POLYMERIZATION SHRINKAGE OF NEW FLOW-TYPE DENTAL COMPOSITE USING MICRO-CT

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Introduction

Polymerization shrinkage of the resin-based dental composites constitutes a risk of the failure of the interfacial bonds as a result of shrinkage stresses. It may result in marginal leakage, premature failure of the restoration, and even micro-cracking of the tooth [1,2]. Therefore, the research for develop a low shrinkage material has been a goal in the manufacture of dental composites.
The color restorative materials are very interesting and market demand for these products was increased recently. They are used especially in milk tooth as fissure sealing, for marking root canal openings or as decoration (tooth tattoo) [3].
In this study, the research of polymerization shrinkage of flow-type dental composites was conducted.

Materials and Methods

Materials used in this study were:

- Flow-Art (Arkona) (38% wt. of Bis-GMA, UDMA, TEGDMA and Bis-EMA) and 62% wt. of fillers (Ba-Al-Si glass and nanosilica), marked as "*FA shade*" (shade = A1, A2 or A3),
- Flow-Color (Arkona) (the same composition as above + pigments), marked as "*FC colour*" *(colour = orange, yellow, blue, green, violet and pink, in ascending order of curing' depth)*

Volumetric shrinkage was measured using micro-CT scanner Skyscan 1174 (Bruker microCT) with accuracy of 6.5 μm. A drop of composite material was shaped into a semi-sphere on the tip of the Teflon pin of diameter 3 mm (FIG. 1). Volume of material used was about 3 mm^3. Scanning was started after 3 min. to allow material spreading on the tip surface and get a spherical shape. Samples were scanned in angular range of 0-180° with step of 1°. Then composite was cured (for the time specified by manufacturer) using halogen lamp (Cromalux 75, Mega-Physik). The tip of the gun was positioned 2 mm above the sample. One minute after curing the next scan was started to obtain volumetric data of cured material [3]. After reconstruction the volume of specimen was obtained before and after curing. The volumetric shrinkage was calculated as the ratio of difference between uncured and cured material volume to uncured composite volume. Each composite was measured 10 times and results were statistically analyzed using Statistica software (StatSoft Inc.).

Results and Discussion

Flow-Art composites had a volumetric shrinkage of about 3.2% (FIG. 2) and there was no significant differences observed in relation to shade.
Coloured composites (*FC*) had the same basic components (mix of resins and fillers) and the main difference was the pigment addition, which resulted in different light transmission and depth of cure.
The value of polymerization shrinkage was slightly dependent of colour in the case of FC composites. In details, it was almost exactly an inverse relation in polymerization depth. Differences statistically significant occurred in the case of yellow and FA A1, violet, blue and green composite as well as pink/violet and pink/orange.

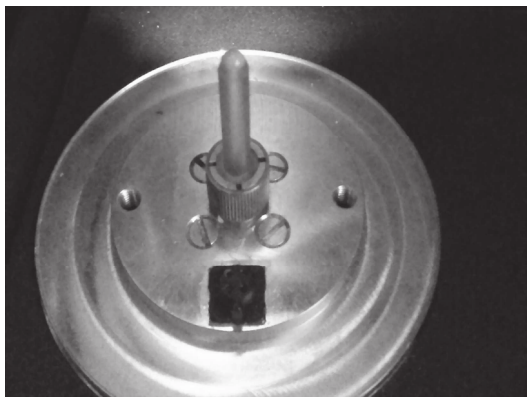

FIG. 1. Drop of composite on Teflon pin mounted on CT stage.

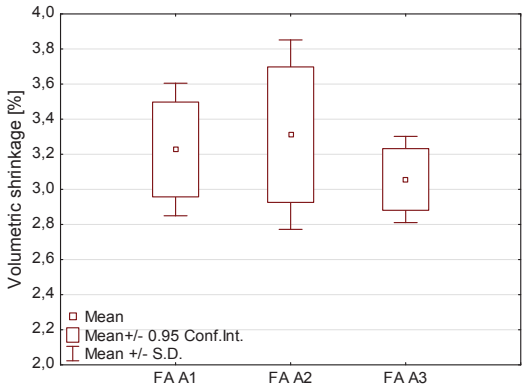

FIG. 2. Polymerization shrinkage of FA composites.

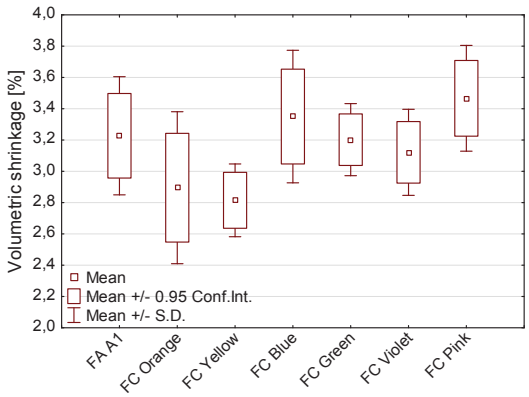

FIG. 3. Polymerization shrinkage of FC composites vs. FA material.

Conclusions

All tested materials showed low value of polymerization shrinkage, comparable with other commercial flow-type composites. The relation between depth of cure and the polymerization shrinkage was demonstrated.

Acknowledgments

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References

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