

Shear Bond Strength Evaluation of Composite versus Glass Ionomer Cement Over One Year

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INTRODUCTION:
Role and Significance of Restorative Dental Materials¹

Composite resin is a widely used restorative material, because of its esthetic properties, biocompatibility, and more importantly its low environmental impact.

The properties of a restorative material require significant durability, strength and withstand degradation of the restoration when subjected to different factors in the oral cavity. The oral environment is a complex environment where a restorative material must be able to sustain against bacteria, changing pH, temperature, masticatory forces and saliva etc. The oral cavity is considered to be the harshest environment for a dental material in the body.

Glass ionomer cements (GIC) are the only direct restorative material to bond chemically to dental hard tissues due to the formation of ionic bonds between carboxylate groups and calcium. The properties of GIC include adhesion to moist tooth structures, anticariogenic properties due to release of fluoride, thermal compatibility with tooth enamel, biocompatibility and low toxicity. The use of GICs in a mechanically loaded situation, however, has been hampered by their low mechanical performance. Poor mechanical properties, such as low fracture strength, toughness and wear, limit their extensive use in dentistry as a filling material in stress-bearing applications. In the posterior dental region, glass ionomer cements are mostly used as a temporary filling material. The requirement to strengthen those cements has led to an ever-increasing research effort into reinforcement or strengthening concepts.

Shear Bond Testing is an established method to evaluate the bond strength between dental hard tissue and restorative materials.^{2, 3}



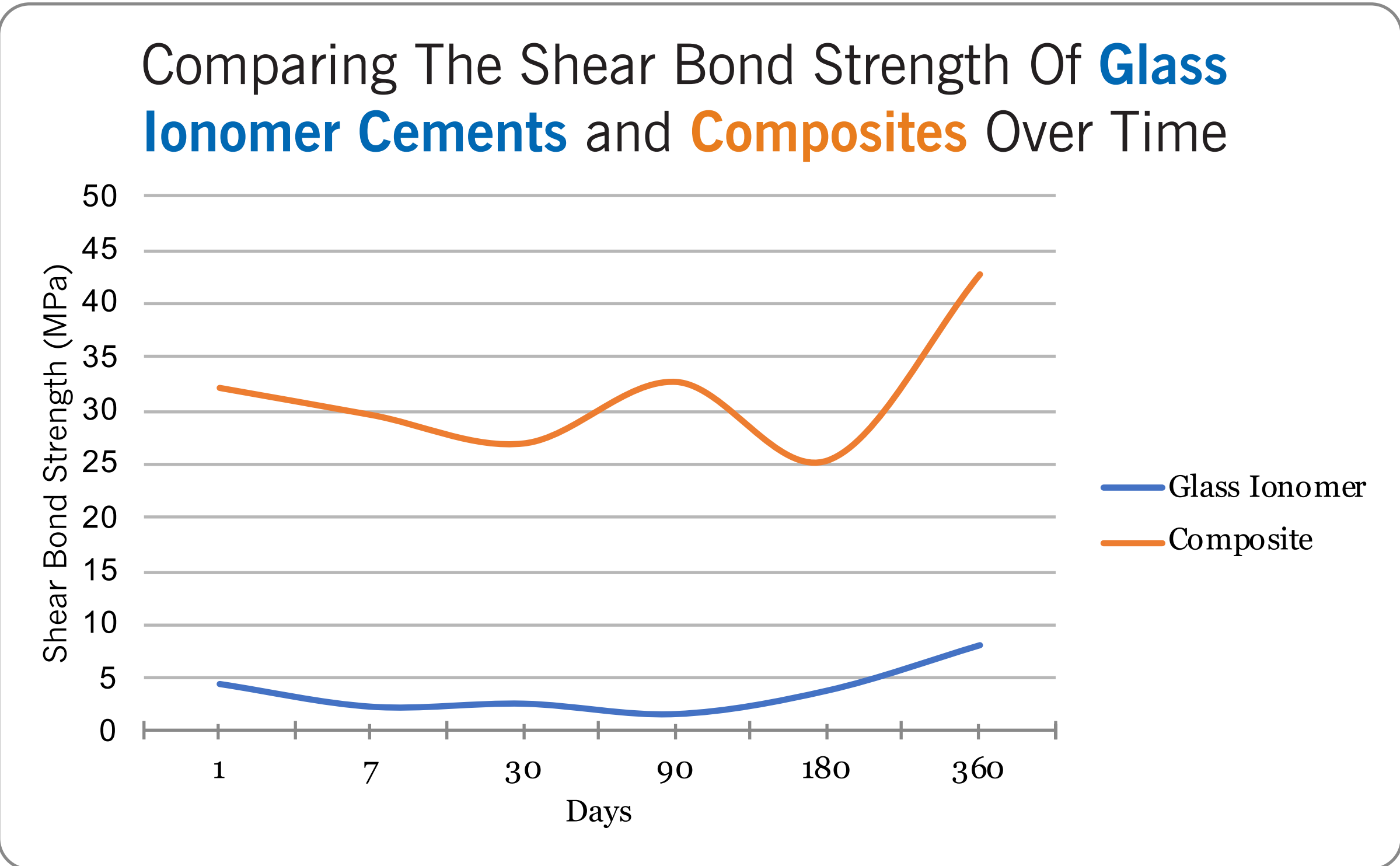
OBJECTIVES: The aim of the research was to evaluate the shear bond strength of Glass Ionomer Cement (GIC) to dentin versus Composite to dentin over a one-year period and tested after 24 hours ,1 week, 1month, 3 months, 6months and 12 months.

MATERIALS AND METHODS: Thirty six human molars were cross-sectioned and embedded in acrylic resin. The exposed flat dentin surface was treated with Scotchbond-Universal Adhesive (3M ESPE) in the self-etching mode according to the manufacturer’s instructions. The adhesive material was light-cured for 10 seconds. The treated samples were placed in a bonding clamp and followed by fabrication of cylindrical composite rods (3 mm in height and 2.37mm in diameter) using FILTEK Supreme Ultra (3M ESPE). They were stored in groups of 6 samples at 37°C and 100% humidity. Another set of 36 embedded tooth samples were fabricated to determine the bond strength of a GIC to dentin. Ketac Universal (3M ESPE) GIC material was used to make cylindrical rods of similar dimensions as above. After conditioning the dentin surface the GIC capsules were triturated for 10 seconds, dispersed and condensed into a cylindrical mold. Samples were setting for up to 10 min with the self-cure system before they were removed from the clamp and stored the same way than the composite samples. The Ultratester (Ultradent) was used to shear off the cylinders from the samples at 1mm per min crosshead speed. Six samples per group of GIC and six samples of Composites were tested at 24 hours, 1 week, 1month, 3 months, 6 months and 12 months respectively. Student t-test at a p<0.05 confidence interval was used to analyze the data.



RESULTS:
No statistical significant difference was found when comparing immediate (24h) bond strength of Ketac Universal GIC with 1 year GIC (p=0.246). The same was found when comparing immediate bond strength (24h) of Filtec Supreme composite with 1 year Filtec Supreme (p=0.364) even though the average value increased over time.

CONCLUSION: Composite material showed significant higher strengths with time compared to GIC material using the shear bond testing methods. The one-year results show higher bond strength for both materials compared to 24 h results but no statistical significant difference was found.



Ultradent Tester

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¹ Craig’s Restorative Dental Materials, Sakaguchi, R., Powers, J.M. (Thirteenth Edition), 2012, p.1-4.

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