

Effect of particle size on biological response by human monocyte-derived macrophages

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Ultra-high molecular weight polyethylene (UHMWPE) wear particles from artificial joints induce osteolysis and the subsequent loosening of implants. Studies have reported that particles in the size range of 0.1–10 μm are the most biologically active in macrophage immune response. To develop prosthetic joints with greater longevity and durability, it is crucial to understand the deleterious effects of wear particles. In this study, to evaluate the effects of particle size on the activities of human monocyte-derived macrophages (HMDMs), seven differently sized particles of polymethylmethacrylate (PMMA), in the range of 0.1–20 μm , were prepared. Viability and the secretion of cytokines were evaluated after phagocytosis of each size particles by HMDMs. Differences in the viability of HMDMs after phagocytosis of particles sized 0.16–9.6 μm were statistically significant. Proinflammatory cytokine production of both tumor necrosis factor- α and interleukin-6 by HMDMs was strongly induced by 0.8 μm PMMA particles. Consistent with the fact that macrophages are known to respond to pathogens measuring approximately 1.0 μm in size, in this study, PMMA particles measuring 0.8 μm in size induced an immune response. This work provides fundamental data for the designing of surface profiles of prosthetic joints, Which may expect the lower incidence of immune response.

