

Selected research topics in Biomedical Engineering: Developments in Dental Research

Location: Kleiner Hörsaal, Universitäres Zentrum für Zahnmedizin Basel (UZB)

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Anatomically accurate modelling in orthodontic biomechanics

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Abstract: Orthodontic tooth movement and physiologic tooth mobility are closely related and are affected by the geometry of the alveolus or the tooth, the material characteristics of the tooth supporting structures, and the force system acting on the crown. Numerical modelling of tooth movement or tooth mobility using finite element methods (FEM) thus requires input from 3D data sources, such as CT, cbCT, MRI and 3D scanners, as well as detailed information on the material parameters of the periodontal ligament (PDL), the bony structures and the teeth. Especially the material behaviour of the PDL is of importance, however still not really clear. The PDL displays time-dependant, nonlinear, anisotropic and multi-phasic behaviour, due to its complex structure. A further problem is the extraction of precise root geometries from 3D data sources, which is a time-consuming and often not very accurate process. This talk presents combined experimental/numerical and clinical studies performed in our lab to determine the constitutive law of the PDL and introduces into the problems of accurately (and efficiently) modelling teeth and tooth supporting structures for simulation of tooth movements.

Curriculum: Christoph Bourauel studied Physics at the University of Bonn and in 1992 received a PhD from the Faculty of Natural science and Mathematics of the University of Bonn. In 1998 he habilitated on the numerical simulations of orthodontic tooth movement. 2005 Christoph Bourauel was appointed as Professor and in 2006 he became Endowed Chair in Oral Technology at the University of Bonn. Prof Bourauel has published more than 250 papers in national and international journals in biomechanics, biomedical engineering, physics, orthodontics and dentistry and has given more than 350 interdisciplinary oral and poster presentations on Congresses and Symposia. He is a reviewer of numerous high ranking journals and a member of European and German Societies of Biomechanics, European and German Societies of Orthodontics and German Physical Society. He was President of the German Society of Biomechanics 2014/2015. His research focus is on experimental dental biomechanics, analysis and numerical simulation of tooth movements, techniques of measurement in orthodontics, computerised analysis and design of orthodontic appliances, corrosion and intraoral aging of dental materials, optomechanical and laser optical measurement techniques and biomechanical analysis of immediately loaded implants.