Zahnklinik 1 - Zahnerhaltung und Parodontologie
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Effect of pretreatment modes on the adhesion to a composite CAD/CAM block.

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Purpose / Aim:

There is no final consensus on the ideal mechanical and subsequent chemical pretreatment of indirect composite CAD/CAM restorations for adhesive luting. There are three different mechanical pretreatments for this restoration material:

- **Grit blasting with alumina,**
- **Tribochemical silica coating,**
- **Hydrofluoric acid etching.**

There are also different possibilities for a subsequent chemical pretreatment:

- **Silanization,**
- **Phosphomethacrylate priming.**

Therefore, the present study aimed to evaluate the influence of different pretreatment modes on the adhesion potential of a luting resin to a composite CAD/CAM block.

Materials and Methods:

180 rods (25 x 4 x 3 mm, height x length x width) were prepared from composite CAD/CAM blocks (CERASMART 270, GC). A chevron notch was cut in the middle of the rods with a cutting disc. The notch was split into two matching halves with a thinner cutting disc. The corresponding halves were divided into six groups and pretreated as follows:

- **Group 1 - grit blasting with 35 µm alumina and silane (EspeSIL, 3M),**
- **Group 2 - grit blasting with 35 µm alumina and multi primer (Monobond Plus, Ivoclar),**
- **Group 3 - hydrofluoric acid etching (VITA Ceramic Etch, VITA) and silane (EspeSIL),**
- **Group 4 - hydrofluoric acid etching (VITA Ceramic Etch) and multi primer (Monobond Plus),**
- **Group 5 - tribochemical silica coating (30 µm silica coated alumina, CoJet, 3M) and silane (EspeSIL),**
- **Group 6 - tribochemical silica coating (30 µm silica coated alumina, CoJet) and multi primer (Monobond Plus).**

Figure 1. Investigated materials for mechanical pretreatment. a) Alumina sand 35 µm (Hasenfratz, Germany) for grit blasting. b) CoJet Sand (3M, Germany) for tribochemical silica coating. c) Hydrofluoric acid (VITA Ceramic Etch, VITA, Germany) for etching.

Figure 2. Investigated materials for subsequent chemical pretreatment. a) Phosphomethacrylate and silane containing multi primer (Monobond Plus, Ivoclar, Liechtensten). b) Silane primer (ESPE Sil, 3M, Germany).

Figure 3. Dual-curing resin for luting the specimens (RelyX Ultimate, 3M, Germany).

The pretreated halves were luted with resin (RelyX Universal, 3M) and light cured on all sides (20 s, 1200 mW/cm3, Bluephase 20i, Ivoclar), resulting in 30 samples per group. All samples were stored in artificial saliva at 37 ° C prior to KIc chevron-notch beam fracture toughness measurements. Half of the samples of each group (n=15) were measured after 24 hours and the other half (n=15) after 60 days.

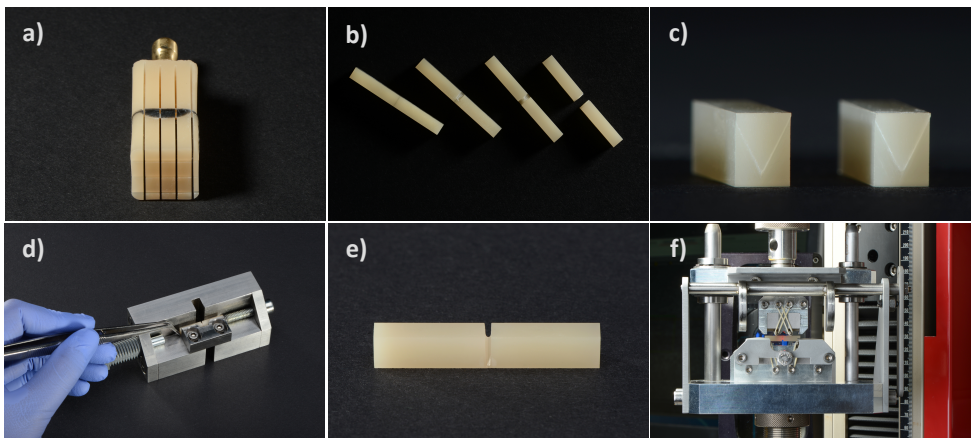

Figure 4. Specimen preparation for chevron notch adhesion testing. a) Two composite blocks luted together (CERASMART 270, GC). b) Sequence showing the notching and splitting of the notch. c) View on the split chevron notch. d) Adhesive luting procedure in a custom alignment device. e) Final adhesively luted chevron notched beam 25 x 4 x 3 mm, height x length x width. f) 4 point bending test using a special jig with a load-line displacement image tracking and laser beam illumination.

Results:

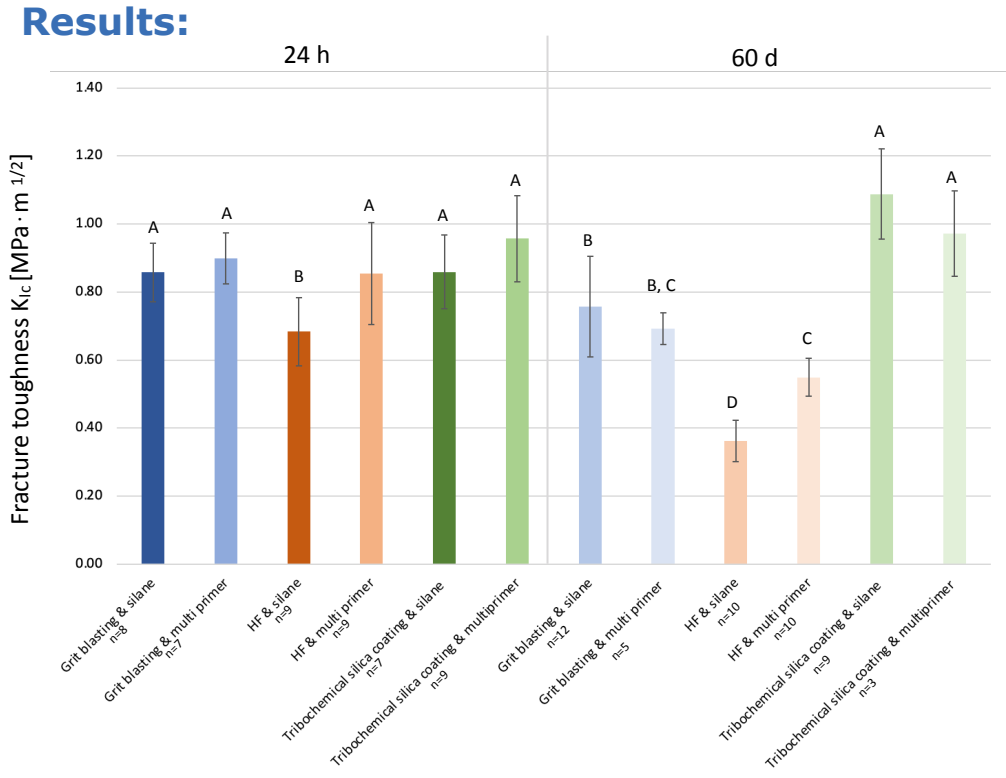

Figure 5. Mean fracture toughness and standard deviation of the materials under investigation. Capital letters indicate statistically homogenous subsets within the same storage period (one-way ANOVA, Tukey-HSD post-hoc, α=.05). The amount of valid measurements is indicated (n).

Conclusions:

Within the limitations of this study, the tribochemical coating with subsequent silanization of the composite CAD/CAM block lead to a higher long-term adhesion compared to other pretreatments.

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