

Can tissue spectrophotometry and laser Doppler flowmetry help to identify patients at risk for wound healing disorders after neck dissection?

Nils H. Rohleder, MD, DDS,^a Sandra Flensburg, MD,^b Florian Bauer, MD, DDS,^a Stefan Wagenpfeil, MSc, PhD,^c Craig J. Wales, MD, DDS,^d Steffen Koerdt, MD,^a Klaus D. Wolff, MD, DDS, PhD,^a Frank Hölzle, MD, DDS, PhD,^c Timm Steiner, MD, DDS,^c and Marco R. Kesting, MD, DDS, PhD^a

Technische Universität München, Munich, Germany; Saarland University, Homburg, Germany; Southern General Hospital, Glasgow, Scotland; RWTH Aachen University, Aachen, Germany

Objective. Microcirculation and oxygen supply in cervical skin were measured with an optical, noninvasive method in patients with or without radiotherapy before neck dissection. The course of wound healing was monitored after the surgical procedure to identify predictive factors for postoperative wound healing disorders.

Study Design. Tissue spectrophotometry and laser Doppler flowmetry were used to determine capillary oxygen saturation, hemoglobin concentration, blood flow, and blood velocity at 2-mm and 8-mm depths in the cervical skin of 91 patients before neck dissection in a maxillofacial unit of a university hospital in Munich, Germany. Parameters were evaluated for differences between patients with irradiation (24) and without (67) and patients with wound healing disorders (25) and without (66) (univariate or multivariate statistical analyses).

Results. Velocity at 2 mm was lower in irradiated skin ($P = .016$). Flow at 2 mm was higher in patients with wound healing disorders ($P = .018$).

Conclusions. High flow values could help to identify patients at risk for cervical wound healing disorders. (Oral Surg Oral Med Oral Pathol Oral Radiol 2014;117:302-311)

Since the first description of a neck dissection (ND) by Jawdyski in 1888 and refinements by Crile in the early 20th century, cervical lymphadenectomy has become the predominant surgical treatment option for cervical lymph node metastases.¹ Radical ND (RND) procedures, which comprise removal of the sternocleidomastoid muscle with the cranial accessory nerve, internal jugular vein, and carotid artery together with the lymphatic tissue, have increasingly been replaced with less radical selective neck dissection (SND).² Thus, postoperative morbidity has been reduced.³ However, RND is more effective than SND in controlling particular tumors such as malignant melanoma.⁴

After surgical resection of tumors such as oral squamous cell carcinoma (OSCC), radiotherapy decreases the risk of local recurrence.⁵ Adjuvant radiotherapy after

OSCC resection usually consists of up to 66 Gy, with attempts to lower overall doses while maintaining outcomes.^{6,7} Radiotherapy to the head and neck has been found to influence cutaneous gene expression of extracellular matrix factors and bears the risk of acute and long-term side effects such as xerostomia.^{7,8} In regions such as the abdominal wall, it has been found to increase perioperative complications in terms of negatively affecting the course and results of wound healing.⁹ In the head and neck, the association of radiotherapy with the development of postoperative wound healing disorders is not completely understood. Patients requiring surgery in previously irradiated tissue (for example, because of local recurrence or late lymph node metastases) are assumed to be at greater risk for developing delayed wound healing; however, sparse literature is available to confirm this idea. Recently, Pellini et al.¹⁰ investigated risk factors for wound healing disorders after neck dissection. The authors identified preoperative chemoradiotherapy and the mode of ND as predictive factors

Coauthors Rohleder, Flensburg, and Bauer contributed equally to this work as first authors.

^aDepartment of Oral and Maxillofacial Surgery, Technische Universität München.

^bDepartment of Anaesthesiology, Technische Universität München.

^cInstitute for Medical Biometry, Epidemiology and Medical Informatics, Saarland University.

^dDepartment of Oral and Maxillofacial Surgery, Southern General Hospital.

^eDepartment of Oral and Maxillofacial Surgery, RWTH Aachen University.

Received for publication Jul 31, 2013; returned for revision Sep 22, 2013; accepted for publication Nov 25, 2013.

© 2014 Elsevier Inc. All rights reserved.

2212-4403/\$ - see front matter

<http://dx.doi.org/10.1016/j.oooo.2013.11.497>

Statement of Clinical Relevance

The “blood flow” parameter (measured with laser Doppler flowmetry) is a predictive value for cervical postoperative wound healing disorders, independent of previous radiotherapy or none. This helps to identify patients with a risk for a dehiscence after selective neck dissection.



Fig. 1. Cervical wound healing disorder developed after selective neck dissection in a female patient.

for wound complications (RND and modified RND increased the risk in opposition to SND).

No clinical tool is available to determine the individual risk for the development of wound healing disorders in patients requiring ND. Radiation induces vascular endothelial injuries that subsequently lead to tissue ischemia and atrophy.¹¹ Development of fibrosis in irradiated tissue might be attributable to hypoxia, which induces profibrotic cytokines and collagen formation in laboratory experiments and is considered to induce angiogenesis.^{12,13} Oxygen tension in irradiated skin has been found to be decreased in animal models, but no clear result has been obtained with regard to whether hypoxia is the predominant factor for the induction of angiogenic cytokines.¹³ The measurement of oxygenation in irradiated skin in humans has been carried out by means of transcutaneous oxygen microelectrodes and has shown a reduction in oxygen tension in patients with previous radiotherapy. However, the results are again inconsistent.¹³⁻¹⁵ Another method for the detection of hypoxia in irradiated human tissue is the immunohistochemical staining of the hypoxia marker carbonic anhydrase IX.¹³ However, these methods are not applicable in daily clinical routine.

This prospective study investigates, for the first time, the use of noninvasive simultaneous tissue spectrophotometry and laser Doppler flowmetry for the measurement of tissue oxygenation and microperfusion parameters in the cervical skin of patients with or without previous local radiotherapy. Measurements were conducted at the bedside on the day before SND. Postoperatively, patients were monitored for the development of wound healing disorders of the ND incision (Figure 1). Assessment of the variable “wound healing disorder” was dichotomized (no, complete primary wound healing; yes, appearance of any minor or

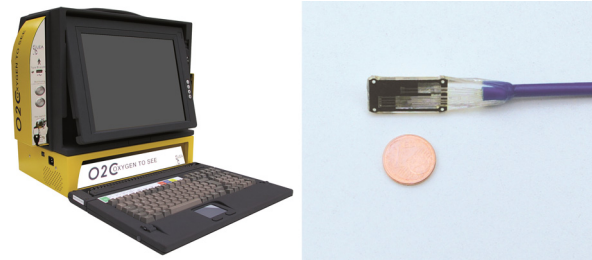


Fig. 2. Device used for simultaneous tissue spectrophotometry and laser Doppler flowmetry (O2C; Lea Medizintechnik GmbH, Giessen, Germany). Left, Portable device with live monitoring and recording software for parameters oxygen saturation, relative hemoglobin concentration, blood flow, and blood velocity. Right, Detailed photograph of the laser sensor, which is attached to the main device. When applied to the region of interest on the skin, the aforementioned parameters are simultaneously measured at both 2 mm and 8 mm tissue depths.

major dehiscence). Data were analyzed to test the following assumptions: “History of cervical radiotherapy alters local tissue oxygenation/perfusion” (null hypothesis I) and “Simultaneous tissue spectrophotometry and laser Doppler flowmetry can predict wound healing disorders after neck dissection” (null hypothesis II). These null hypotheses were tested to achieve the 2 objectives of the study: to investigate the influence of cervical radiotherapy on tissue oxygenation/perfusion and wound healing after neck dissection (objective I) and to identify a predictive marker for the development of postoperative wound healing disorders after neck dissection (objective II). For this reason, the study design included preoperative measurement of the tissue oxygenation/perfusion parameters and also postoperative monitoring of the course of wound healing, and an analysis of the medical history of the patients with respect to cervical radiotherapy. A potential predictive marker for development of a wound healing disorder would then be evaluated by statistical correlation of pre- and postoperative data.

PATIENTS AND METHODS

Patients

A total of 91 patients who had undergone surgical procedures for OSCC or other oral malignancies in the Department of Oral and Maxillofacial Surgery, Technische Universität München, Munich, Germany, between January 1, 2012, and December 31, 2012, were included. All patients were treated by resection of the cervical lymph nodes, tumor resection, and reconstruction by using local or free flaps. Clinical data were obtained before surgery (e.g., history of cervical radiotherapy in patients with secondary surgical procedures, alcohol/nicotine abuse) and during the hospital

Download English Version:

<https://daneshyari.com/en/article/6057849>

Download Persian Version:

<https://daneshyari.com/article/6057849>

[Daneshyari.com](https://daneshyari.com)