Spectrofluorometry study of interface between root dentin and one-bottle adhesive. Preliminary results

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INTRODUCTION: The aim of this work was to study the molecular interaction between the radicular dentin and the bonding system in the hybrid layer when a fibre-reinforced composite post was attached. The technique chosen for determining the characteristics of this reaction was fluorescence resonance energy transfer (FRET) between the autofluorescent dentin (donor) and a bonding system labelled with a fluorescent compound (dextran FITC) (acceptor). The degree of resolution of the technique (10 to 100 nm) enabled molecular interactions to be observed.

METHOD: Spectrofluorometry was performed using an Aminco SPF 500C spectrofluorometer in order to study the absorption and excitation spectra of the radicular dentin and the bonding system, Excite DSC (Vivadent, Schaan, Liechtenstein). Dextran fluorescein labelling of the adhesive (methacrylate polymer) was used to help show up the FRET as the fluorescence spectra of the adhesive and dentin are very similar, which is not the case for FITC. The adhesive samples, alone or mixed with 0.1 or 0.5% dextran fluorescein (MW=10000, Molecular Probes) were polymerized on a slide. Roots of single-rooted teeth conserved in a 0.1% chloramine T solution were prepared to receive a post by removal of the pulp, and preparation of the canal with reamers appropriate to the splint size (Moser n°1 pre-reamers and reamers for the mandibular and lateral maxillary incisors, and n° 3 for the canines and central maxillary incisors). The roots were then cut longitudinally with an Isomet saw (Isomet, Buehler, Lake Bluff, NY, USA) and examined by fluorescence spectroscopy, either without preparation or after etching of the endocanular part and polymerization of a layer of adhesive on the surface.

RESULTS: *Table 1: Excitation and emission characteristics of the compounds involved*

	λmax Excitation	λmax Emission
Dentin	343 nm	400 nm
Excite DSC	330 nm	360 nm
Dextran FITC	490 nm	526 nm

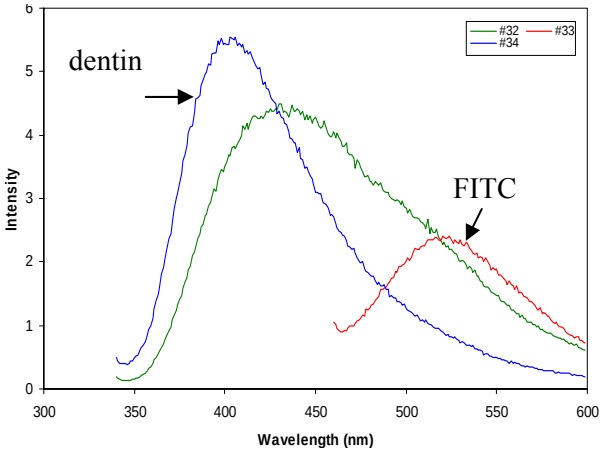

Fig. 1. Emission spectra of dentin (blue), and Excite DSC with fluorescein (red) after polymerization, showing FRET between dentin and labelled adhesive (green curve)

DISCUSSION & CONCLUSIONS: The preliminary spectrofluorimetry studies showed:

- The validity of an Excite DSC-FITC mixture, without FRET between the two compounds, for showing up FRET between the dentin and the adhesive.
- The potential of energy transfer (FRET) between autofluorescent dentin and Excite DSC adhesive-FITC. The FRET enables molecular interactions between the adhesive and the dentin in the hybrid layer to be observed with a nanometric level of resolution (10 to 100nm) and a "molecular map" of the interface to be obtained.

REFERENCES: (1) Fu B, Sun X, Qian W, Shen Y, Chen R, Hannig M. Evidence of chemical bonding to hydroxyapatite by phosphoric acid esters. Biomater 2005; 26:5104-5110. (2) Spencer P, Wang Y, Walker MP, Wieliczka DM and Swafford JR. Interfacial chemistry of the dentin/adhesive bond. J Dent Res, 2000; 79:1458-63. (3) Wang Y and Spencer P. Quantifying adhesive penetration in adhesive/dentin interface using confocal Raman microspectroscopy. J Biomed Mater Res, 2002; 59:46-55.