Program Number: 1116

Dual-Cure Core Compatibility to DBA using Self-Cured and Self-Etching Activators

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Introduction

Successful adhesion to dentin of dual-cured composite core build-up materials has been a challenge when used with many visible light-cured (VLC) dentin bonding agents (DBA). Manufacturers developed 'self-cured activators' (SCA) to enhance the bond com-patibility of their dentin bonding agent to dual-cured composites.

Objective

To evaluate the bond compatibility (Shear Bond Strength SBS) of dual-cured composite core build-up materials to several commercially available DBA with their SCA and an experi-mental self-etching bond enhancer (EXP).

Methods

- Flat bonding sites were prepared on the buccal surfaces of 24 freshly extracted bovine teeth by grinding the teeth on a water-cooled abrasive wheel.
- 5 dual-cured composite core build-up materials (**Table 1**) were bonded to bovine dentin, according to the manufacturer instructions, utilizing 5 VLC DBA (**Tables 2,3**) with their SCA (**Table 4**):
  - with and without pre-treatment with:
    - self-etching primers (SEP) (**Table 5**)
    - an experimental self-etching bond enhancer (EXP), BJM Laboratories Ltd. (**Table 5**).
- Shear bond strength (SBS) was measured in accordance with ISO/TS11405:2003.
- The experimental results were statistically analyzed (N=10) by ANOVA ($p<0.05$).

Table 1. Dual-Cured Composite Core Build-Up Materials

Component	Brand Name	Manufacturer
CCAF	CompCoreAF	Premier Dental Products
LC	LuxaCore	DMG
CP	Core Paste	DenMat
TC	Ti-Core	EDS
QC	Q-Core	BJM Laboratories Ltd.

Table 2. 5th generation Visible Light-Cured (VLC) Dentin Bonding Agents (DBA)

Component	Brand Name	Manufacturer
IB	IntegraBond	Premier Dental Products
OSP	Optibond Solo Plus	Kerr
P&BNT	Prime & Bond NT	Dentsply
PB	Prima 2000	BJM Laboratories Ltd.

Table 3. 6th generation Self Etching Visible Light-Cured (VLC) Dentin Bonding Agents (DBA)

Component	Brand Name	Manufacturer
OSP	Optibond Solo Plus	Kerr
XIII (A&B)	Xeno III	Dentsply
CNXB	Contax Bond	DMG
PQB	Prima Quick Bond	BJM Laboratories Ltd.

Table 4. Self-Cured Activators (SCA)

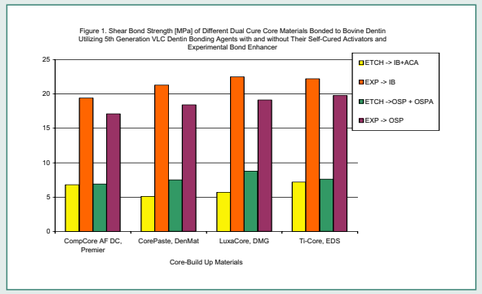
Component	Brand Name	Manufacturer
ACA	Premier Auto Cure Activator	Premier Dental Products
OSPA	Optibond Solo Plus Activator	Kerr
NTA	Prime & Bond NT Activator	Dentsply
BACA	Auto-Cure Activator	BJM Laboratories Ltd.

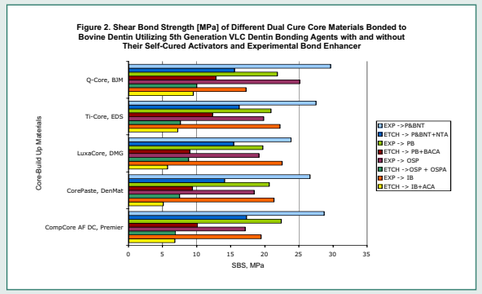
Table 5. Self-Etching Primers (SEP)

Component	Brand Name	Manufacturer
OSPPR	Optibond Solo Plus Primer	Kerr
CNXP	Contax Primer	DMG
PQP	Prima Quick Prime	BJM Laboratories Ltd.
EXP	Experimental Self-Etching Bond Enhancer	BJM Laboratories Ltd.

Results

The SBS (MPa) test results are presented in the following figures and tables.





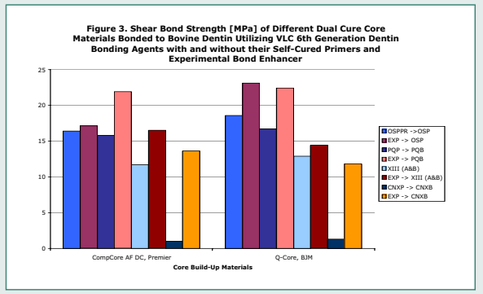


Table 6. Shear Bond Strength [MPa] of Different Dual Cure Core Materials Bonded to Bovine Dentin Utilizing 5th Generation VLC Dentin Bonding Agents with and without their Self-Cured Activators and Experimental Bond Enhancer

	CompCoreAF	CorePaste	LuxaCore	Ti-Core
ETCH→IB+ACA	6.8±4.0	5.1±3.2	5.7±2.4	7.2±2.8
EXP→IB	19.4±3.1	21.3±5.4	22.5±7.2	22.2±4.2
ETCH→OSP+OSPA	6.9±2.6	7.5±3.3	8.8±3.5	7.6±3.7
EXP→OSP	17.1±2.5	18.4±3.8	19.1±4.2	19.8±3.2

Table 7. Shear Bond Strength [MPa] of Different Dual Cure Core Materials Bonded to Bovine Dentin Utilizing 6th Generation VLC Dentin Bonding Agents with and without their Self-Etching Primers and Experimental Bond Enhancer

	CompCoreAF	Q-Core
OSPPR → OSP	16.4±2.0	18.6±2.7
EXP → OSP	17.1±2.5	23.1±2.6
PQP → PQB	15.8±1.8	16.7±2.4
EXP → PQB	21.9±2.1	22.4±3.0
XIII (A&B)	11.7±1.3	12.9±1.6
EXP → XIII (A&B)	16.5±2.1	14.4±2.2
CNXP → CNXB	1.0±0.2	1.3±0.2
EXP → CNXB	13.6±1.7	11.8±0.8

Discussion

BJM'S PQP was modified in order enhance the compatibility of it's bonding agent PQB to DC core materials. The modified formula-tion was later on referred to as the experimental self-etching bond enhancer (EXP).

The following modifications were incorporated into the PQP:

1. Reduced % of solvents
2. Added relatively lower molecular weight dimethaclylates
3. Added difunctional methacrylate monomers and surface-modified, synthetic SiO_2-nano-spheres of 20 nm
4. Added proprietary initiators

Conclusions

- The modified PQP, code name EXP, enhanced the SBS of PQB to DC core materials.
- All 5 core materials bonded to the EXP pre-treated, un-etched, bovine dentin without SCA exhibited signifi-cantly higher SBS compared to the same materials bonded with SCA to etched dentin.
- The EXP treated surfaces for all 6 generation DBA, exhibited higher SBS then the original DBA primers.