Biosketch

PAUL LAMBRECHTS is born in 1955. He followed Latin-Greek studies at the 'St. Jan Bergmanscollege' of Diest. He graduated as a dentist in 1978 at the Catholic University of Leuven (K.U.Leuven), Belgium and obtained his PhD at the same university in 1983 based on a thesis investigating dental composites: "*Basic properties of dental composites and their impact on clinical performance*". Today, he is Full Professor and Chair of the Department of Conservative Dentistry (K.U.Leuven), and also serves the dental school as Program Director of the dental Bachelor/Master and Master-after-Master programs at K.U.Leuven. He teaches cariology, oral aspects of nutrition and endodontics. During two tenth of his week time, he teaches pre-clinical and clinical conservative dentistry; 4/10 is spent to own clinical activity, primarily in microscopic endodontics, but also in aesthetic restorative dentistry; for the remaining 4/10, he conducts research in endodontics, more specifically focussing on the development of a concept of minimal-invasive endodontic research, using 3D X-ray Micro-CT scanning, Cone beam CT and Environmental SEM, towards new root-canal preparation and filling techniques. The photodynamic laser-activated disinfection (PAD) techniques are one of the new research challenges of his group, while the pathology of external cervical resorption is one of his favourite study topics. In addition, specific interest goes also to laboratory and clinical research on dental composites, actually focussing on 3D-laser-profiling of clinical wear phenomena and biotribocorrosion. Together with Prof. B. Van Meerbeek, he became in 2003 co-holder of the Toshio Nakao Chair for Adhesive Dentistry. He is (co-)promoter of several doctoral dissertations, and (co-)author of numerous publications together with the Leuven BIOMAT Research Cluster. He gives scientific and post-academic courses all over the world.

Speakers focus.

Prof. Paul Lambrechts is extremely focussed on minimal invasive restorative dentistry using advanced diagnosis and treatment protocols. He's a strong protagonist of microscopic dentistry during all restorative procedures, endodontics and even animal dentistry. Micro, bio and techno in resto and endo are his idealistic goals in clinical dentistry, research and teaching.

Title: 'Adventure to discover the anatomic, radiologic and histological complexity of external cervical resorption.

Time: 1h, 30 min.

Abstract.

External cervical resorption (ECR) is an aggressive form of root resorption of variable etiological origin, leading to a three dimensional loss of dental hard tissues (cementum, dentin and enamel as well). This is due to clastic action of hard tissue resorbing cells, activated by a damage of the covering cementum, and probably stimulated by infection. Clinically it is a challenging situation as it is characterized by a late symptomatology and misleading differential diagnosis. Cone beam CT increases significantly the diagnostic potential. Vitality is often preserved thanks to the pericanalar protection from a resorption resistance sheet (PRRS), not only composed by predentin but also by surrounding pericanalar dentin of about 200 µm thickness. Highly vascularised connective tissue, saturated with an inflammatory infiltrate is at one side lined by multinucleated clastic cells and on the gingival transition side lined by epithelial tissue. The clastic activity is often going together with an attempt to repair, seen by formation of osseoid tissue and osseodentin maturation, inducing the typically mottled radiologic appearance. Apparently the physiological addition of osseous tissue is not systematically observed and still needs further research.

The aim of the lecture is to present a 3-D view on external cervical resorption (ECR) with dental microscopy (ProErgo, Zeiss), stereomicroscopy (Wild), digital radiography (VistaRay, Durr), cone beam CT (3D Accuitomo 80, Morita), micro-focus CT (Skycan 1172) and scanning electron microscopy (Fe-SEM, Phillips XL30) in order to visualize the complexity of the protective resorption resistant sheet (PRRS) and the structure of osseodentin tissue apposition. The etiology, the clinical extension and the treatment strategy of several cases is presented based on the 3-D understanding of the pathology.

Research to etiologic factors and pathogenesis is highly important for better knowledge of the process in order to reach an efficient therapeutic policy. Clinically, early recognition of the pathology is only possible when as many as possible etiologic factors are known, in order to screen efficiently to ECR in every patient. This enables to stop the process at an early stage what subsequently increases the treatability and prognosis of the tooth with ECR.

Bullet points. Learning objectives and key ideas of the lecture.

Key learning points

- Cone beam CT is essential in the diagnosis of ECR
- Histological and histochemical imaging of the granulation tissue highlights the resorption process.
- SEM-analysis provides a better insight in activity of clastic cells and osteodentin formation.
- The root canal is surrounded by a pericanalar resorption resistant sheet (PRRS).
- Osseoid tissue formation and osseodentin apposition in a coral like manner makes the pathology even more complex.
- The outcome of the minimal invasive treatment is significantly enhanced by better diagnosis.

Title: 'Synergism between Microscopy, Digital Radiology, Cone-Beam-CT and micro-CT in the 3D diagnostics of endodontic pathology'

Time: 1h, 30 min.

Abstract.

The aim is to diagnose complex endodontic anatomy and hidden pathology in a three dimensional way through a *synergism* of imaging techniques. Printing the 3D endodontium in your mind in combination with the real time magnified image through the surgical microscope will create a *virtual* endodontic environment which increases the awareness of the anatomical limitations, the final outcome of the treatment and ultimate prognosis.

Novel non-destructive imaging and visualization techniques like **X-ray micro-CT** *ex-vivo* (Resolution of <1µm), **Cone-Beam-CT** *in-vivo* (Resolution of 125 µm), **Surgical Microscopy** and **Environmental FE-SEM** allow us to study the complexity of the root canal system and the tenacity of the biofilm. The three dimensional shaping, cleaning and filling of the root canal space is reconstructed by innovative *in-vitro* and *in-vivo* techniques. ***Dynamic rinsing*** with RinseEndo of Durr, the Endoactivator (C. Ruddle), Ultrasonics (ESI tip and Irrisafe), ***Photoactivated disinfection*** (PAD) with laser therapy, all contribute to the smart concept to reach those bacteria in hidden niches, anastomoses, dentinal tubules and biofilms.

Finally, one could question if ***Sealing*** the root canal system by ***hybridization*** and ***resin tag formation***, combined with ***entombing*** remaining micro organisms, is a dream or reality? The insight in dentin bonding for adhesive restorative dentistry is now finding its way inward and downward the root canal. In order to allow hybridization and tag formation, again the smear layer, smear plugs, dentin debris and biofilms have to be removed and the system sealed through thermoplastic obturation.

Bullet points. Learning objectives and key ideas of the lecture.

Participants will be able to understand:

- Digital radiography, with a high number of line pairs, offers a higher resolution than can be reached with conventional periapical X-ray films.
- Digital radiography can offer better images, with a lower radiation dose.
- Cone-Beam-CT offers images from three different axes: transaxial, coronal and sagital view.
- The images of a Cone-Beam-CT scan can be virtually reconstructed to a 3D volumetric image which allows better orientation and interpretation.
- For endodontic use the settings of the Cone-Beam-CT scanner for slice thickness and slice distance determine to a great extend the possibility to see details, necessary for endodontic diagnosis and treatmentplanning.
- A resolution of 125 µm - 80 µm is technically possible but not with all CBCT scanners.
- The bigger the aimed volume to scan, the lower the detail. Small volume scans offer higher detail.
- Indications for CBCT are: 4th canal in mesiobuccal upper molar, second canal in lower incisors and canines, premolars with 2-3 canals, external and internal resorptions, anatomical variations as dens in dente, invaginations, C canals, taurodont, etc…

- Together with magnification through dental loupes and surgical microscopes the diagnostic information from CBCT can be maximized.
- The shaping and cleaning has to be assisted with dynamic liquid agitation, like ultrasonics, endoactivator biofilm disruption and eventually photo activated disinfection.