to conventional flap types for head and neck reconstruction, as well as a relative ease of harvest. The main advantages are a reliable blood supply, sufficient pedicle length (approximately 10 cm) to reach the neck, thick donor tissue, and relatively favorable donor site. Previous publications have suggested that a PAP flap may be a good alternative to an ALT flap in head and neck reconstruction if the perforant vessel of the ALT flap is not suitable (in approximately 5% of cases) or if the esthetic result at the donor site is more important (eg, young patients). This flap harvested from the upper medial and posterior thigh contains skin and fat tissue, providing a sufficient flap size even in a thin patient for reconstructing soft tissue defects; however, the narrow width can limit the harvested tissue volume.

6. CONCLUSIONS

Laser-Doppler flowmetry requires some experience, especially during the analysis, however it is a well-reproducible and non-invasive method for the detection of the microcirculatory changes of free flaps.

Oncological surgery in the head and neck region can often lead to complex functional and aesthetical defects. The management of these extensive impairments often involves therapeutic difficulties, and the surgeon may have to seek new opportunities to achieve acceptable results. In general, single-stage surgery is associated with fewer complications and better neural regeneration. The chimeric type I ALT flap can be a good option for facial dynamic reconstruction, but the surgeon must also consider individual anatomical variation and other potential therapeutic solutions with a view to obtaining a satisfactory clinical outcome.

This is the first description of the use of a PAP-flap for the reconstruction of facial deformity in a patient with PHA. To choose the best therapeutic option for patients, all potential treatment modalities have to be considered, which may be influenced by the physical status or request of the patient, sometimes necessitating the use of uncommon reconstructive surgical solutions. We have to emphasize the importance of interdisciplinary cooperation, the development of surgical skills and knowledge, which are essential for the proper management of complex cases. PAP flaps may be useful in certain cases where the individual surgical plan has a particular intended impact, and the surgeon has the possibility to choose from a wider armamentarium instead of being forced to apply the most frequently used flaps (radial forearm and ALT flaps) when solving a surgical situation in the head and neck region.

7. SUMMARY OF NEW FINDINGS

1. this is the first description of the use of a PAP-flap for the reconstruction of facial deformity in Europe

2. this is the first description of the use of a PAP-flap for the reconstruction of facial deformity in a patient with PHA

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LIST OF PAPERS RELATED TO THE SUBJECT OF THE THESIS

- I.** László I, Janovszky Á, Lovas A, Vargán V, Öveges N, Tánzos T, Mikor A, Trásy D, **Lóderer Z**, Piffkó J, Szabó A, Molnár Z. Effects of goal-directed crystalloid vs. colloid fluid therapy on microcirculation during free flap surgery: A randomised clinical trial. *Eur J Anaesthesiol.* 2019;36(8):592-604. doi: 10.1097/EJA.0000000000001024. **Q1, IF: 4,14**
- II.** Lóderer Z, Vereb T, Paczona R, Janovszky Á, Piffkó J. An anterolateral thigh chimeric flap for dynamic facial and esthetic reconstruction after oncological surgery in the maxillofacial region: a case report. *Head Face Med.* 2018;14(1):7. doi: 10.1186/s13005-018-0164-6. **Q1, IF: 1,492**
- III.** Lóderer Z, Janovszky Á, Lázár P, Piffkó J. Surgical Management of Progressive Hemifacial Atrophy With De-Epithelialized Profunda Artery Perforator Flap: A Case Report. *J Oral Maxillofac Surg.* 2017;75(3):596-602. doi: 10.1016/j.joms.2016.10.020. **Q1, IF: 1,779**