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Porous poly (ethylene glycol)-polyurethane scaffolds for onsite delivery of bone marrow stem cells protects from oxidative stress and potentiates wound tissue repair

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Chronic wound remains as a constant challenge for patients with diabetes. Among the present strategies to overcome the failures of wound healing, stem cell transplantation has shown a promising role. However, this technique still suffers from limitations such as high levels of ROS at wound site along with low bioavailability upon systemic administration. To overcome these limitations, we developed a biocompatible and porous scaffold for cell delivery. Utilizing simple urethane chemistry and semi-interpenetrating polymer network approach a polyethylene glycol-polyurethane porous polymer network was generated. The key physicochemical properties of these polymers were characterized using FT-IR, Raman, SEM, DSC and TG-DTA. The biocompatibility tested on various cell lines as well as mouse primary bone marrow stem (BMSCs) cells isolated from *C57BL/6J* mice depicted these polymer networks to be highly cytocompatible. The cells cultured in presence of polymer network have shown a ≥6 fold increase in gene expression of gelatinase and collagenase via activation of Akt and Erk elucidating the mechanism of cellular penetration. Interestingly, H2O2-induced apoptosis of BMSCs was abrogated in presence of polymer networks indicating a protective effect from oxidative stress. Transplantation of BMSC+PEG-PU at murine excisional splint wound site depicted significant increase in fibroblast proliferation, collagen deposition and anti-oxidant enzyme activities with concurrent reduction in inflammation at the injury site. Finally, immunostaining revealed an enhanced engraftment (stem cell markers expression) and vascularity (CD31) indicating an accelerated wound tissue closure. This pre-clinical study demonstrates the proof-of-concept and further necessitates their evaluation as potential cell delivery vehicle scaffolds in clinical settings.

Biography

Ramasatyaveni Geesala is currently pursuing her PhD from CSIR-Indian Institute of Chemical Technology is a Student of Academy of Scientific and Innovative Research (AcSIR), New Delhi. She has published 4 papers in reputed journals including Biomaterials and has presented her research work in several leading research conferences.

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