



Bond Strength of Universal Adhesives Applied on High-Level Irradiated Dentin

Nguyen A.D.*¹, Broscheit S.¹, Vordermark D.², Gerlach R.², Bitter K.¹, Gernhardt C.R.¹

¹University Outpatient Clinic for Conservative Dentistry and Periodontology, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

²Department of Radiotherapy, University Clinic, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

Introduction

Tumour-therapeutic radiotherapy is an important part of the treatment of tumours in the head and neck region, which also have a major impact in the field of dentistry. Universal adhesive systems have been on the market for over 10 years and have established themselves in recent years for the bonding of direct and indirect restorations. They are characterized by the fact that they can be applied in the etch-and-rinse or self-etch mode.

Objectives

The aim of this in-vitro study was to investigate the bond strength of three different universal adhesive systems in the etch-and-rinse mode and self-etch mode on irradiated dentin.

Methods

180 prepared wisdom teeth (Fig. 1) received in vitro either no irradiation or irradiation with a tumour-therapeutically relevant dose of 60 Gy (Fig. 2) (2 Gy/day for 5 days/week). The samples from both groups were divided into six subgroups (n = 15) in order to evaluate the three universal adhesives (Futurabond® U, VOCO; AdheSE® Universal Ivoclar Vivadent; Xeno® Select, Dentsply Sirona) in both possible application modes (ER/SE). The micro tensile bond strength (µTBS) on perfused dentin was determined 15 minutes after application of the materials using a universal testing machine (1.0 mm/min). The data obtained were statistically analyzed (SPSS 25.0, ANOVA (p<0.001), Tukey's test (p<0.05)).

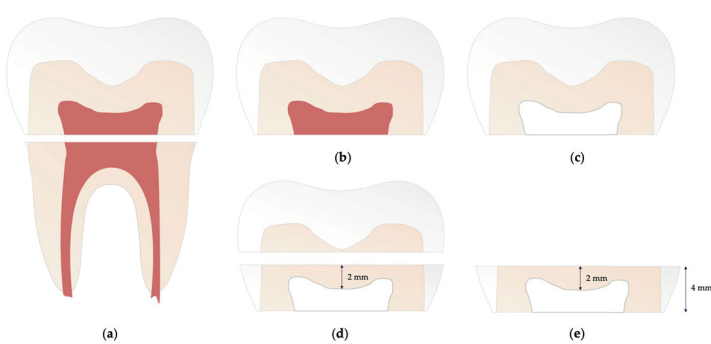


Fig. 1 Schematic illustration of sample preparation: (a) Root removal (b) Coronal part (c) Coronal part after pulp removal (d) Occlusal reduction 2mm above the pulp chamber (e) Final dentin sample

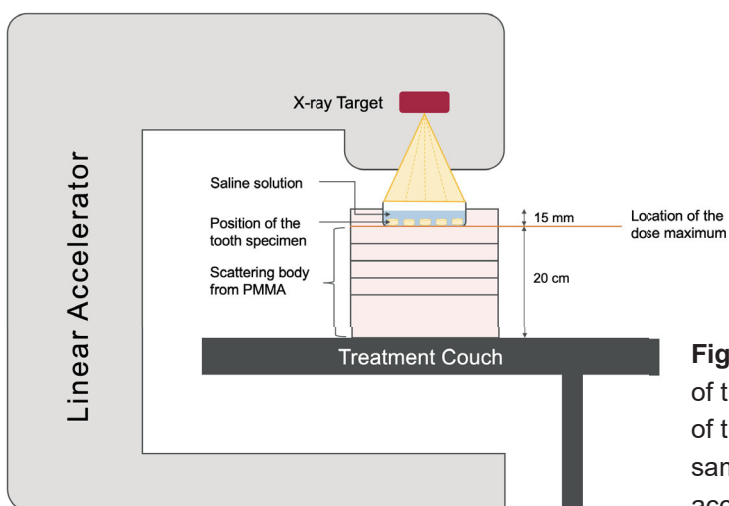


Fig. 2 Schematic illustration of the irradiation procedure of the prepared dentine samples in the linear accelerator

Results

The influence of irradiation and application mode was significant (p<0.001, ANOVA). A reduced bond strength was observed for all systems after irradiation (Tab. 1, Fig. 3-5). However, this was not significant in the case of Futurabond® U and AdheSE® Universal (ER & SE). For Xeno® Select significantly reduced bond strengths were determined in the SE mode (11.42 MPa +/-3.86) after irradiation (60 Gy) compared to the non-irradiated control group (24.17 MPa +/- 8.36). For all three adhesive systems, the processing mode showed no influence on the non-irradiated control samples (p>0.05, Tukey's test).

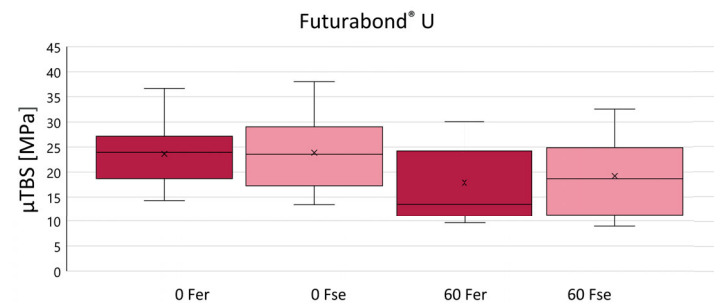


Fig. 3 Graphical illustration of the results of the Futurabond® U group (healthy and irradiated dentin, dark color corresponds to etch-and-rinse application)

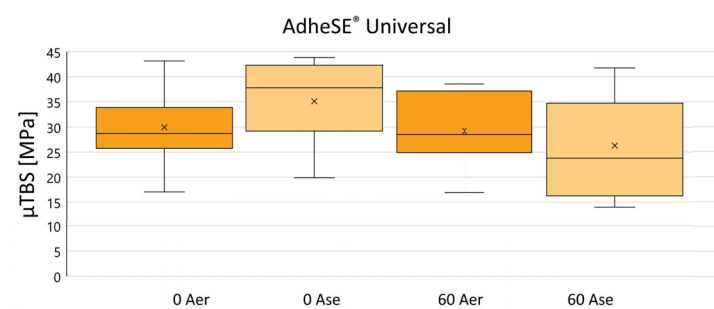


Fig. 4 Graphical illustration of the results of the AdheSE® Universal group (healthy and irradiated dentin, dark color corresponds to etch-and-rinse application)

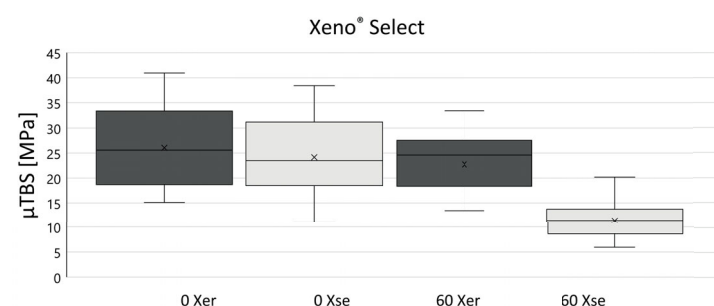


Fig. 5 Graphical illustration of the results of the Xeno® Select group (healthy and irradiated dentin, dark color corresponds to etch-and-rinse application)

Tab. 1 Results of micro tensile bond strength and standard deviation

Group	0 Gy	60 Gy	Reduction of µTBS after irradiation
F er	23.64 (± 6.76)	17.88 (± 7.54)	-24.4 %
F se	23.87 (± 7.49)	19.21 (± 7.34)	-19.5 %
A er	29.97 (± 7.18)	29.24 (± 7.28)	-2.4 %
A se	35.10 (± 8.41)	26.30 (± 10.07)	-25.1 %
X er	26.06 (± 8.20)	22.74 (± 6.22)	-12.7 %
X se	24.17 (± 8.36)	11.42 (± 3.86)	-52.8 %

Conclusions

Considering the limitations of a laboratory study, a reduction in the bond strength of universal adhesive systems to irradiated dentin was observed, depending on the material and the conditioning mode used. This study received no external financial funding.

