Selected research topics in Biomedical Engineering: Developments in Dental Research

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

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De- and remineralization of teeth

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Abstract
Dental demineralization, and especially remineralization, are very slow dynamic processes that lend themselves to study in 3 dimensions using time-lapse X-ray microtomography (XMT or micro-CT). Measuring mineral content (concentration) accurately with XMT is problematic for a number of reasons. Over the years, we have designed scanners specifically for this purpose and slowly refined the hardware, processing techniques and protocols in order to allow the detection of very small changes in mineral levels. These include the use of time-delay integration scanning, X-ray modelling calibration, physical and post-reconstruction alignment and equalization. Each of these refinements (with the exception of time-delay integration) represent incremental improvements in accuracy, but the sum of them creates a powerful technique for use in dental research.

Curriculum: Graham Davis graduated as an electronic engineer in 1980 and obtained a PhD in medical electronics in 1984. After working originally in the design of computerised electromyography apparatus, he moved to the London Hospital Medical College (now part of Queen Mary University of London) in 1988 and shortly thereafter began work on the development of X-ray microtomography (XMT). Designing scanners and software algorithms with accuracies exceeding commercially available systems, he is well recognised in this area of development and has served on the European Standards Committee CEN/TC 138/WG 1/AH 1 Computed Tomography. He also serves as a program committee member for the "Developments in X-ray Tomography" conference held every 2 years as part of The International Society for Optical Engineering's (SPIE) International Symposium on Optical Science, Engineering, and Instrumentation.

He is currently the lead for Imaging Sciences in the Centre for Oral Bioengineering, which includes electron microscopy, X-ray imaging, optical coherence tomography and facial scanning. His chief aim is to work alongside clinicians towards better understanding and treatment of dental conditions and has an additional interest in developing public engagement activities related to dentistry involving gaming and virtual reality. He also supports staff and student wellbeing at QMUL, helping to organise the QMUL running club, and is trained in mental health first aid.