

## **BSRD POSTER PRIZE WINNER 2009**

### **RESEARCH**

#### **AN IN-VITRO STUDY OF THE EFFECT OF SURFACE TREATMENT ON THE BOND STRENGTH OF COMPOSITE RESIN TO TWO FORMS OF GLASS CERAMIC**

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#### **Purpose**

Lithium-disilicate glass ceramic is replacing leucite-reinforced as the hot pressed ceramic material of choice. The objective of this study was to evaluate the effect of different steps in the surface treatment of these 2 types of hot pressed glass ceramic when bonded to composite resin. The effect of post-etch cleaning, silanization & heat silanization were evaluated by measurement of the microtensile bond strength ( $\mu$ -tbs).

#### **Materials and Methods**

24 blocks measuring 4x6x8mm of lithium disilicate (e-max press®) and 24 blocks of leucite re-inforced (Heracram®) glass ceramic were fabricated, polished and sandblasted with 70  $\mu$ m glass beads. Bonding surfaces of all blocks were etched using 9.5% hydrofluoric acid for 90 seconds.

For each group, half of the blocks (n=12), received post-etch cleaning with 37.5% Phosphoric acid for 1 minute, rinsed with water for 20 seconds then ultrasonically cleaned in water for 5 minutes. The two groups were further divided into three groups of 4 each. One group was treated with silane and air dried, the next was treated with silane and dried in a hot oven at 100°C for 5 minutes. The last group was left untreated. Thus 12 experimental groups were formed.

Each block was bonded to a block of composite resin of identical dimensions using a standardised protocol; Optibond FL® as adhesive and Filtek Supreme® composite resin as a luting agent light cured for 160 seconds under a standard load of 1Kg.

Each ceramic composite block was sectioned to produce test sticks of 1mm<sup>2</sup> using a non-trimming technique. These were then subjected to micro-tensile testing. The means of  $\mu$ -tbs were analyzed with one way ANOVA and Tukey-Kramer multiple comparison test. The tested specimens were analysed for mode of failure using scanning electron microscopy.

## Results

All four variables in the study (post etch cleaning, silane, heat-silane and ceramic material) showed statistically significant effects on the  $\mu$ -tbs. The lowest  $\mu$ -tbs value was 13.51( $\pm$ 3.02) Mpa (Herapress®) with no post etch cleaning and no silane. The highest value was 42.6 ( $\pm$ 3.70) Mpa (e-max®) with post-etch cleaning and heat dried silane. The greatest difference in means was due to post etch cleaning (16.31 Mpa) followed by the effect of silane (4.74 Mpa) and then the effect of heat dried silane (2.58 Mpa). All of the analysed specimens for e-max® failed adhesively at the ceramic-luting agent interface. For Herapress®, 75% of specimens failed adhesively, 15% failed cohesively and 10% were mixed failures.

## Conclusions

For both forms of glass ceramics, post etch cleaning was the most important step in the surface treatment of glass ceramics providing the greatest improvements in bond strengths. The lithium-disilicate ceramic (e-max press®) produced higher  $\mu$ -tbs bond strength values when compared to the leucite based ceramic (Herapress®)