



Argon Plasma Effect on Bond Strength of Bulk-fill Composite Repair

Beatriz C. Mendonça, Bruna M. Fronza, Gabriel Nima, Gláucia M. B. Ambrosano, Marcelo Giannini

Abstract

This study evaluated the effect of atmospheric pressure plasma (PL), sandblasting with aluminum oxide (SA), and the on the bond strength of fresh bulk-fill resin composite to water-aged restorative bulk-fill resin composite. Seventy pre-polymerized composite plates were fabricated using Filtek Bulk Fill Posterior Restorative (3M ESPE) stored in distilled water for 4 months and randomly divided into 4 groups. For all specimen, two resin cylinders were made using a 1,4 mm diameter x 1 mm height matrix. The resin cylinders were tested after 24 hours, using shear test device. Data were analyzed by 2-way ANOVA and Tukey's test (5%).

Key words: Composite Resin, Repair, Plasma, Bond Strength.

Introduction

A possible alternative to improve adhesion between old and new composites would be the application of plasma generated from argon gas. Plasma acts by changing the functional groups on different treated surfaces to transform an inactive (nonpolar) material into a reactive (polar) one, without structural properties changes.(1)

Plasma has already been used in indirect restorations, more specifically in zirconia structures (2) and also in adhesion to dentin (3), but limited information are available regarding composite repair.

Table 1. Mean (standard deviation) of bond strengths for experimental groups (in MPa).

| Treatment | Mean | Standard Deviation |
|--|--------|--------------------|
| SA with Aluminium Oxide (50µ) for 10 s | 7.0 b | 2.3 |
| PL for 30s | 4.6 c | 1.8 |
| SA + PL | 5.6 bc | 1.2 |
| SA + Silane + Hydrophobic adhesive resin (control) | 18.1 a | 2.2 |

Means followed by distinct letters differ from each other (p ≤ 0.05)

Results and Discussion

Seventy pre-polymerized composite plates (15 mm long x 8 mm wide x 3 mm thick) were fabricated using Filtek Bulk Fill Posterior Restorative (3M ESPE) and stored in distilled water for 4 months. The aged plates were polished with 600-grit SiC paper and assigned to the following groups:

| | |
|---------|--|
| Group 1 | SA (50 µm) for 10 seconds, |
| Group 2 | PL for 30 seconds , |
| Group 3 | SA (50 µm) for 10 seconds + PL for 30 seconds and |
| Group 4 | SA (50 µm) for 10 seconds + silane + hydrophobic adhesive resin (control). |

After treatments, a silicone mold was used to construct a bulk-fill composite resin cylinder (1.5 mm high, 1.5 mm diameter) on each aged composite plate. Following water storage for 24 hours, samples were submitted to shear bond testing. Data were expressed in MPa (n = 6) and statistically analyzed by one-way ANOVA and Tukey test (α=0.05).

Results

Sandblasting followed by application of silane and hydrophobic resin showed the highest bond strength.

Only plasma application for 30 seconds showed the lowest bond strength compared to other types of surface treatments.

Sandblasting followed by plasma application for 30 seconds did not differ statistically from the following treatments: sandblasting with aluminum oxide for 10 seconds and applying plasma for 30 seconds.

Conclusion

The conventional method to repair composites that included sandblasting, silane and hydrophobic adhesive resin yielded the highest bond strength of fresh bulk-fill composite to water-aged bulk-fill resin composite. Plasma alone and its combination with sandblasting were not beneficial as control.

Acknowledgement

Support by SAE - UNICAMP

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