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Comparitive Evaluation of Shear Bond Strength of Two Resin Based Dual Cure Core Build up Material- an in Vitro

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I. Introduction

Core build-up is one of the most important steps to restore a severely damaged, fractured or extensively carious tooth. As the core becomes an integral part of the load bearing structure of the tooth, it should provide resistance and retention form for the coronal restoration and possess sufficient strength to resist occlusal forces. An ideal core build-up material should have physical properties similar to those of tooth structure. Restored tooth, allows complex stress distribution pattern along the tooth and restoration interface, producing compression, tension or shear stress.The process of mastication is basically related to shearing phenomenon and the true nature of the adhesive strength of materials at the tooth and restoration interface is described by the shear bond strength .SBS test is the most common method to evaluate bond strength, as testing in shear mode is more clinically relevant and relatively simple, reproducible, and widely accepted test .

II. AIM

To evaluate and compare the Shear bond strength of two Dual cure resin based core build-up materials namelyCoreflo dc lite (BISCO) and Core x flow(DENTSPLY).

III. Materials And Methods

Core Flo Dc Lite

- Dual-cured, radiopaque, fluoride-containing core material, self-leveling, low-viscosity material

CORE X FLOW

- Base and catalyst, which when mixed form a dual cured, highly filled, composite resin core build-up and post-cementation material.

MATERIALS	COMPOSITION
1.CORE FLO DC LITE(BISCO USA)	BASE:Fused Silica, BisGMA, Sodium Fluoride, Acetic Acid CATALYST: BisGMA, Fused Silica, Dibenzoyl Peroxide,
2.UNIVERSAL PRIMER	PART A: Ethanol PART B: Bisphenol A Diglycidylmethacrylate(40 – 75%) 2-Hydroxyethyl Methacrylate, MDP, Ethanol.
3.CORE X FLOW(DENTSPLY)	• Urethane di methacrylate • Di- & Tri-functional Methacrylates • Barium Boron Fluoroaluminosilicate Glass Camphorquinone (CQ) Photoinitiator • Photo accelerators • Silicon Dioxide • Benzoyl Peroxide.
4.PRIME AND BOND UNIVERSAL	• Phosphoric acid modified acrylate resin • Multifunctional acrylate • Bifunctional acrylate • Acidic acrylate • Isopropanol • Water • Initiator • Stabilizer

Specimen Preparation

20 extracted human mandibular molars cleaned with ultrasonic scaler and stored in distilled water. Teeth were sectioned horizontally with carborundumdisc 1 mm below the DEJMounted in auto polymerizing resin. Teeth were randomly divided into two groups basis of material used.

Dentin Surface Treatment

Group A

Dispense the equal drops UNIVERSAL PRIMER DUAL CURE ADHESIVE
Part A&B in the ratio of 1:1
Apply Two separate coats of UNIVERSAL PRIMER,scrubbing the preparation with micro brush for 10-15 secs per coats don't light cure between coats&Light cure for 10 secs.

Group B

Dispense one drop of PRIME &BOND UNIVERSAL using microbrush apply in dentin surface slightly agitate for 20 secs evaporate solvent for 5 secs light cured for 20 secs
PLACEMENT OF DUAL CURED COMPOSITE
Readymade Teflon moulds of inner diameter 5mm and height 5mm and inner walls coated with petroleum jelly, olaced on the treated dentine surface, subsequently bulk filled with respective dual cured core build up materials in each group at room temperature.

Thermocycling

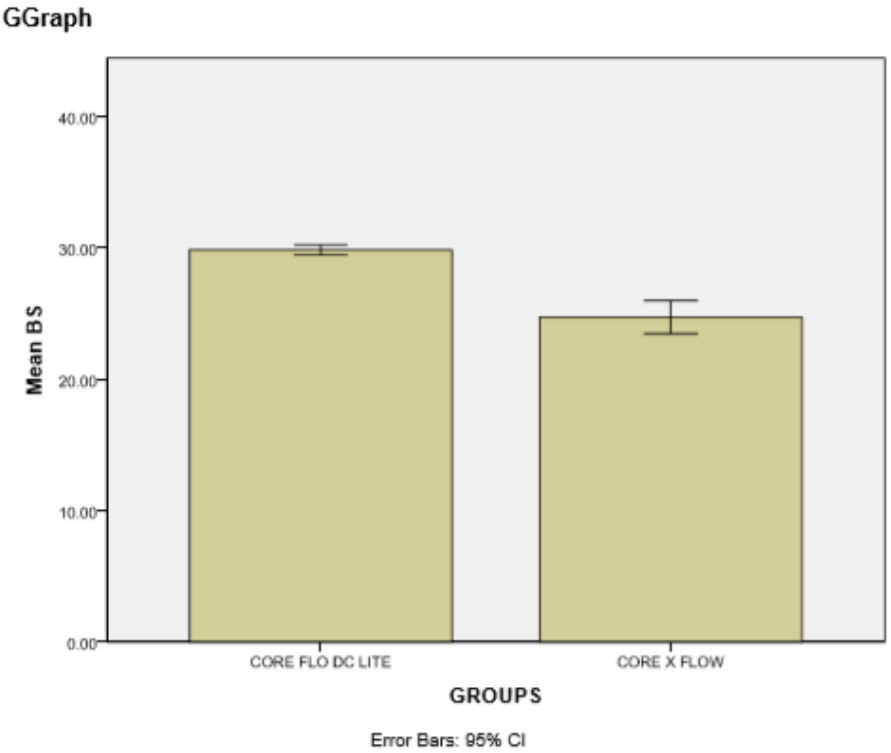
The molds were then de assembled and were stored at 100% humidity at 37°C. Two groups of material kept in Thermocycling for 24 hrs. 5°c-55°c for 500 cycles for dwell time of 30 secs,transit between bath 10 secs according to ISO #11405 standard.Samples were subjected to SBS test using Instron Universal Testing Machine (Model 3382) following the 2003 ISO technical specification #11405. At a cross-head speed of 0.5 mm/min until the specimens fractured under stress load.shear force was applied perpendicular to the tooth surface, to evaluate the bond strength of the core build-up materials.

Statistical Analysis

The data were tabulated and statistically analyzed using statistical software SPSS version 22.0. Non parametric stastiscal analysis was planned in this study.Mann Whitney U test was carried out to determine the significant differences at P<0.000 in between the two Groups.

	BS
Mann-Whitney U	.000
Wilcoxon W	55.000
Z	-3.780
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000[b]

SAMPLES	CORE FLO DC LITE (Mpa)	CORE X FLOW (Mpa)
1	30.5	28.38
2	30.11	25.21
3	30.02	26.32
4	30.20	24.04
5	29.08	25.06
6	28.99	24.11
7	30.12	22.18
8	29.10	23.08
9	30.08	25.22
10	30.18	23.04



IV. Results

- Mann Whitney U test showed a significant difference in mean SBSs at P < 0.000. The mean SBS of group A was highest than group B at 24 hs with thermocycling
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GROUPS	Mean	Std. Deviation	N	Minimum	Median	Maximum
CORE FLO DC LITE	29.8380	.55475	10	28.99	30.0950	30.50
CORE X FLOW	24.7230	1.75642	10	22.18	24.5850	28.38

V. Discussion

This study compared two different, resin based dual-cure core build-up materials with respective Universal dentin bonding adhesives as provided and recommended by the manufacturer, to achieve the maximum effect of bonding procedure.Morphological and structural variations in dentin, presence of more inorganic material in coronal dentin may be the cause for increased bond strength. The density and diameter of dentinal tubules was very high which is around 45,000/mm and 2.5µm much larger when compared to pulpal floor dentin.These changes could impart influence penetration of monomers into dentinal tubules resulting in poorer bonding to this region..

CORE FLO DC LITE

Self-leveling, low-viscosity, dual- cured core material offers excellent handling properties.Versatile enough for multiple indications including core build-up, post cementation, and as a dentin replacement material.Durable and reliable due to physical properties including low shrinkage and high compressive and flexural strengths.

Universal Primer

Universal Primer is compatible with self-cure, light-cure, and dual-cure materials, and the chemistry offers flexibility to self-etch, selective-etch, or total-etch. Dual-cured adhesive with virtually no postoperative sensitivity.Its low viscosity allows the adhesive/primer to readily flow into etched surfaces and offers both chemical and mechanical sealing.

Core x flow

CoreXflowconsists of two-components, base and catalyst, which when mixed forms a dual-cured, highly filled, composite resin core build-up and material for the cementation of posts.Compressive strength reflects the resistance of a core material to masticatory and parafunctional forces.

Prime&Bond universal™

universal adhesive is a combined Etch&Rinse (Total Etch), Self Etch and Selective Etch adhesive. It offers a simple adhesive application technique for both direct and indirect indications and bonds to enamel, dentin, composites, zirconia and metals.

Universal adhesive

There are one-step self-etch adhesive systems called "Universal or Multi-mode Adhesives", which can be applied in etched or unetched enamel and dentin.Multiple modes of application by total etch or self etch or selective etch technique. These bonding agents are also indicated to be used as silane for glass ceramics and primers for metal alloys and polycrystalline ceramics.

In this study self etch mode was used because of less time consuming, clinical procedures,less technique sensitive.

Thermocycling

Thermocycling is an artificial aging methodology that stimulates stresses caused by oral functions,and subjects the specimens to altering temperatures that induce contraction and expansion stress between the resin restoration and tooth due to differences in the coefficient of thermal expansion. Time distribution was done as studies have shown that bond strength evaluations are performed in-vitro24 h after specimen preparation and is considered adequate time to test the adhesive capability of the material.The mean (± standard deviation [SD]) of group A was higher compared to group B.This difference can be attributed to the fact that adhesive used in Group A contains MDP monomer a versatile amphiphilic functional monomer. Stable MDP-calcium salts are formed during this reaction and deposited in self-assembled nanolayers of varying degrees.These Adhesives to create a bridge over the gap between the hydrophilic tooth substrate and hydrophobic resin restorative, under a variety of surface conditions.More acidic adhesive the less compatible with the self-cure mode of dual-cure resin based materials.This is primarily due to acid deactivation of the aromatic tertiary amines that play a crucial role in chemical curing mechanisms of most of these materials.But in group A Universal primer dental adhesive have less acidic(3.2) than Group B Adhesive(2.5). Till date, there are very few in vitro studies that evaluated the shear bond strength of these novel core build up materials.In our study, we found that Core flow DC lite showed a significantly higher shear bond strength as compared to core X flow. This could be attributed to the functional monomer of MDP that is present in Core flow DC lite, and less acidic compared to core x flow

VI. Conclusion

Based on the findings of the present in-vitro study, following conclusion were drawn Core flo dc lite(Group A) core build-up material showed the highest Shear bond strength as compared with Core x flow(Group B) of 24 hrsthermocycling, which was statistically significant.

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