

## Optical Coherence Tomography: Applications in Dentistry

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**INTRODUCTION:** In dental restoration, a prosthetic is prepared to replace one or more missing teeth. Fixed partial prostheses as integral ceramics, integral polymers, metal-ceramics or metal-polymers bridges, are mainly used in the frontal part of the dental arch (especially the integral bridges). They have to satisfy high stress requirements as well as esthetic. The masticatory stress may induce fractures of the bridges. These may be triggered by initial materials defects or by alterations of the technological process. The fractures of these bridges lead to functional, esthetic and phonetic disturbances which finally render the prosthetic treatment inefficient. One from the purposes of this study is to evaluate the capability of OCT in detection and analysis of possible fractures in several fixed partial dentures. Bone implants insertion implies the necessity of a important primary stability. The quality of the implant insertion could be investigated by implant bone interface analysis. There are several methods for evaluating the micro leakage in composite restorations such as bacterial penetration, fluid transport, clarification, and penetration of radioisotopes, electrochemical methods and gas chromatography. Dye penetration tests; however, seem to be the most widely used.

**METHODS:** The optical configuration uses two single mode directional couplers with a superluminescent diode as the source at 1300 nm. The scanning procedure is similar to that used in any confocal microscope, where the fast scanning is en-face (line rate) and the depth scanning is much slower (at the frame rate) (1). The en-face scans provide an instant comparison to the familiar sight provided by direct view or via a conventional microscope. Features seen with the naked eye could easily be compared with features hidden in depth. Sequential and rapid switching between the en-face regime and the cross section regime, specific for the en-face OCT systems developed by us, represents a significant advantage in the non-invasive imaging. Images with different orientations and 3D OCT imaging can be obtained using the same system.

**RESULTS:** The detected defects have a large volume and therefore are highly capable to generate fracture lines in the proximal or almost

superficial on the occlusal area, leading to the failure of the prosthetic treatment. The detection of these defects before inserting the prostheses allows all the corrections in order to avoid the fracture of the ceramic component. The all ceramic prostheses entered the field of prosthetics as a maximum esthetic alternative. The fractures that occur within the structure of these prostheses were motivated by the elasticity module of the ceramics and by the defects within the ceramic layers. Early detection of substance defects within these layers allows for optimal corrections before inserting them into the mouth and applying masticatory stress together with reduction of fractures. In this study, we demonstrate that en-face optical coherence tomography can be used to evaluate these interfaces. We have collected both C-scans OCT images (en-face) as well as B scan OCT images (cross section). 3D analysis was possible by acquiring 30-100 C-scans which were used post acquisition to explore the volume of the tissue around the interface. The images show gaps of different sizes and shapes between the implant and the bone at different depths.

**DISCUSSION & CONCLUSIONS:** OCT could act as a valuable tool in dentistry as a noninvasive method. Utilisation of OCT will save time and resources by eliminating prostheses with defects before being mounted in the patient's oral cavity and to identify the gaps in direct composite restorations.

**REFERENCES:** <sup>1</sup> A. Gh. Podoleanu, J. A. Rogers, D. A. Jackson, S. Dunne (2000) *Three dimensional OCT images from retina and skin* Opt.Express, Vol. 7, No. 9, p. 292-298, (2000). <sup>2</sup> I. Bratu D., R. Nussbaum (2001) *Bazele clinice și tehnice ale protezării fixe*, Editura Signata. <sup>3</sup> C.Sinescu, M.Negruțiu, C.Todea, A.Gh. Podoleanu, M.Hughes, P. Laissue, C. Clonda (2007) *Coherente Tomography as a non invasive method used in ceramic material defects identification in fixed partial dentures*, Dental Target, nr. 5, year II.