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Microtensile Bond Strength of Five Self-Conditioning Dentin Adhesives in Vitro

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Introduction

With the increasing demands for aesthetic dental restorations in dentistry many adhesives and bonding agents have been developed in order to provide sufficient bonding ability to enamel and dentin with fewer bonding steps. The mechanism for bonding adhesives to dentin is based on the combined effect of hybridization and formation of resin tags. Adhesive systems should be easy to use, be not too technique-sensitive, and perform equally well on dentin and enamel. To reduce the technique sensitivity that effects bonding ability of adhesive systems, the steps required have been reduced. Thus, self-etching primers were developed to simplify the bonding procedure. They are based on the use of nonrinse, acidic polymerizable monomers which serve as condiitioner, primer and bonding resin, an form a continuous layer between the resin composite and the tooth surface, which is simultaneously demineralized with acidic monomers followed by bonding agent penetration into the tooth substrate (1-4).

Objectives

The aim of this study was to evaluate microtensile bond strength of five different self-conditioning dentin adhesives (Futurabond NR, Adper Prompt L-Pop, Contax, AdheSE, Clearfil Protect Bond) on perfused dentin in vitro (Fig. 1-7).

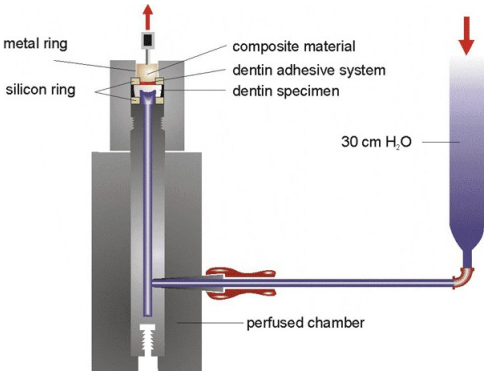

Fig. 1: Special designed apparatus to test microtensile bond strength under permanent dentin perfusion and simulating intrapulpal pressure.

Fig. 2

Fig. 3

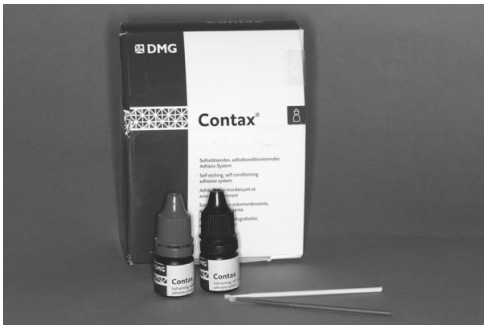

Fig. 4

Fig. 5

Fig. 2-6: Self-etching adhesives used in the present study.

Fig. 7: Composite material used in the present study.

Material and Methods

The study was carried out on fifty caries-free freshly extracted third molars, which had been stored in saline for a maximum of seven days after extraction. All teeth were prepared in a special manner allowing the simulation of the dentin perfusion. Dentin specimens with a total thickness of 3.5 mm (± 0.5mm) were obtained under standardized conditions. The distance between the pulp chamber and the occlusal plateau was adjusted to 2.0 mm (± 0.2 mm). All specimens were divided at random into five groups of ten each: Group A: Futurabond NR; group B: Adper Prompt L-Pop; group C: Contax; group D: AdheSE; group E: Clearfil Protect Bond (Fig. 2-6). The adhesive systems were applied as recommended by the manufacturer. Microtensile bond strength was measured 15 minutes after application and light curing of the composite material (Clearfil AP-X, colour A2) (Fig. 7) using an universal testing machine (Zwick Z005) (Fig. 8-11). For each group mean value and standard deviation were calculated. Statistical analysis were performed using ANOVA and Tukey's test.

Fig. 8: Universal testing machine (Zwick 005).

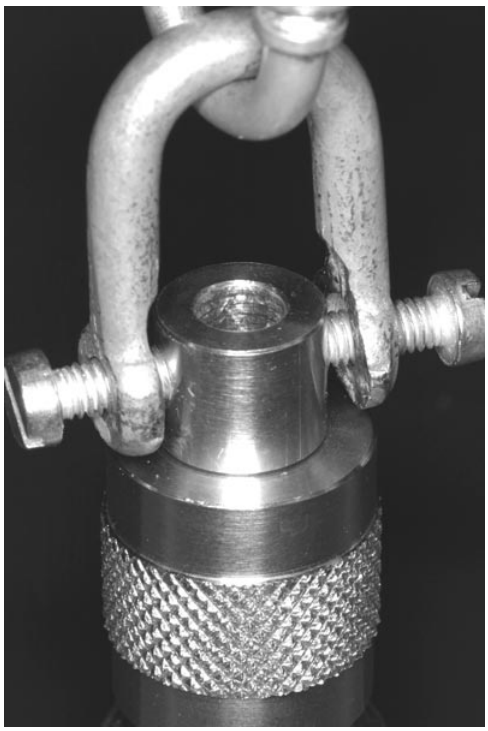

Fig. 9

Fig. 9-11: Experimental apparatus to test microtensile bond strength under permanent dentin perfusion.

Results

In every group microtensile bond strength could be measured. Following bond strengths were evaluated (mean values and standard deviations, printed in MPa): The highest values were observed for specimens treated with Clearfil Protect Bond with 22.53 MPa (± 3.68) while the lowest were measured in group A for specimens treated with Futurabond NR (13.34 (± 4.27). (Tab. 1, Fig. 12).

	Group A	Group B	Group C	Group D	Group E
	Futurabond NR	*Adper Prompt L-Pop*	*Contax*	*AdheSE*	*Clearfil Protect Bond*
Mean value	13,34	22,33	20,50	17,65	22,53
±	4,27	2,77	3,30	4,84	3,68

Tab. 1: Mean value and standard deviation within the different groups

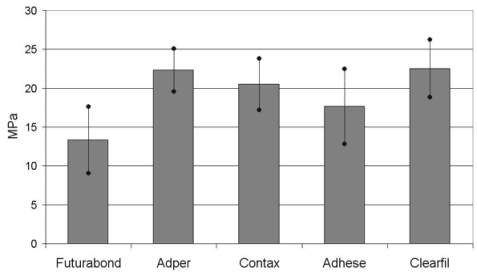

Fig. 12: Mean value and standard deviation within the different groups.

Statistical analysis showed a significant influence of the used material combination on tensile bond strength ($p < 0.001$, ANOVA). Pairwise comparisons showed no significant differences between group B, C, D and E. Tensile bond strength in group A (Futurabond NR) was significantly decreased compared to all other groups except group D (AdheSE) ($p < 0.05$, Tukeys test).

Conclusions

All self-conditionng bonding agents used in this study were able to establish bond strength on perfused dentin. The specimens treated with Clearfil Protect Bond showed the highest bond strengths. However, all dentin adhesives showed almost favourable values. Clinical investigations will have to proove these findings.

Literature

1. Atash R, Van den Abbeele A (2005) Bond strengths of eight contemporary adhesives to enamel and to dentine: an in vitro study on bovine primary teeth. Int J Paediatr Dent 15: 264-73.
2. Van Meerbeek B, Vargas M, Inoue S (2001) Adhesives and cements to promote preservation dentistry. Operative Dentistry Supplement 6: 119-1443.
3. Tay FR, Pashley DH (2001) Aggressiveness of contemporary self-etching systems. I: Depth of penetration beyond dentin smear layers. Dent Mater 17: 296-308.
4. Abo T, Uno S, Sano H (2004) Comparison of bonding efficacy of an all-in-one adhesive with a self-etching primer system. Eur J Oral Sci 112: 286-92.

Abbreviations

MPa = Megapascals

This Poster was submitted by Dr. Katrin Bekes.

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Poster Faksimile:

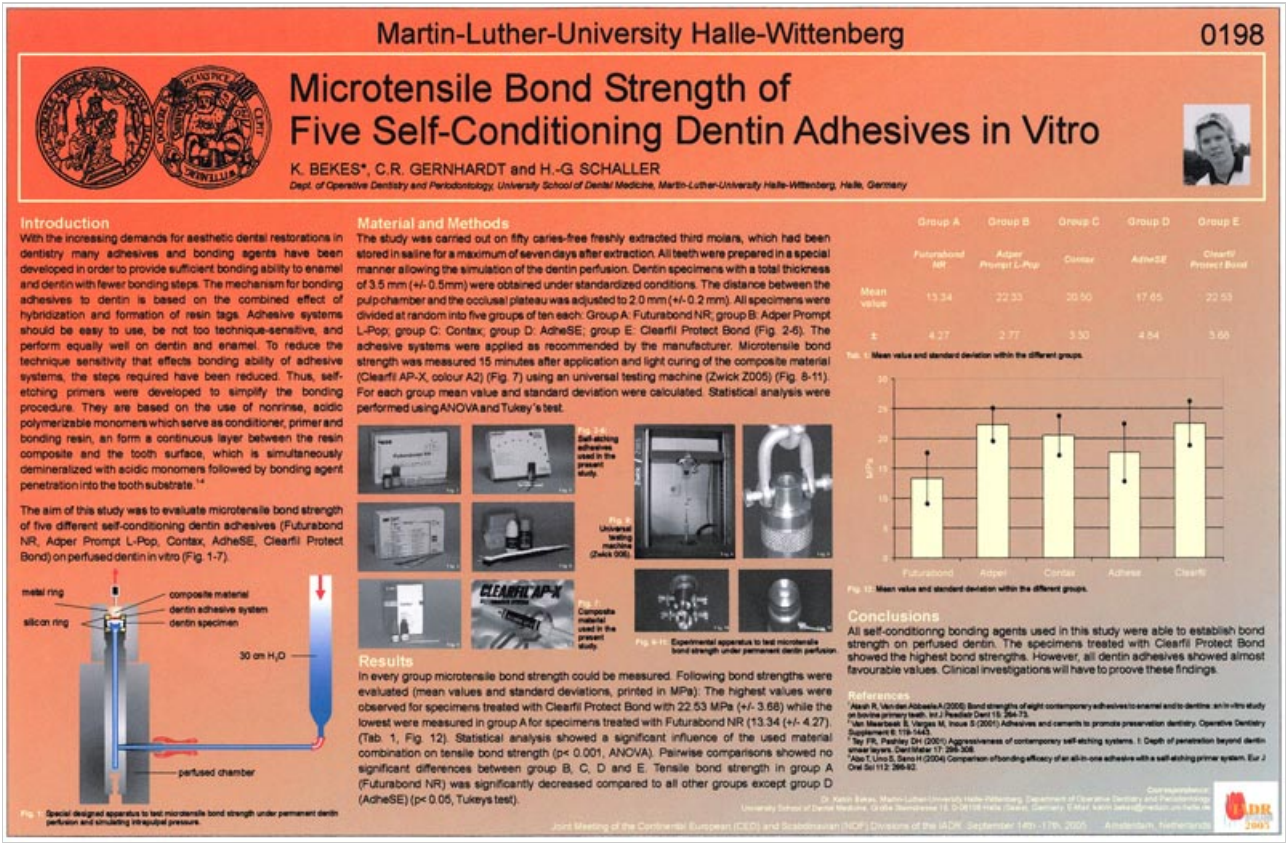

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Fig. 1 Special designed apparatus to test microtensile bond strength under permanent dentin perfusion and simulating intrapulpal pressure.

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