Influence of two anti-oxidants on root canal dentin bonding

F.Raux & M.Degrange

Department of Biomaterials, University of Paris 5. 1 rue M. Arnoux, F-92120 Montrouge

INTRODUCTION: Endodontic irrigants like sodium hypochlorite and hydrogen peroxide reduce dentin bond strength. The mechanism of this compromised bonding remains unclear. Several hypotheses have been proposed to explain this problem: denaturation and of the collagen matrix or oxidizing action of the irrigants. Following the latter hypothesis, the oxidized dentin could alter the degree of conversion of both adhesive and composite resin monomers.
The aims of this study were: 1) To check the influence of endodontic dentin treatments on the degree of conversion of resin monomers and 2) To assess the ability of 2 anti-oxidants (Na ascorbate and GSH) to reverse the reduced adhesion to oxidized dentin.

MATERIALS & METHODS: First, the linear relation between the Knoop microhardness (KHN) of a selected composite, (Tetric Flow®, VIVADENT) and its degree of conversion (DC) was established. The DC of 12 samples of composite with different polymerization times were assessed by FTIR before their hardness was measured. Second, the influence of different endodontic solutions (5% NaOCl, Glyde® - Dentsply, ZOE-based sealer) on the KHN of composite was assessed. The composite was directly applied in contact with root dentin slabs. KHN was evaluated at different distances from the canal zone. The reverse action of 2 anti-oxidants (10% sodium ascorbate & 10% glutathione (GSH) was also tested. 7 batches of 5 teeth were treated endodontically with ProTaper files according to the manufacturer's instructions, and treated as described below.

Third, the same experimental plan was followed to check the influence of these different treatments on dentin bond strength (DBS). But according to the results of the previous approach, we limited the DBS test to samples resulting from batches 1, 2, 4 & 6. The selected test was a micro-tensile test.

Batch	Irrigant	filling	Treatment
1	0.9%NaCl		
2	NaOCl 5%		
3	NaOCl + Glyde		
4	NaOCl + Glyde	ZOE	
5	NaOCl + Glyde	ZOE	Na Asc
6	NaOCl + Glyde	ZOE	GSH
7	NaOCl + Glyde	ZOE	Na Asc + GSH

RESULTS: 1) A good linear correlation ($r^2 = 0.8$). between KHN and DC of Tetric Flow allowed KHN to be used to indirectly assess the DC. 2) The endodontic treatment significantly influenced the DC of the composite ($p < 0.0001$) but without a localisation effect ($p = 0.15$). 5% NaOCl had a deleterious effect on the polymerization of Tetric Flow®.($p< 0.0001$). 10 min. application of GSH or both GSH+NA ascorbate to root dentin allowed KHN values to be recovered that were close to those measured in contact with the sound dentin (batch 1,4 : n.s.). 3) Root dentin treated by 5% NaOCl (batch 2) or by overall endodontic solutions (batch 4) showed DBS values significantly lower than those obtained on sound dentin (respectively $p = 0.0016$ and $p< 0.0001$). 10 min. application of 10% GSH solution on the canal walls allowed the effect of oxidizing agents to be reversed. Batch 6 DBSs were not significantly different from those of the reference batch ($p= 0.2$).

DISCUSSION & CONCLUSIONS: This study first confirmed the linear correlation between KHN and DC for a given composite resin matrix as shown by Ferracane's study (1). The recorded linear function (KHN (f)DC) provided a reliable and simple method to assess the variation in polymerization of a composite directly applied to treated dentin. It has been shown that irrigant solutions commonly used in endodontics lead to decreased DBSs (2-3). It is likely that the dentin oxidation partially inhibits the polymerization of the resin matrix. This oxygen-inhibition also explains the reduction in DBS. But dentin treatment with anti-oxidant agents before bonding can reverse this drawback. GHS appears to be a more efficient reducing agent than Na ascorbate.

REFERENCES: [1] JL. Ferracane (1985) *Correlation between hardness and degree of conversion during the setting reaction of unfilled dental restorative resins.* Dent Mater. 1: 11-14.[2] SCN. Lai, YF. Mak, GSP. Cheung, R. Osorio, M. Toledano, RM. Carvalho, FR. Tay and DH. Pashley (2001). *Reversal of compromised bonding to oxidized etched dentin.* J Dent Res. 80: 1919-1924.[3] MD Morris, KW Lee, KA Agee, S Bouillaguet, DH Pashley (2001). *Effects of sodium hypochlorite and RC-Prep on bond strengths of resin cement to endodontic surfaces*. J Endodon.; 27: 753-757.