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The Effect of Fluoride Release from a Bonding Material on Nanoleakage

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Introduction

The so called "nanoleakage" is located within the hybrid layer at the dentin composite interface. The term has been introduced by Sano et al. in 1995 to characterize penetration pathways within hybrid layers of dentin-composite interfaces in the absence of gap formations. This phenomenon is reported in the literature to hamper dentin bonding. Remineralization of etched dentin due to fluoride release from bonding agents might affect the nanoleakage pattern.

Objectives

To evaluate the effect on nanoleakage formation by a fluoride releasing dentin bonding material over time.

Material and Methods

Standardized class-V cavities were prepared in 60 extracted human molars. 30 cavities were filled with composite (Spectrum) using the Prime&Bond NT bonding system (containing cetylamine hydrofluoride). 30 teeth were filled with the same composite and an experimental Prime&Bond NT without fluoride additives. Prior to the microscopic studies 15 teeth per group were stored for 24 h in water and the remaining 15 teeth per group were stored for 6 months in water. After storage the teeth were soaked in a 1% rhodamine B dye solution (24 h, 20 °C), rinsed in water for 60 s and sectioned parallel to the tooth axis, dividing the restorations into two parts. Confocal laser scanning microscopy (CLSM) was used to visualize a layer 10 µm below the prepared surface. The morphology of the dentin composite interfaces were visualized at high magnification in fluorescent mode. The lengths of the penetrated pathways were measured at low magnification using an overlay of images recorded either in reflection or overmodulated fluorescent mode.

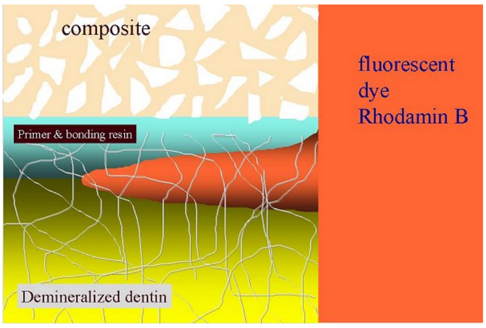


Fig. 1: Scheme of the penetration pathways between dentin and composite.

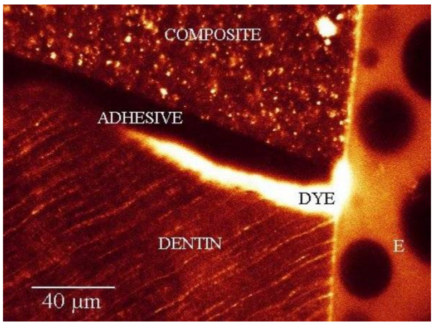
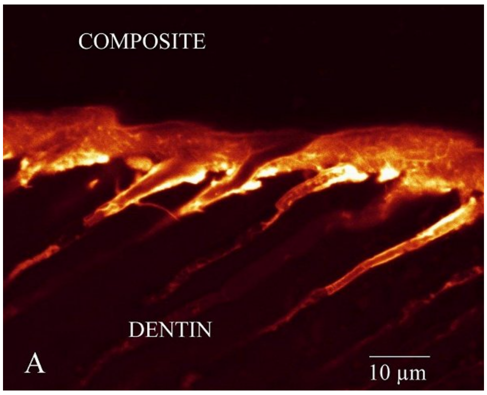


Fig. 2: Low magnification CLSM image of dye penetration with over modulated fluorescence signal.
E = embedding material.

Results

High resolution CLSM images demonstrate penetration pathways located at the interface between hybrid layer and dentin. No differences between fluoride releasing material and the material without fluoride can be detected (see Figs. 3A and 3B). Storage for 24 h resulted in penetration lengths of 53 ± 59 µm. After 6 months the penetration lengths are 74 ± 40 µm for the fluoride releasing bonding agent and 75 ± 52 µm for the experimental bond without fluoride content. After storage for 6 months dye penetration slightly increases, but the difference is not statistically significant (p=0.09 fluoride releasing material and p=0.11 material without fluoride; Mann-Withney U-test).



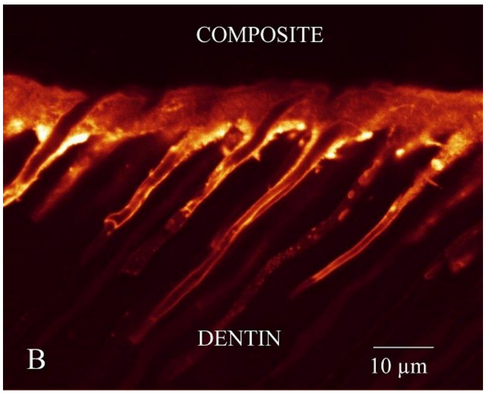


Fig. 3A: High magnification CLSM image of dye penetration after long term storage (fluoride releasing material).

Fig. 3B: High magnification CLSM image of dye penetration after long term storage (no fluoride releasing material).

Material	Measured nanoleakage short term storage	Measured nanoleakage long term storage	Statistics
Prime & Bond NT	53 ± 59	74 ± 40	p=0.09
Prime & Bond NT nf	53 ± 59	75 ± 52	p=0.11

Tab. 1 Measured extension of dye penetration: nf=non fluorid.

Conclusion

It is concluded that the penetrations observed are a result of nanoleakage. Fluoride release or a 6 months storage has no statistically significant effect on nanoleakage.

This Poster was submitted by Priv.-Doz. Dr. Thomas Pioch.

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Poster Faksimile:

The Effect of Fluoride Release from a Bonding Material on Nanoleakage

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Indroduction: The so called „nanoleakage" is located within the hybrid layer at the dentin composite interface. The term has been introduced by Sano *et al.* in 1995 to characterize penetration pathways within hybrid layers of dentin-composite interfaces in the absence of gap formations. This phenomenon is reported in the literature to hamper dentin bonding. Remineralization of etched dentin due to fluoride release from bonding agents might affect the nanoleakage pattern.

Purpose: To evaluate the effect on nanoleakage formation by a fluoride releasing dentin bonding material over time.

Materials and Methods: Standardized class-V cavities were prepared in 60 extracted human molars. 30 cavities were filled with composite (Spectrum) using the Prime&Bond NT bonding system (containing cetylamine hydrofluoride). 30 teeth were filled with the same composite and an experimental Prime&Bond NT without fluoride additives. Prior to the microscopic studies 15 teeth per group were stored for 24 h in water and the remaining 15 teeth per group were stored for 6 months in water. After storage the teeth were soaked in a 1% rhodamine B dye solution (24 h, 20 °C), rinsed in water for 60 s and sectioned parallel to the tooth axis, dividing the restorations into two parts. Confocal laser scanning microscopy (CLSM) was used to visualize a layer 10 µm below the prepared surface. The morphology of the dentin composite interfaces were visualized at high magnification in fluorescent mode. The lengths of the penetrated pathways were measured at low magnification using an overlay of images recorded either in reflection or overmodulated fluorescent mode.

Results: High resolution CLSM images demonstrate penetration pathways located at the interface between hybrid layer and dentin. No differences between fluoride releasing material and the material without fluoride can be detected (see Figs. 3A and 3B). Storage for 24 h resulted in penetration lengths of 53 ± 59 µm. After 6 months the penetration lengths are 74 ± 40 µm for the fluoride releasing bonding agent and 75 ± 52 µm for the experimental bond without fluoride content. After storage for 6 months dye penetration slightly increases, but the difference is not statistically significant ($p=0.09$ fluoride releasing material and $p=0.11$ material without fluoride; Mann-Withney U-test).

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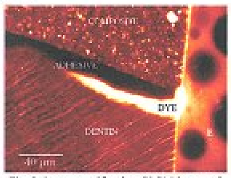

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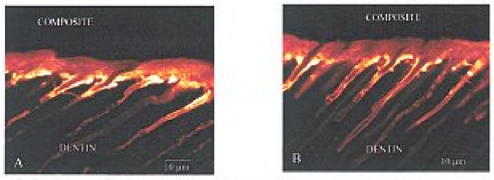

Fig. 3: High magnification CLSM image of dye penetration after long term storage.
A = fluoride releasing material, B = no fluoride releasing material

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