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Research paper

The bond strength of the resin-to-zirconia interface using different bonding concepts

Michael Behr*, Peter Proff, Carola Kolbeck, Sabine Langrieger, Johannes Kunze, Gerhard Handel, Martin Rosentritt

Department of Prosthetic Dentistry, Regensburg University Medical Center, Germany

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ABSTRACT

Objectives. This study investigated the shear bond strength (SBS) and the tensile bond strength (TBS) of the zirconia-to-resin interface using different cement bonding concepts. **Methods.** Coplanar zirconia specimens were bonded to CoCr-cylinders measuring 5 mm in diameter and 3 mm in height. All bonding areas were first sandblasted with 110 μm Al_2O_3 (0.28 MPa, 10 s). SBS and TBS were determined after 24 h and 90 d of water storage as well as after 12,000 thermal cycles (TC, 5°/55 °C, 17 d). The bonding concepts consisted of the application of a silane coupling agent, tribological silica coating (Rocatec system), cements or primers containing phosphone, mono-phosphate, or di-phosphate, and a combination of silica coating and primer. **Results.** Bond strength higher than 10 MPa was considered clinically sufficient. SBS measured with each bonding concept surpassed this value, except control and MaxCem after 90 d. In contrast, TBS values were rather different. The application of a silane coupling agent alone showed very low values in the TBS test. Silica coating was only sufficient after 90 d of water storage and when combined with phosphate-esters or phosphone-containing primers. Bonding agents based on di-phosphates or phosphones showed stable TBS values of less than 10 MPa under different aging conditions. The predominant mode of failure was adhesive failure at the ceramic surface. **Conclusions.** None of the investigated bonding concepts of the zirconia-to-resin interface provided clinically sufficient tensile bond strength. SBS values were inadequate for a sufficient ranking.

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1. Introduction

Standards for crown retention are described on the basis of the taper, height, and surface area of the prepared tooth (Jorgensen, 1955). Decreasing the taper and increasing both the preparation height and surface area expand the retention

of conventionally cemented crowns. Zirconia or alumina all-ceramic restorations are known to have an intaglio surface due to the manufacturing process (Blatz et al., 2003) and this special micro-roughness should promote a micromechanical interlocking of luting agents. Investigations by Palacios et al. (2006), and Ernst et al. (2005) seem to confirm this statement.

* Corresponding address: Department of Prosthetic Dentistry, Regensburg University Medical Center, 93042 Regensburg, Germany. Tel.: +49 941 944 6058; fax: +49 941 944 6171.

E-mail address: michael.behr@klinik.uni-regensburg.de (M. Behr).