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POLYMERIZATION SHRINKAGE OF DENTAL COMPOSITES

ARKONA

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INTRODUCTION

Dental composites are based on polymer resin matrix which diminishes its volume during polymerization process due to joining of monomer chains [1]. It is the reason of polymerization shrinkage of each polymer material. Serious consequence of the shrinkage in dentistry is marginal leakage and secondary caries resulting from this [2]. Therefore, the develop a low shrinkage material is a big challenge in the manufacturing of dental composites.

There are many methods of diminishing polymerization shrinkage. One group is focused on resin matrix composition, the second on filler selection [3] and the others on applying technique [4].

Literature presents a lot of methods of shrinkage measurements [1]. In previous study the Authors used the method based on microCT measurements [5]. In this paper a new approach has been presented. In this study, the new method of polymerization shrinkage was applied to evaluate the polymerization shrinkage of selected dental composites

METHODS

Volumetric shrinkage measurements was conducted using microCT Skyscan 1174 (Bruker microCT) with accuracy of 6.5 µm. Volume of composite's drop was measured assuming it is a body of revolution, formed by rotation of half of its cross-section. A drop of composite (volume of about 3 mm^3) was placed on tip made of PE (d=3 mm). After 3 minutes time (material's spreading) 5 images were taken in different angle position (0, 45, 90, 135 and 180°). In next step composite was cured using Cromalux 75 halogen lamp with special limiter (Fig. 1). After curing and additional time of 1 min (dark polymerization [6]) another set of 5 images were taken in appropriate angular position. Override of images taken before and after curing is presented on Fig. 2. Dark line in upper region means the difference in volumes. Results were statistically analyzed using Statistica ver. 13 software (Dell Inc. 2016).

RESULTS AND DISCUSSION

Results of measurements are presented on Fig. 3. Highest value of volumetric shrinkage (3.70%±0.70) was observed for FlowART composite. The same resin and different volume of filler has the Boston composite. Its shrinkage was significantly lower (2.44%±0.16). The Charisma Opal Flow composite has almost the same ratio of components as Flow-Art, but different resin was used. In this case the shrinkage had a value of 2.86%±0.30. It is noteworthy that spread of all results (S.D.) was very low, which testify the quality of measurements. All results were statistically different on significance level α=0.05.

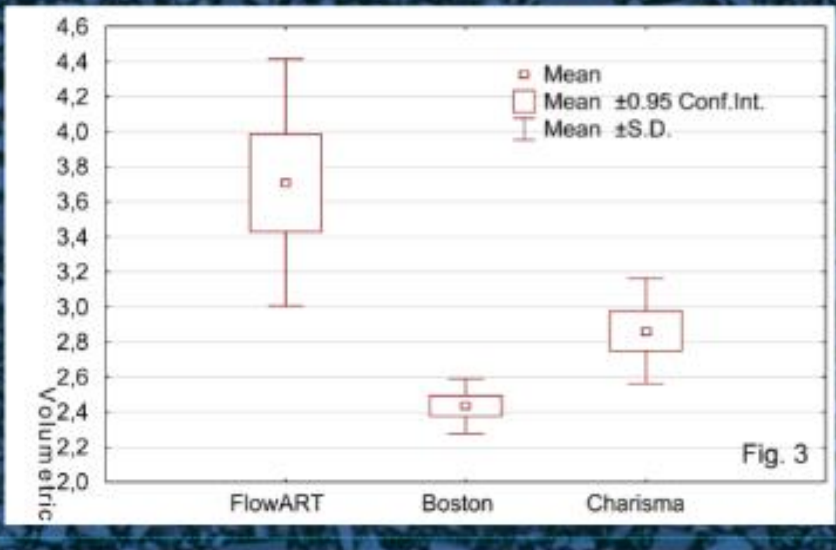

Fig. 3

MATERIALS used in this study:

#Flow-Art (Arkona), 38% wt. of resin mix: Bis-GMA, UDMA, TEGDMA and Bis-EMA) and 60% wt. of fillers (Ba-Al-Si glass and nanosilica);

#Boston (Arkona), consist of 20% resin mix: Bis-GMA, UDMA, Tri-EDMA (TEGDMA), EBADMA and about 78% wt. of fillers: Ba-Al-Si glass, pyrogenic silica;

#Charisma Opal Flow (Heraeus), which was composed of Bis-GMA resin and about 58% wt. of fine inorganic fillers (Ba-Al glass and

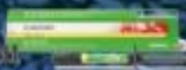


Fig. 1

Fig. 2

CONCLUSIONS

All tested materials showed low value of polymerization shrinkage, comparable with other commercial dental composites. The influence of material composition on polymerization shrinkage was demonstrated.

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