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The Quality Of Bracket Bonding Studied By Means Of Oct Investigation. A Preliminary Study

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INTRODUCTION: Bonding brackets is an essential part in most fixed orthodontic treatments. Because of the great diversity of bracket and bonding materials, researchers all over the world have dealt with the various aspects of bonding since the beginning up to the present moments. The aim of our is to initiate an innovative investigation method of the bracket-tooth interface by means of OCT (optical coherent tomography) and to determine whether it is suitable as an orthodontic research tool.

METHODS: 40 extracted noncarious permanent teeth were considered in this study. Prior to the investigation all teeth were cleaned with a non-fluoride polishing paste and a rotary brush. They were divided in two groups of 20 each. One group represented teeth bonded with metallic brackets and the second group contained teeth bonded with ceramic brackets. The bonding protocol for the metallic brackets was performed as follows: 4" aluminablasting, 30" acid etching (38% phosphoric acid), rinsing and gentle but thorough blow-drying, application of an orthodontic bonding agent (Ortho Solo, Kerr), application of bonding on the bracket base followed by gentle blow-drying, application of the composite resin and bonding the bracket on the conditioned tooth surface followed by light curing using a plasma curing unit (Smart Lite, DeTrey Dentsply). For the ceramic bracket bonding our protocol contained the same steps mentioned above. In this work we used two different OCT systems that were assembled by the Applied Optics Group of the University of Kent. The optical configurations are similar to those presented before in [1,2] using two single mode directional couplers with a superluminiscent diode as the source. Unlike conventional A-scan based time-domain OCT [3] , en-face OCT systems[4] were used which can deliver B-scans and C-scans from en-face (or T-scan) reflectivity profiles. This is similar to the procedure used in any confocal microscope, where the fast scanning is en-face and the depth scanning (focus change rather than a change in the reference arm length in the case of an OCT) is much slower (at the frame rate). 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 examination of prostheses. The frame grabber is controlled by signals from the generators driving the X-scanner and the Y-scanner. One galvo is driven with a ramp at 500 Hz and the other galvo-scanner with a ramp at 2 Hz. Systems operating at 670 nm, 850 and 1300 nm were used. Both systems have typical working distances of 2 to 3 cm and depth resolutions of 18 to 20 µm (in air).

RESULTS: After the OCT investigation several gaps were detected at the bracket base- tooth interface. The largest gap had approximately 0,1 mm in diameter and the smallest one only 250 µm. In all investigated samples various gaps were found.

DISCUSSION & CONCLUSIONS: OCT helped us perfom a useful noninvasive real-time investigation of the quality of the bracket base-tooth interface. Further research is necessary in order to establish a correlation between the number and diameter of the gaps and clinical stability of the bonding procedure.

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