

Confocal Microscopy and *en-face* C-scan OCT investigations in Class V Composite Restorations

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INTRODUCTION: There are several methods for evaluating microleakage in class V composite restorations such as bacterial penetration, fluid transport, clarification, radioisotope penetration, electrochemical methods and gas chromatography. Dye penetration tests, however, seem to be the most widely used. The purpose of this study is to evaluate gap formation in class V composite filled cavities using a non-invasive method – optical coherence tomography.

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) [3]. The *en-face* scans provide an instant comparison to the familiar sight provided by direct view or via a conventional microscope [4].

RESULTS: Gap forming in class V cavities can be evaluated by the OCT technique and with a system resolution of 10 μm we were able to detect gaps as small as 50 μm , but only those of a few micrometers would be experimentally measurable. Imaging gaps narrower than 10 μm requires improvements in our incoherent light source. Furthermore, the use of OCT has the advantage of showing the restored region as well as the gap, if it exists, and precisely localizing its position, as demonstrated here. Exploration of the recent advances in OCT in terms of different excitation wavelengths and wider bandwidths can lead to state-of-the-art imaging systems in conservative dentistry enabling imaging of both enamel and dentin. Finally, as demonstrated in the literature, in vivo and real-time OCT images can be obtained, and therefore this method of assessment is potentially useful for clinical diagnostics.

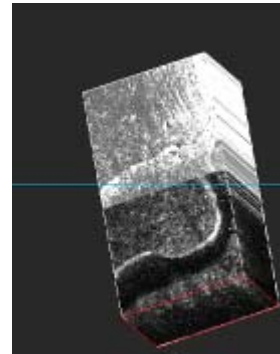


Fig. 2: Microleakage investigation of class V composite restorations: the confocal microscopy investigation (upper image) and the *en-face* OCT scan (lower image). 3D reconstruction of the gap between the composite filling and the cavity.

DISCUSSION & CONCLUSIONS: OCT has numerous advantages which justify its use in the oral cavity in comparison with conventional dental imaging. OCT can achieve the best depth resolution of all known methods (in principle 1 micron if the source exhibits a sufficiently wide spectrum) and is safe. The role of confocal microscopy is to precisely locate the area on which the OCT system will allow depth image generating in a non-invasive manner.

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