

Evaluation of internal void volume in resin composites with different restorative techniques by micro-computed tomography

Pongtakorn Sermsopit¹, Chantapat Yangyuen¹, Paniti Snabboon¹, Pirat Karntiang²

¹College of Dental Medicine, Rangsit University, Pathumthani, Thailand

²Operative Dept, College of Dental Medicine, Rangsit University, Pathumthani, Thailand

*Corresponding author contact information: pirat@rsu.ac.th

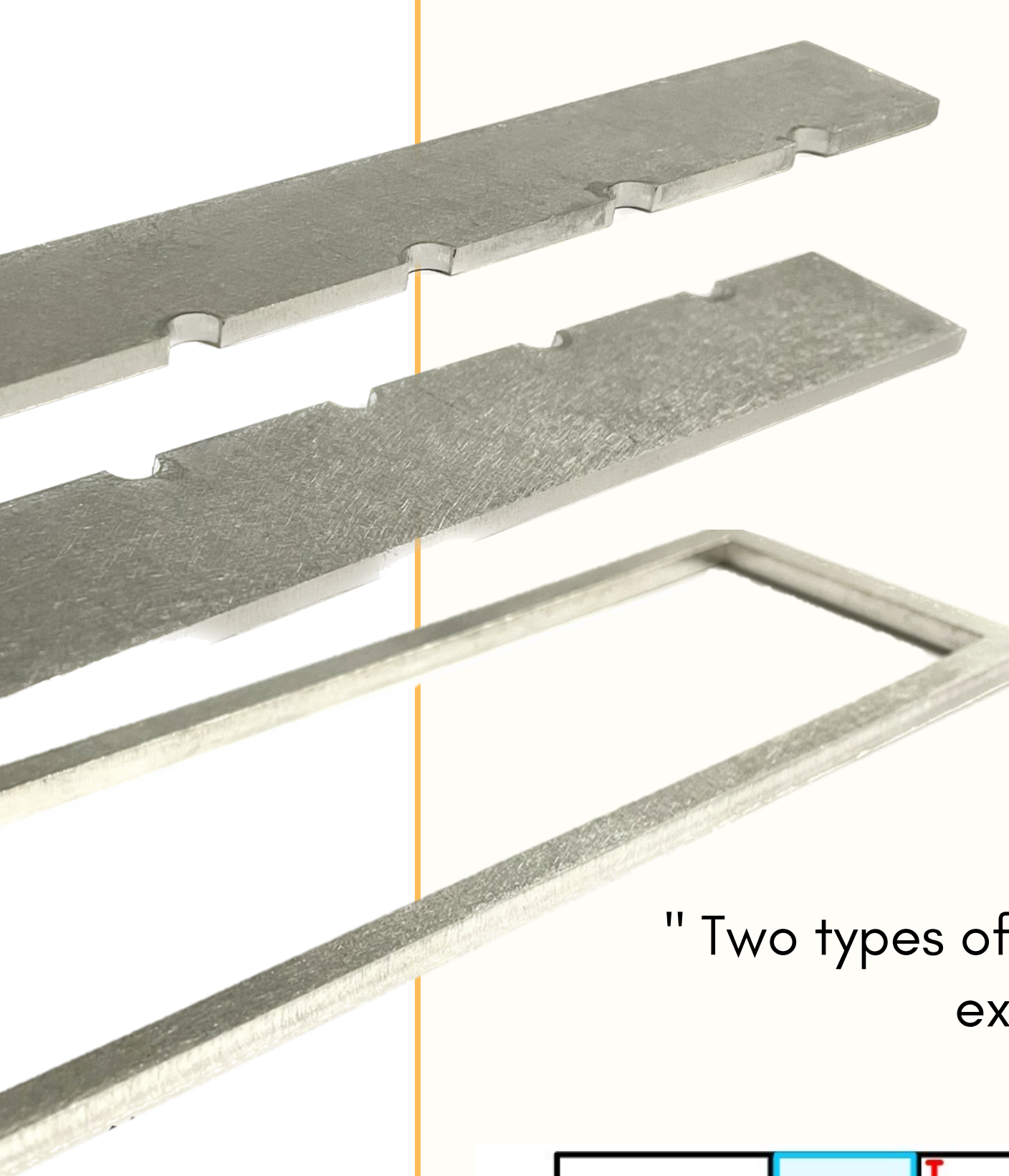


Introduction

Due to the polymeric nature of resin composite, it shrinks upon polymerization and has a limited depth of cure. Layered restorative techniques and bulk-fill restorative materials have been developed to minimize the consequences of shrinkage and improve ease of use. Though, there is still an issue regarding void formation inside the restoration. Hence, the aim of this study is to evaluate differences in void volume percentage in resin composite restoration fabricated by different techniques and materials.

Materials and Methods

Sample preparation



Stainless steel mold
1, 2, 3 mm

Stainless steel
frame



Filtek Z350 XT

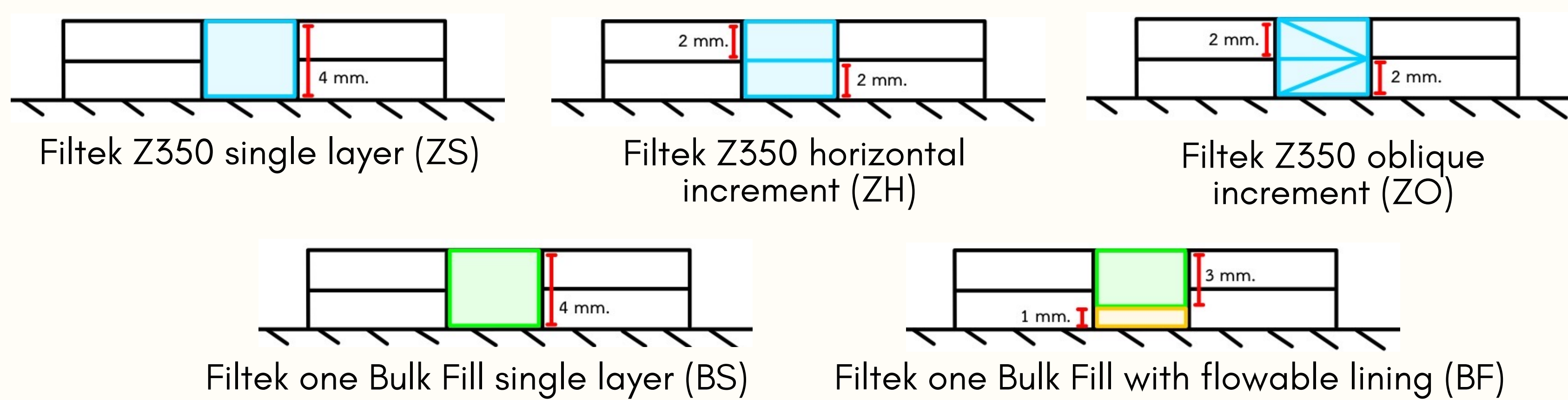


Filtek One Bulk Fill



Filtek Z350 XT
Flowable

"Two types of resin composite were used to fabricate specimens according to the experimental groups using stainless-steel cylindrical mold."

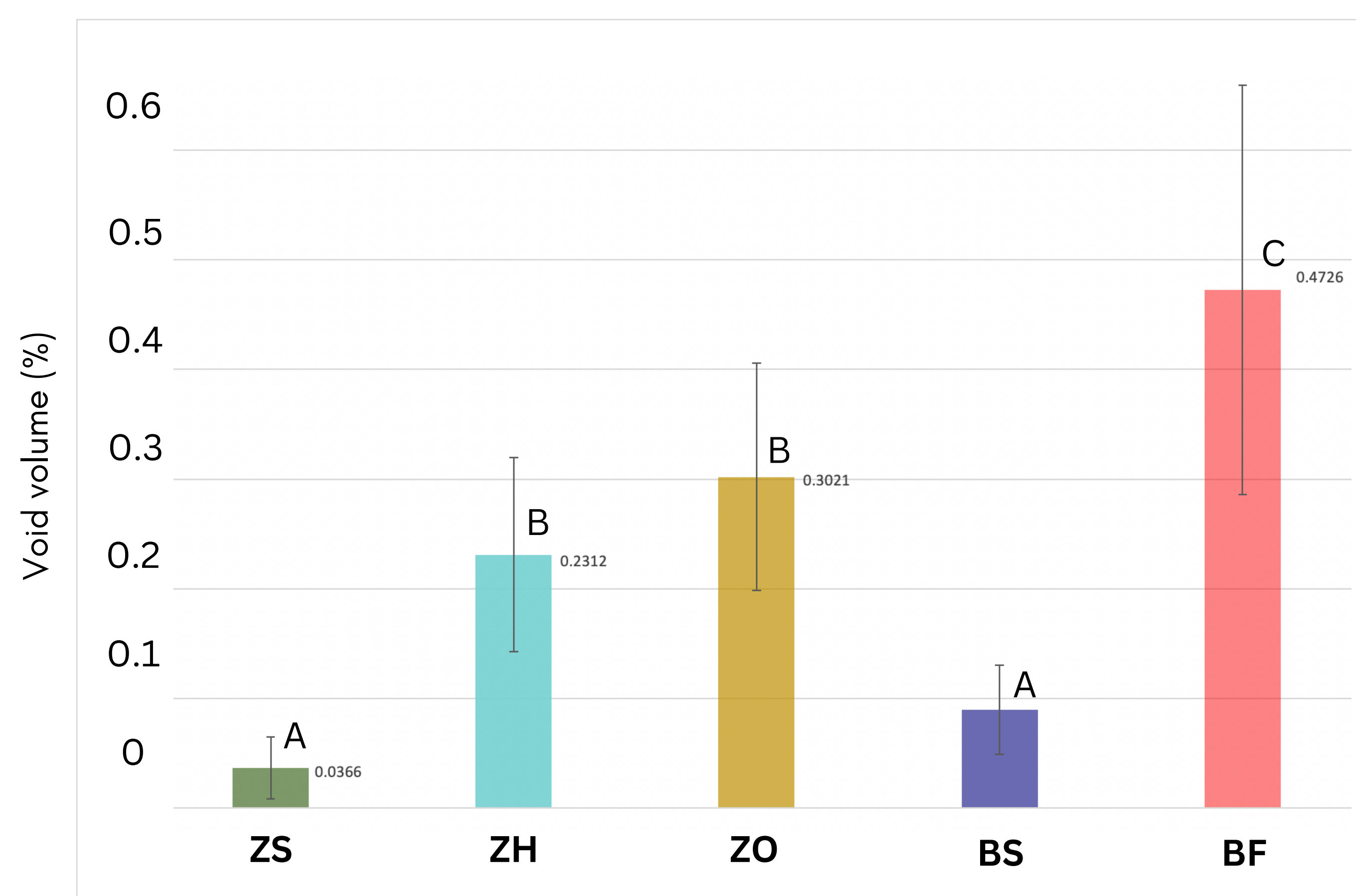


Micro-CT Scanning and Analysis

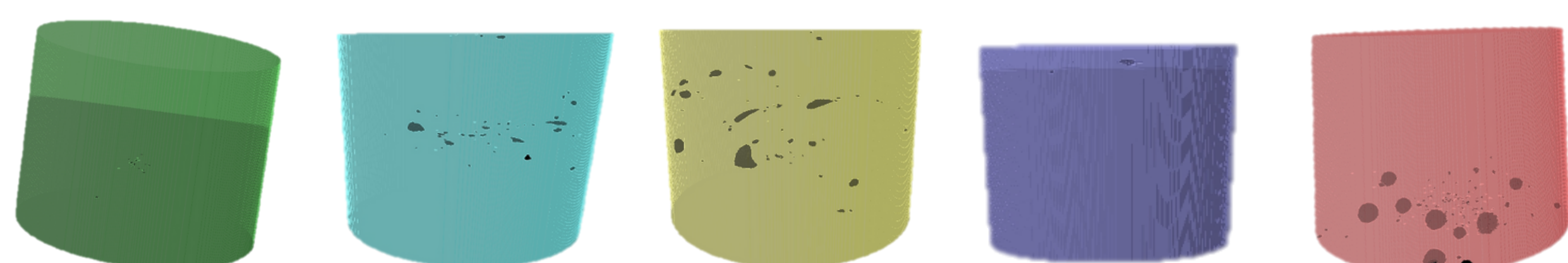
Samples were then further evaluated by micro-CT and data were imported into CTAn software for 3D reconstruction and calculation of percentage of void volume.

Data Analysis

Statistical analysis of void volume percentage data was performed with a statistical software EZR (Saitama Medical Center, Aichi Medical University) using one-way analysis of variance (ANOVA) followed by Tukey's test to find statistically significant difference between groups, whereby ($p = 0.05$) was considered statistically significant.



Different letters indicate statistical significance differences among groups regarding mean percentage of void volume



Results

- Group BF significantly showed the most void formation ($0.4726 \pm 0.1866\%$) among all the tested groups ($p=0.05$).
- Group ZS and BS showed the least void formation ($p=0.05$) (ZS = $0.0366 \pm 0.0279\%$ and BS = $0.0895 \pm 0.0405\%$ respectively).

Discussion

- According to researchers, the presence of flowable resin composites may lead to additional voids because of their compositions and application methods.
- Results revealed that filling techniques of 2 layers or more significantly played a critical role to the high number of void formations.
- The cause of void at the interface is possibly due to an air entrapped between the underlying polymerized increment and the increment above it as reported in other studies

Conclusion

The multilayer restorative technique significantly created more voids compared to single-layer restorative technique, irrespective of the material used. Thus, increasing the interface may increase the void formation.

References:

1. Demirel G, Baltacıoğlu İH, Kolsuz ME, Ocak M, Orhan K. Micro-computed tomography evaluation of internal void formation of bulk-fill resin composites in Class II restorations. *Polymer Composites*. 2019;40(8):2984-92.
2. Balthazard R, Jager S, Dahoun A, Gerdolle D, Engels-Deutsch M, Mortier E. High-resolution tomography study of the porosity of three restorative resin composites. *Clin Oral Investig*. 2014;18(6):1613-8.
3. Soares CJ, Rosatto C, Carvalho VF, Bicalho AA, Henriques J, Faria ESAL. Radiopacity and Porosity of Bulk-fill and Conventional Composite Posterior Restorations-Digital X-ray Analysis. *Oper Dent*. 2017;42(6):616-25.