Summary

Publication 1

The work is a literature review on biocompatibility of methacrylate-based restorative dental resins. The physical, chemical, and biological properties of restorative dental materials influence the clinical outcome of dental treatment. Methacrylate-based resins are extensively used in everyday dental practice, but accumulating records point to their toxicity. Experimental data show that methacrylates and epoxy compounds used to induce polymerization and reduce resin shrinkage are cytotoxic. Methacrylate monomers produce reactive oxygen species, induce apoptosis and/or genotoxicity, and affect cell proliferation in culture. There is a need for awareness about the biological risks of these materials. This article reviews the most important experimental data on cell-induced cytotoxicity of composite dental resins. It provides insights and expands knowledge on the use of biomaterials that are biocompatible for dentists and patients. New sensitive methods introduced to the preclinical testing of dental resins may help to highlight specific mechanisms, quantify the biological risk and guide the dentist to select the right biomaterial for dental applications.

Publication 2

This study aimed to assess the acute and delayed cytotoxicity of three, popular light-cured methacrylate-based restorative resins (MRs): Charisma (C), Estelite (E), and Filtek (F), to human gingival fibroblasts in culture. Cells were grown for up to 24 h with light-cured (or pre-cured) resins. We evaluated resin cytotoxicity, redox imbalance, necrosis/apoptosis, miR-9, and heat shock protein 70 (HSP70). The role of resin-induced oxidative stress (damage) in HSP70-response (repair) was assessed using binary fluorescence labelling. All MRs decreased viable cell numbers and cell proliferation and damaged cell membranes, and their 24 h-delayed toxicity was lower (C), higher (F), or similar (E) to that induced by freshly-cured resins. Cell membrane damage induced by C and E decreased with time, while F produced a linear increase. All resins generated intracellular oxidative stress with the predominant necrotic outcome, and produced heterogeneous responses in miR-9 and HSP70. The double fluorescence (damage/repair) experiments pointed to common features of E and F but not C. In the subset of cells, the binary response induced by E and F was different from C, similar to each other, and positively interrelated. Experimental data show that selective MR cytotoxicity should be taken into account when considering repetitive use or massive reconstruction.