A LABORATORY EVALUATION OF A NOVEL SELF-CURED CORE BUILD-UP MATERIAL

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August 15, 2001

INTRODUCTION

Resin based post and core build-up materials are popular and convenient materials for creating an appropriate substructure for full coverage restorations. Recently the introduction of resin core paste materials in cartridges with stader self-mixing tips has significantly improved the ease of use of these materials.

Several parameters are important for achieving maximum performance from these materials. The intrinsic strength of the build-up must be sufficient to resist occlusal loading and deformation. The material must exhibit low shrinkage to prevent gap formation and marginal stress and perhaps most critically the material must be able to be bonded to the tooth for retention and for the integrity of the build-up.

BJM laboratories in Israel have developed a new core material employing novel resin systems. The purpose of this laboratory study was to compare selected physical properties of the new material to a current popular material, Den-Mat's core paste.

METHODS AND MATERIALS

The intrinsic physical strength of the materials was determined by diametral tensile strength and compressive strength. For tensile strength specimens measuring 6 mm in diameter and 2.5 mm in thickness were fabricated in a Teflon mold. The materials were placed in a constant temperature oven at 37° C for 24 hours. The specimens were tested to failure along the diameter of the disk using an Instron Model 1123 testing machine. Compressive strength specimens were fabricated in cylindrical glass forms 13 mm high and 8 mm in diameter. After storage for 24 hours at 37° C each end was flattened using 320 grit silicon carbide papers and tested to failure. Polymerization shrinkage was determined using mercury dilatometry using the NIST method.

Four dual-cured adhesive systems were tested with each core paste. After extracted human molar were wet ground with 600 grit silicon carbide paper exposing dentin the adhesive systems were applied as follows:

Scotchbond Multipurpose: After etching with phosphoric acid and rinsing, Scotchbond activator and Scotchbond Primer were each applied to the dentin in sequence. Equal amounts of Scotchbond catalyst and adhesive were mixed and applied to the dentin.

Optibond: After etching with phosphoric acid and rinsing, Optibond primer was applied to the dentin. Optibond dual-cure paste and dual-cure activator were mixed in equal amounts and applied to the dentin.

Prime&Bond NT: After etching with phosphoric acid equal amounts of Prime & Bond NT and Prime & Bond self-cure activator were mixed and applied to the dentin.

IntegraBond: After etching with phosphoric acid, equal amounts of IntegraBond adhesive and Auto-cure activator were mixed and applied to the dentin.

After each adhesive was placed a gelatin capsule matrix was filled with the paste material and the matrix firmly seated on the dentin surface. After allowing a 3-minute bench cure the specimens were placed in a constant temperature oven at 37° C for 20 minutes and then placed in water and stored for 24 hours in water at 37° C. The specimens were debonded using and Instron Model 1123 testing machine using a crosshead speed of 5 mm/minute.

RESULTS

Diametral Tensile Strength

Material	Tensile Strength (MPa)
CompCore AF	41.0 ± 6.4
Den-Mat Core Paste	33.7 ± 5.7

Compressive Strength

Material	Compressive Strength(MPa)
CompCore AF	212.8 ± 26.2
Den-Mat Core Paste	172.8 ± 27.5

Polymerization Shrinkage

Material	Shrinkage (Volume %)
CompCore AF	1.6
Den-Mat Core Paste	2.4

Mean Shear Bond Strength (SBS) in MPa

Adhesive System	CompCore AF	Den-Mat Core Paste
Scotchbond	18.6 ± 5.1	18.1 ± 5.4
OptiBond	11.1 ± 1.4	6.3 ± 2.5
Prime & Bond NT	6.4 ± 2.1	0.2 ± 0.3
IntegraBond	17.8 ± 3.9	1.4 ± 0.6

DISCUSSION AND CONCLUSION

The newly developed CompCore AF material demonstrated statistically higher tensile and compressive strength and significantly lower polymerization shrinkage compared to DenMat's Core Paste. In addition the new material demonstrated excellent shear bond strength to dentin using IntegraBond with the Auto-cure activator as well as Scotchbond Multipurpose. The low bond strength values using both materials and Prime & Bond NT is a clear illustration that self-cure resins systems are not universally compatible with all adhesive systems regardless of whether they use a dual-cured activator. This is not found with visible light cured resins and adhesive and represents an area of confusion for most practitioners. Operators using self-cure resin systems must follow the manufacturer's directions for adhesives or risk disastrous clinical results.