Mitigating polyethylene-mediated periprosthetic tissue inflammation through MEDSAH-grafting

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INTRODUCTION: Periprosthetic tissue inflammation is a challenging complication that arises in joint replacement surgeries, often caused by wear debris generated by polyethylene components. In this study, we examined the biological impacts of grafting [2-(methacryloyloxy)ethyl]dimethyl-(3-sulfopropyl)ammonium hydroxide (MEDSAH) to attenuate the inflammatory response induced by polyethylene wear particles.
METHODS: The MEDSAH polymer was grafted onto the surface of polyethylene (PE) particles through a solvent-evaporation technique. Next, RT-qPCR analyzed the expression of inflammatory cytokines in J774A.1 macrophage-like cells and primary culture of osteoblasts after treatment with PE powder with or without the MEDSAH coating.
RESULTS: Although MEDSAH-coated PE powder did not significantly impact macrophage-mediated inflammation, it substantially reduced the expression of pro-inflammatory cytokines and other mediators in primary cultured mouse osteoblasts, indicating its potential utility in mitigating periprosthetic tissue inflammation.
DISCUSSION AND CONCLUSION: Our findings suggest that MEDSAH coating on PE-based materials represents a promising approach for mitigating periprosthetic osteolysis and preventing aseptic loosening in total joint replacements. Further research, including large-scale clinical trials and biomechanical analyses, is needed to assess the long-term performance and clinical implications of MEDSAH-coated PE-based materials in total joint arthroplasty.