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The Influence of Bonding Area Width on Tensile Bond Strength in Vitro

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Introduction

Previous studies have shown a correlation between bond strength of dentin adhesive systems and different test modalities like shear or tensile bond tests (1). Other investigations focused on the influence of perfusion or specimen preparation (2, 3). It is also known that the composite material and colour of this material have a significant influence on bond strength of dentin adhesive systems (4, 5). But until now only low information is available on the influence of different bonding area sizes on bond strength.

Objectives

Therefore, the aim of the present investigation was to evaluate the influence of four different area sizes on tensile bond strength of two dentin adhesive system (Excite, Clearfil New Bond) (Fig. 3, 4).

Fig. 3: Dentin adhesive system Excite used in this study.

Fig. 4: Dentin adhesive Clearfil New Bond used in this study.

Material und Methods

Eigthy freshly extracted third molars, stored in saline for a maximum of seven days, were included in this study. All teeth were specially prepared allowing the simulation of dentin perfusion. Dentin specimens with a total thickness of 3.5 mm (± 0.5 mm) were obtained under standardized conditions (Fig. 1).

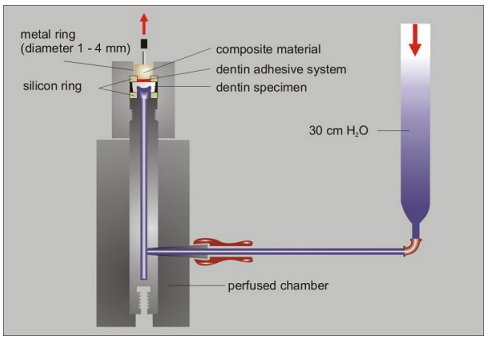

Fig. 1: Special designed apparatus to test tensile bond strength under permanent dentin perfusion.

All specimens were randomly assigned to eight experimental groups of fifteen each: group C1- C4: Clearfil New Bond (bonding area diameter 1 mm - 4 mm); group E1- E4: Excite (1 mm - 4 mm). All materials were applied on the different standardized surface areas as recommended by the manufacturers (Fig. 2, 3, 4).

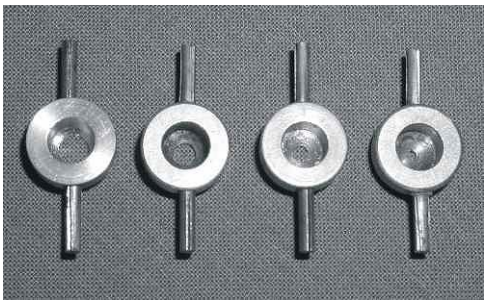

Fig. 2: Special designed metal rings to test tensile bond strength on different diameter sizes.

Maximum tensile bond strength of the above mentioned adhesive agents was measured 15 minutes after application and light-curing of the composite material (Tetric, colour A2) using an universal testing machine (Fig. 5, 6, 7).

Fig. 5: Special designed apparatus mounted in a universal testing machine.

Fig. 6: Experimental apparatus with specimen inside before loading.

Fig. 7: Experimental device after loading until fracture.

For each group mean value and standard deviation were calculated. Statistical analysis were performed using ANOVA and Tukey's test.

Results

In all groups tensile bond strength could be measured (Tab. 1, Fig. 8).

	Group C1	Group C2	Group C3	Group C4	Group E1	Group E2	Group E3	Group E4
Mean value (in MPa)	18.5	9.97	4.78	4.68	10.84	7.22	4.87	3.56
Standard deviation	±10.4	±3.76	±2.21	±2.41	±6.62	±3.11	±1.90	±1.11

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

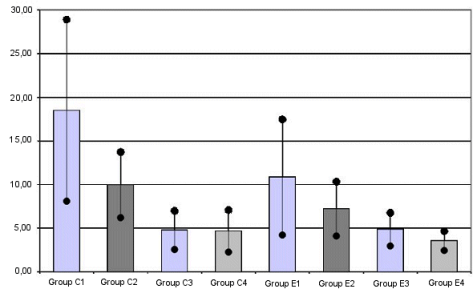

Fig. 8: Mean value and standard deviation within the different groups.

Following tensile bond strengths were evaluated (mean value and standard deviation in MPa): group C1 18.5 (± 10.4), group C2 9.97 (± 3.76), group C3 4.78 (± 2.21) group C4 4.68 (± 2.41), group E1 10.84 (± 6.62), group E2 7.22 (± 3.11), group E3 4.87 (± 1.90) and group E4 3.56 (± 1.11). Statistical analysis showed a significant influence of the used dentin bonding agent and the bonding area size on tensile bond strength ($p < 0.001$, ANOVA). Group C1 was significantly increased compared to all other groups ($p < 0.05$, Tukey's test). Pairwise comparison of the same diameter-size showed no significant difference between the different materials except between group C1 and E1.

Discussion and Conclusions

Within the limitations of an in vitro study, it can be concluded that different bonding area sizes have an influence on the results of both adhesive systems tested. The mostly increasing bond strength in groups used on smaller surface areas might help to explain the known difference between in vitro tests and clinical performance. Further investigations focusing on this point have to prove these findings.

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This poster was submitted by Dr. Christian Gernhardt.

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