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Reduction of Polymerization Stress of Composite Resin on Model-Cavities

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Introduction

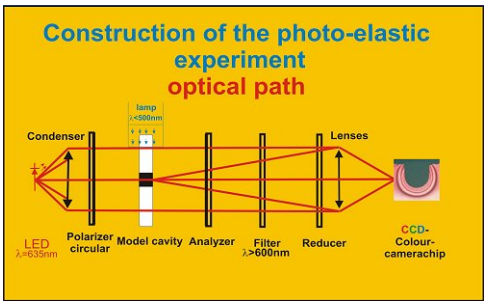
Beside many advantages composite fillings are leaning to gap formation. To avoid any gap, the incremental polymerization became standard in recent times.

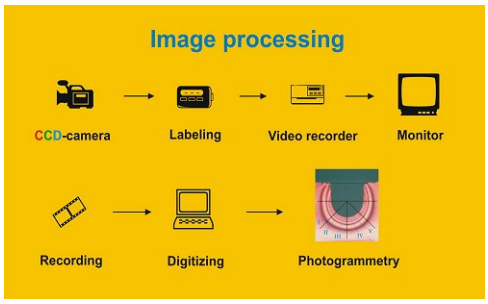
Objectives

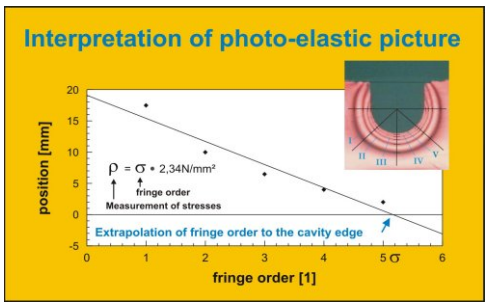
The objective of this study was to visualize the stress, generated by polymerisation shrinkage, in the material of a model-cavity by a photo-elastic method. So it should be possible to compare the mechanical stress in the model-cavity material induced by different filling methods.

Material and Methods

Realistic volumed cavities (V=112mm3, C=0.92) of photoactive resin were examined by red circular polarized light. The bulk-technique, the incremental-placement and a new technique, a small volume light-insert (V=8,6mm 3) with light-guiding properties which was pre-exposed in bulk-fillings, were examined and compared. A conventional micro hybrid resin (Arabesk TOP) and an experimental nano-composite were used. A halogen lamp (850mW/cm²), a plasma-lamp (570mW/cm²) and a blue solid state laser (488nm/16mW) were used for light induced polymerization.

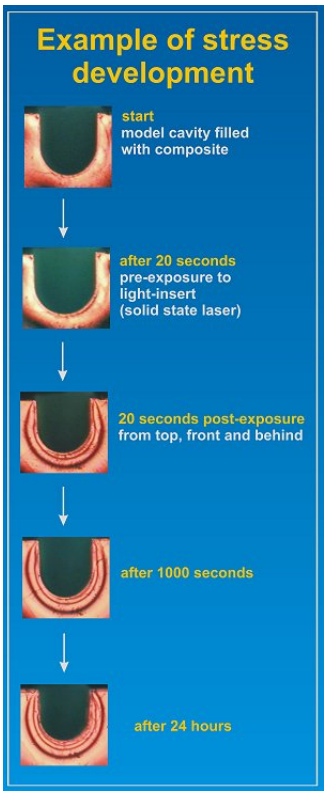


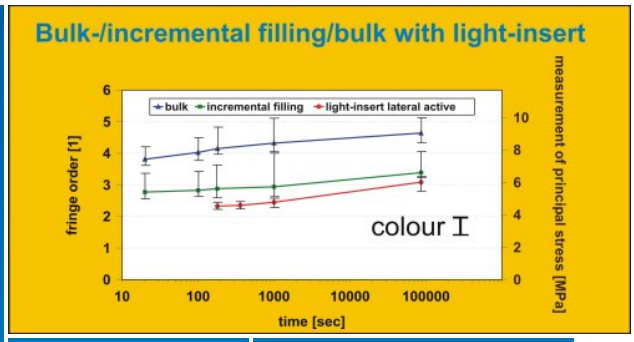


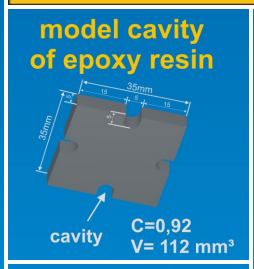


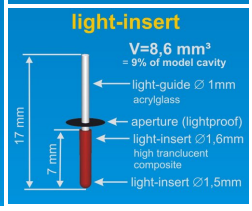
Procedure
- **Bonding**
- **bulk filling:** 20 sec exposure to the halogen-lamp from top, front and behind
- **light-insert filling:** 20 sec exposure only over light-insert and then 20 sec exposure to halogen-lamp from top, front and behind
- **incremental filling:** 20 sec halogen-lamp exposure to each layer from the top

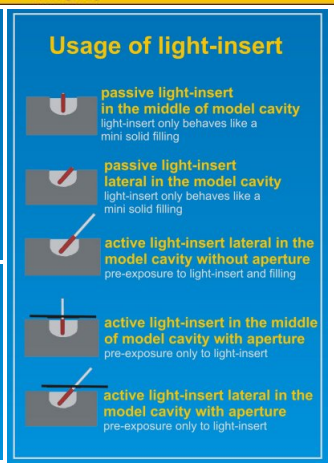
Materials
- **Types of composites**:
nano-hybrid composite (experimental prototypeof GRANDIO-VOCO)
microhybrid composite (Arabesk Top-VOCO)
light-curing, one-component dentin and enamel bond (containing acetone)
- **Type of lamps:**
halogen-lamp (850mW/cm²)
plasma-lamp (570mW/cm²)
solid state laser





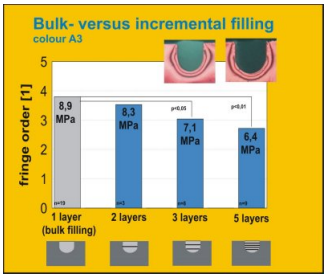


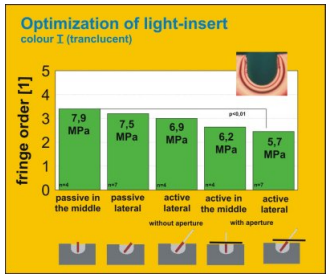


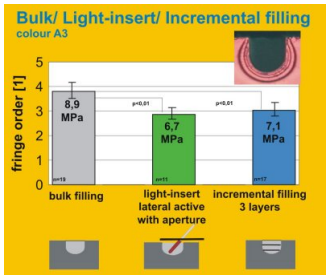


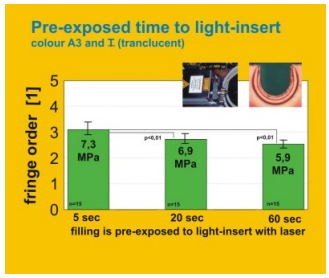
Results

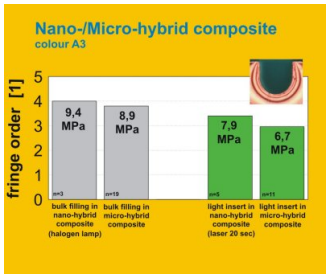
The results offer the highest stress evaluation on bulk-techniques. The stress induced by incremental polymerization was reduced in comparison to bulk polymerization. The light-insert, as a new method, offers equivalent results like incremental-technique . The results were evaluated by a statistical test of Kolmogoroff-Smirnoff and showed significant differences between bulk / incremental and bulk / bulk with light-insert placement at a level of 1% [Abb.5][Abb.8]. The substituted light sources showed no significant influence.











Conclusions

The photo-elastic method allowed a comparison of the stress in cavity material induced by different filling- and processing techniques. It could prove that there is a stress reduction through incremental fillings and an equivalent effect of the light-insert. The function of this insert may be interpreted as an efficient three-dimensional soft-start technique.

Literature

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Poster Faksimile: