NEW PHOTOINITIATING SYSTEMS FOR DENTAL APPLICATIONS

Monika Topa-Skwarczyńska[1], Katarzyna Starzak[1], Andrzej Świeży[1,2], Karolina Kozanecka[1], Joanna Ortyl[1,2,3]

[1] Cracow University of Technology, Faculty of Chemical Engineering and Technology, Laboratory of Photochemistry and Optical Spectroscopy, Warszawska 24 St. 31-155 Cracow, Poland
[2] Photo4Chem sp. z o.o., J. Lea 114 St. 30-133 Cracow, Poland
[3] Photo HiTech sp. z o.o., Bobrzyńskiego 14 St. 30-348 Cracow, Poland

Photo-curing 3D printing technique, despite its arrival on the market a decade ago, is still not very popular in the dental industry. This is because there are expensive and low-performance printing resins on the market, and because of the high cost of printers for the dental industry. Another problem that makes 3D printing unpopular and not widely used in the dental industry is the toxicity of acrylic resins. Material made from acrylic monomers has a lower resistance to damage than, for example, porcelain or all-ceramic crowns used as fixed prosthetic restorations. The acrylic material quickly becomes mechanically damaged, abraded and lacks sufficient marginal tightness, thus easily depositing food particles and bacterial plaque, which can cause inflammation and decay.

Poor marginal tightness between the restoration and the tooth tissue is caused by polymerisation shrinkage of materials designed for temporary crowns and bridges.[1,2] Polymerisation shrinkage is an extremely unfavourable phenomenon in restorative dentistry, as it can cause stress-induced microcracks, poor adhesion of the photo-cured material to the substrate, surface delamination or deformation of shape symmetry.

In this work, new initiator systems for potential use in photo-curable 3D printing for dental applications were presented. Spectroscopic and kinetic studies of new photoinitiating systems were carried out and the most efficient systems for 3D printing were selected.

Acknowledgements

This research was funded by National Centre for Research and Development in Poland under the Lider Program, grant number LIDER13/0156/2022.

One of the authors M.T.S. would like to thank Foundation for Polish Science (Warsaw, Poland), project START, Grant No. START 088.2023 for financial support.

References

1. S.H. Kim, D.C. Watts. Polymerization shrinkage-strain kinetics of temporary crown and bridge materials. Dent. Mat. 20 (2004) 88–95. https://doi.org/10.1016/S0109-5641(03)00101-5.

2. M. Topa-Skwarczyńska, J. Ortyl, Photopolymerization shrinkage: strategies for reduction, measurement methods and future insights, Polym. Chem. 14 (2023) 2145-2158. https://doi.org/10.1039/D3PY00261F