Department of Oral and Cranio-Maxillofacial Surgery

Chair of Dental, Oral, and Maxillofacial Medicine – especially Oral and Cranio-Maxillofacial Surgery

Address
Güldenstraße 11
91054 Erlangen
Phone: +49 9131 8533601
Fax: +49 9131 8536288
www.mkg-chirurgie.uk-erlangen.de

Director
Prof. Dr. med. Dr. med. dent.
Dr. h.c. Friedrich W. Neukam
(until 30.9.2017)

Contact
PD Dr. med. Dr. med. dent. Falk Wehrhan
Phone: +49 9131 8533601
Fax: +49 9131 8536288
mkg-chirurgie@uk-erlangen.de

Research Focus
• Tumor research
• Infection and inflammation
• Biomedical techniques

Structure of the Department
Professorships: 1
Personnel: 100
• Doctors (of Medicine): 18
• Scientists: 1 (thelof funded externally: 0)
• Graduate students: 20

Clinical focus areas
• Tumor surgery of the oral cavity and the face
• Trauma surgery of the facial skull
• Surgery of facial malformations
• Orthognathic surgery of the facial skull
• TMJ surgery
• Dental alveolar surgery

Research
The research at the Department of Oral and Cranio-Maxillofacial Surgery focuses on the field of tumor research as well as on the investigation of infections and inflammations in the facial area. Another focus is biomedical research.

Tumor research
Microsurgical tissue transfer for the reconstruction of extensive hard and soft tissue defects of the mouth, jaw and facial region represents a standard procedure in clinical routine. A challenge exists with the application of the microsurgical tissue transfer in the pre-irradiated hard and soft tissue, since thromboembolic events and wound healing compromise the clinical success of free transplants. Since more than 30% of the patient’s microvasculately treated patients have pre-irradiation in the head and neck region, we investigate mechanisms and methods that reduce the rate of irradiation-associated vascular complications and wound healing disorders. In a clinical study it is investigated whether thromboembolic complications due to irradiation of vessel, vessel thickening and the expression of inflammatory parameters in the irradiated vessel wall predict the likelihood of a thromboembolic complication. After applying for and approval in the DFG large-scale program, an operation microscope with integrated infrared-based perfusion measurement of microvascular structures was obtained. These intraoperative perfusion measurements enable intraoperative blood flow control and are correlated with the biological, histopathological parameters of the perfusion. Another focus was the influence of the immune system on tumor progression. Tumor progression can be understood as immunologically mediated processes in the sense of a tolerance induction against the tumor. For the condition of tolerance of the tumor, macrophages are of particular importance. Macrophages can occur in the tissue in two different functional states - also known as polarization: M1 polarized macrophages activate other immune cells and promote inflammation. M2 macrophages inhibit the immune response and can even support cancer cells by delivering growth factors. We were able to show that there is a convergence between increased malignancies of the tumors with enhanced M2 polarization of the macrophages. In addition, there is already a link between M2 polarization of the macrophages and the occurrence of recurrences in early stages.

We further worked on the development of a minimally invasive method for the diagnosis, prognosis and clinical monitoring of the squamous cell carcinoma of the oral cavity (PSCM) and oral leukoplakia. For this purpose, genes and miRNA are to be identified by means of the method of the next generation sequencing (NGS) which is directly involved in the malignant transformation of precursors of cancer, in particular of the oral leukoplakia (OLP) and therefore in the development of a tumor as so-called “key players”. At the same time, miRNA mRNA networks are to be developed in order to further elucidate this process. We hope to identify miRNA and genes that directly control the transition from premalignant to malignant lesion. This could ultimately contribute to the identification of prognostic markers for the imminent development of a tumor from its precursors. In addition, the basis for the development of new approaches for new, effective therapies could be laid which specifically counteract the malignant transformation and thus the development of the PSCM.

Infection and inflammation
Research addresses etiology, pathogenesis, and therapeutic options of inflammatory reactions of the facial skeleton. Furthermore, the osseous regeneration of bone defects in sites displaying compromised wound healing is investigated. A relevant focus is on the medication-related osteonecrosis of the jaw (MRONJ). As MRONJ is restricted to craniofacial bone structures, research focuses on jaw bone specific signal transduction processes during development, bone remodeling, and disease. Cranial neural crest derived pluripotent progenitor cells are of scientific and clinical interest in experimental approaches to develop regeneration strategies in craniofacial bone structures. In addition, patient-related factors are being evaluated which may promote onset and course of MRONJ.

Biomedical techniques
The focus “biomedical technology” comprises research projects on regeneration of soft and hard tissues, intraoperative imaging, and laser applications. Bone substitutes promote formation of new bone in pre-existing osseous defects by different biologic mechanisms, including inflammatory and proliferative cellular reactions. The project aims at creating, applying, and evaluating the biomimetic materials and bio-functional surfaces in implant dentistry. In a further project for the guided soft tissue regeneration, the temporal sequence of the reperfusion and vascularization of free mucosal grafts and collagen matrices is quantitatively examined. Within this clinical patient study, perfusion measurements of the tissue are carried using a Laser-Doppler-spectrophotometer. In cooperation with the Bavarian Laser Center, a sensor-assisted laser system for selective bone ablation was tested in cadaver bone as well as in an in vivo setting. By connecting the Er:YAG laser to a process control for material-specific ablation, the system is able to differentiate cortical and cancellous bone as well as soft tissues. In oral and maxillofacial surgery, the selective bone ablation offers a new perspective to preserve nerve structures during surgery, such as the mandibular nerve during osteotomy of the lower jaw. A second research approach is to transfer the system of optical tissue differentiation towards tumor tissue to allow high selective tumor resection in the future.
Teaching

The Department of Oral and Cranio-Maxillofacial Surgery is involved in the curricular teaching of human and dental medicine with compulsory and elective subjects. Particularly noteworthy is the training of dental students in dental implantology as part of the elective course ilect®. Furthermore MD and PhD theses are supervised.

Selected Publications


International Cooperations

Dr. E. Felszeghy, EARC (kft), Semmelweis-Universität, Budapest: Hungary

Prof. Dr. E. Nkenke, Medizinische Universität, Vienna: Austria