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RESEARCH AREA

Physical and biocompatibility investigations of rapid polymerized and pre-heated resin composites. According to the manufacturer's recommendation, the adequate curing of the rapid polymerized resin composites can be achieved in 3 seconds with a suitable curing unit up to 4 mm in layer thickness. However, both the layer thickness and the short exposure time could be a barrier to the proper monomer-polymer conversion. Additionally, internal stress can develop due to shrinkage of the polymerizing material, which can cause gaps at the filling/tooth interface. Insufficient polymerization may result in unreacted monomer release in the oral cavity or may diffuse to the pulp through the tubular dentin. The monomers' toxic effects are well known, although details are still being researched to this day. However, this chemical effect might be supplemented by a thermal effect, arises from both the energy, delivered by the curing unit and from the heat generated during the exothermic polymerization of the resin composite. It may cause further cell damage to pulpal cells if it exceeds the 5.5 °C threshold in the pulp. This thermal effect is even more significant in the cases of pre-heated resin composites, which are preferred because of their good adaptation ability and mechanical properties.

During our investigations, we would test the gap formation caused by the polymerization shrinkage using micro-CT; we would measure the intrapulpal manifestation of the heat generated during the polymerization; and we would examine the effects of physical and chemical stimuli on cells histomorphometric and immunohistochemical changes) on 3D pulpal tissue model.

TECHNIQUES AVAILABLE IN THE LAB

Intrapulpal thermal registration
Micro-CT imaging, reconstruction, evaluation
Histomorphometric and immunhistochemical studies

SELECTED PUBLICATIONS

Lempel, E., Kincses, D., Szebeni, D., Jordáki, D., Lovász, BV., Szalma, J. (2022) Intrapulpal temperature changes during the cementation of ceramic veneers. **Scientific Reports 12:** 12919.

Lempel, E., Szalma, J. (2022) Effect of spray air settings of speed-increasing contra-angle handpieces on intrapulpal temperatures, drilling times, and coolant spray pattern. **Clin Oral Investig 26:** 523-533.

Kincses, D., Böddi, K., Őri, Zs., Lovász, B. V., Jeges, S., Szalma, J., Kunsági-Máté, S., **Lempel, E.** (2021) Pre-heating effect on monomer elution and degree of conversion of contemporary and thermoviscous bulk-fill resin-based dental composites. **Polymers (Basel) 13:** 3599.

Lempel, E., Őri, Zs., Kincses, D., Lovász, B. V., Kunsági-Máté, S., Szalma, J. (2021) Degree of conversion and in vitro temperature rise of pulp chamber during polymerization of flowable and sculptable conventional, bulk-fill and short-fibre reinforced resin composites. **Dental Mater 7:** 983–997.

Lempel, E., Lovász, B. V., Bihari, E., Krajczár, K., Jeges, S., Tóth, Á., Szalma, J. (2019) Long-term clinical evaluation of direct resin composite restorations in vital vs. endodontically treated posterior teeth – Retrospective study up to 13 years. **Dent Mater 35:** 1308-1318.

Lempel, E., Őri, Zs., Szalma, J., Lovász, B. V., Kiss, A., Tóth, Á., Kunsági-Máté, S. (2019) Effect of exposure time and pre-heating on the conversion degree of conventional, bulk-fill, fiber reinforced and polyacid-modified resin composites. **Dent Mater 35:** 217-228.