LATEST DEVELOPMENTS IN LIGHT-CURING DENTAL MATERIALS

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Composites are commonly used dental restorative materials that present excellent aesthetic properties. Polymerization shrinkage is one of the main drawbacks associated with the use of dental composites. The resulting shrinkage stress generated during the curing of the material may result in marginal leakage between the restoration and the tooth. As a consequence, marginal staining, post-operative sensitivity or the formation of secondary caries can arise. Over the past decades, several strategies have been considered in order to reduce the shrinkage stress of dental materials. In this presentation, an overview of recent technologies for low shrinkage applications will be given. The incorporation of innovative chain transfer agents as well as the replacement of methacrylates with 1,1-disubstituted 2-vinylcyclopropanes were shown to be particularly efficient.

Another drawback of current dental composites is their limited depth of cure (DoC). In order to address this problem, bulk-fill composites were developed. Such materials exhibit a significantly higher DoC (typically 4 mm) in comparison to the previous generation of restorative materials (typically 2 mm). Consequently, fewer increments are required to fill a cavity so that the time-consuming layering process can be shorten or even skipped (depending on the size of the cavity). In order to obtain a satisfying depth of cure as well as good esthetic properties, the refractive indices of the organic phase and of the inorganic fillers should be similar prior to irradiation. In this case, an optimal translucency of the uncured material is obtained, enabling a deep light penetration. After curing, a strong decrease of the translucency would lead to opaque materials that fit the esthetic requirements for most indications. Radiopaque fillers typically exhibit a high refractive index ($\geq$ 1.53). Therefore, high refractive index monomers are required for the formulation of radiopaque bulk-fill composites. The development of bulk-fill materials based on new high refractive index diluents will be presented.