Department of Prosthodontics
Chair of Dental, Oral, and Maxillofacial Medicine – especially Prosthetic Dentistry

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Research Focus
• Dental biomechanics
• Psychogenic influence/quality of life and complementary medical procedures in dental questions
• Optical 3D-measurement technique in dentistry
• CAD/CAM research laboratories
• Prosthodontics and implant therapy based on 3D-imaging

Structure of the Department
Professors: 1
Personnel: 30
• Doctors (of Medicine): 19
• Scientists: 13 (thereof funded externally: 0)
• Graduate students: 10

Clinical focus areas
• Implant prosthetics
• Fixed and removable prosthetic
• Diagnosis and treatment of temporomandibular joint dysfunction (TMJD)
• Hypnosis and acupuncture treatment
• Esthetic dentistry
• Prosthetic rehabilitation with epinephrine
• Prosthetic rehabilitation of children

Research
Due to the high demands and quality standards of research projects, synergistic effects of highly qualified specialists are mandatory. This is reflected in the general orientation and a focus on future demands as well as in extensive cooperation with other fields of research. One key focus of research is the aging population and the resulting demographic changes and the investigation of the relationship between oral and general health.

Dental biomechanics
PI: PD Dr. M. Karl
Mechanical parameters of the components used are decisive co-factors determining long-term treatment outcomes in implant dentistry. During the past year, an in vitro study measuring micro-motion between implants and abutments was conducted using a specially designed test setup. Clinical failures such as fractured implants are of great importance in this context as they allow for analyzing potential design and material related issues. Using a clinically fractured diameter reduced screw-type implant, the possibilities of fractographic analysis were shown. Broadening the potential applications of the recently developed diagnostic tool for quantifying bone quality on the basis of intraoperative compressive testing, finite element analyses were performed simulating an acetabular cup endoprostheses.

In vitro test setup for measuring micromotion between implant and abutment

Finite Element Analysis showing an acetabular cup endoprosthesis under torsional load

Psychogenic impact/quality of life and complementary medical procedures in dental questions
PI: Prof. Dr. S. Ettinger
This area of research is divided in two main focal points. The first focal point evaluates psychogenic influence on treatment planning and outcome of dental disease patterns with a psychogenic background. Among other factors, the subject’s appraisal of his own body can influence dental questions. Besides, the etiological correlation of gag reflexes during dental treatment, the influence of stress and clinical pictures on fear, depressive states, and social parameters are evaluated, too.

The second focal point concerns the therapeutic intervention with medical hypnosis and acupuncture in dental treatment and their influence on psycho-social factors as well as pain in above mentioned dental problems.

Optical 3D-measurement technique in dentistry
PI: Dr. R. Matta, L. Wolf
Quantitative assessment of biomechanical effects in vivo intraorally required highly complex research set-ups due to lack of adequate measurement technology in the past. The aim of the research group is to establish and evaluate full-field three-dimensional (3D) optical inspection systems for clinical application in biomechanic research. The system will allow real time quantitative depiction of biomechanical influences in the oral cavity. 3D-image correlation provides strain measurements in all dimensions which are critical for accurate strain and loading response measurements in objects. The results of these optical measurements are compatible with finite element analysis software and facilitate verification and iteration of models that cannot be used solely to draw general conclusions regarding specific questions related to biomechanics. The system available at the Department of Prosthodontics uses photogrammetric principles. Relevant parameters for future in vivo applications were identified in current and completed studies, and first in vivo applications revealed promising results.

CAD/CAM research laboratories
PI: Dr. R. Matta, ZA G. Skibinski
Industrial CAD/CAM manufacturing technologies have gained significant market share in producing dental restorations in recent years, primarily due to standardized product quality and precision as well as economic processing routine in dental laboratories. To achieve high qual-
ity and precision, product aligned process routes are a mandatory prerequisite. The research group focuses on segmenting CAD/CAM processes and assessment of the impact on the overall quality. In addition to recently developed methodologies for 3D-display and analysis of microgaps in conventional dental restorations, new protocols are in development for a clinical assessment of fit of implant retained superstructures. The research laboratories are equipped with state-of-the-art industrial non-contact scanners and necessary analytical software programs. As high strength oxide ceramics are applied more frequently as framework materials in dentistry, several research projects assess the clinical application and factors influencing long-term success.

**Prosthodontics and implant therapy based on 3D-imaging**

Pi: Dr. R. Matta, L. Wolf, Dr. C. Motel

The three dimensional imaging becomes more and more important for the modern implant and prosthodontic therapy plan. This includes the Computer Tomography (CT), the Cone Beam Computer Tomography (CBCT) and the intraoral digital impression.

The research in this area is of great importance because the long-term clinical success of prosthodontic and implant restorations depends on the accuracy of the three-dimensional transfer of oral structures in “virtual” illustrations.

**Teaching**

The main focus of traditional prosthodontic education has shifted from a technically oriented towards an interdisciplinary treatment approach. Prophylaxis and biology are in the focus as well as minimally invasive treatment concepts. Clinically relevant topics are introduced into the preclinical curriculum, focusing on biologic interactions and material properties. While theoretical knowledge remains integral part of dental education, manual manufacture of dental restoration will be taught only exemplarily.

A unique opportunity for all dental students at the FAU Dental School is the opportunity to participate in a three-year extra-curricular implant program. The “i.Lect” program is funded by third parties and provided in cooperation with the Department of Oral and Cranio-Maxillofacial Surgery. The i.Lect program has become an essential part of the elective and interdisciplinary education of dental students. The first students passed successfully their examination in 2012 and finished their i.Lect pre-graduate program and started the post-graduated program which is also provided in cooperation with the Department of Oral and Cranio-Maxillofacial Surgery.

The Department of Prosthodontics supervises MD theses.

**Selected Publications**

Karl M. In vitro studies on CAD/CAM restorations fabricated with Procera technology: an overview. Quintessence Int. 2015; 46(7): 561-574


**International Cooperations**

Prof. T.D. Taylor, Prof. J.K. Kelley, PhD, University of Connecticut, Farmington: USA

Dr. H. Leblebicicioğlu, PhD, Erçyes University, Kayseri: Turkey.