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Comparison of in vitro cytotoxicity and genotoxicity of MMA-based polymeric materials and various metallic materials

Sultan GÜLÇE İZ¹, Saime İsmet DELİLOĞLU GÜRHAN¹, Bilge Hakan ŞEN²,
Tuğba ENDOĞAN³, Nesrin HASIRCI^{3,4}

¹Department of Bioengineering, Faculty of Engineering, Ege University, İzmir - TURKEY,

²Department of Endodontology, Faculty of Dentistry, Ege University, İzmir - TURKEY,

³Department of Polymer Science and Technology, Middle East Technical University, Ankara - TURKEY

⁴Department of Chemistry, Middle East Technical University, Ankara - TURKEY

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 [Authors](#)



medsci@tubitak.gov.tr

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Abstract: To determine the in vitro cytotoxicity and genotoxicity of some polymeric and metallic implant materials used as base materials in dentistry, based on ISO (International Organization for Standardization) and OECD (Organization for Economic Co-Operation and Development) test protocols. Materials and methods: Three different acrylate-based polymeric materials were tested for their in vitro cytotoxicity and genotoxicity (polymethylmethacrylate microspheres [PMMA], a solid cement prepared by mixing PMMA with its monomer methylmethacrylate [PMMA+MMA], a solid cement prepared by mixing PMMA, MMA, and hydroxyapatite [PMMA+MMA+HA], as well as 4 different metallic materials (titanium [Ti grade 4], nickel alloy 625 [Ni-625], stainless steel alloy 304L [SS-304L], and stainless steel alloy 321 [SS-321]). Cytotoxic effects of the materials were determined using L929 mouse fibroblasts by MTT assay. Cell attachment properties related to the biocompatibility of the materials were analyzed using a scanning electron microscope (SEM). Genotoxicity of the materials was determined with human peripheral lymphocytes via micronucleus assay. Results: The highest compatibility was exhibited by Ti grade 4, followed by Ni-625, SS-304L and, SS-321. Among the polymeric materials, PMMA+MMA+HA had the highest biocompatibility, followed by PMMA+MMA and PMMA. Conclusion: The biocompatibility of the metallic materials was higher than that of the polymeric materials. Ti, the most inert metal, exhibited the highest biocompatibility. The addition of HA reduced the cytotoxic and mutagenic effects of MMA monomer and leachable ingredients.

Key words: Biocompatibility, in vitro cytotoxicity, in vitro genotoxicity

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