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Comparative analysis of various surface treatment techniques on the shear bond strength of repaired dental composite materials

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ABSTRACT

Background and Objective: Repairing composite restorations is a conservative alternative to replacement, and bond strength is influenced by both the composite type and surface treatment. This study compared the shear bond strength of microhybrid and bulk-fill composites repaired with bulk-fill composite using different surface treatment protocols.

Methods: This experimental study, conducted from July 2023 to February 2024, included 120 samples: 60 microhybrid composites and 60 bulk-fill composites. The samples were divided into a control group with no further treatment and an experimental group with additional surface treatments. The samples were prepared in Teflon moulds, cured, aged in deionized water, and exposed to thermal cycling as per ISO standard/TR 11405 (2003). The surface treatments included roughening, application of a universal adhesive (iBOND Universal), sandblasting with alumina, and a silane coupling agent (bis-Silane, BISCO Inc.). The repair composites were applied and cured, followed by shear bond strength testing using a universal testing machine.

Results: Specific post-hoc comparisons revealed that control groups generally exhibited the lowest bond strengths, with varying mean values: 11.98 ± 3.83 MPa, 23.01 ± 7.46 MPa, and 12.90 ± 3.03 MPa for different controls. Conversely, specimens treated with bulk-fill material consistently showed higher shear bond strength, especially those undergoing sandblasting, which recorded the highest bond strengths among all the groups tested ($p < 0.01$). Additionally, the failure analysis under a stereo light microscope revealed a transition in rupture types from “adhesive interface” to “cohesive in composite” in aged specimens, after thermal cycling, indicating a reduction in the cohesive strength over time.

Conclusion: Sandblasting notably improved the repair effectiveness, emphasizing the importance of surface preparation in dental composite repairs. These findings underscore the need for careful selection of surface treatment techniques to optimize repair outcomes in dental restorations.

Keywords: Composite resins, dental materials, dental restoration, shear strength.

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