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Fiber reinforced hydro gel scaffolds for heart valve tissue engineering

Maryam Eslami Harvard Medical School, USA

Department of Biology Islamic Azad University, Science & Research Branch, Tehran, Iran

Heart valve related disorders are among the major causes of death worldwide. Although prosthetic valves are widely used to treat this pathology, current prosthetic grafts cannot grow with the patient while maintaining normal valve mechanical and hemodynamic properties. Tissue engineering may provide a possible solution to this issue through using biodegradable scaffolds and patients' own cells. Despite their similarity to heart valve tissue, most hydrogel scaffolds are not mechanically suitable for the dynamic stresses of the heart valve microenvironment. In this study, we integrated electrospun poly(glycerol sebacate) (PGS)-poly(ε-caprolactone) (PCL) microfiber scaffolds, which possess enhanced mechanical properties for heart valve engineering, within a hybrid hydrogel made from methacrylated hyaluronic acid (HAMA) and methacrylated gelatin (GelMA). Sheep mitral valvular interstitial cells (MVICs) were encapsulated in the hydrogel and evaluated in hydrogel-only, PGS-PCL scaffold-only and composite scaffold conditions. Although the cellular viability and metabolic activity were similar among all scaffold types, the presence of the hydrogel improved the 3D distribution of MVICs. As seen by similar values in both the Young's modulus and the ultimate tensile strength (UTS) between the PGS/PCL scaffolds and the composites, microfibrous scaffolds preserved their mechanical properties in the presence of the hydrogels. Compared to electrospun or hydrogel scaffolds alone, this combined system may provide a more suitable 3D structure for generating scaffolds for heart valve tissue engineering.

Biography

Maryam Eslami graduated with MD (2010), PhD (2014) degrees. She joined Harvard Medical School (Harvard-MIT Division of Health Sciences and Technology) as a part of her PhD dissertation in the field of heart valve. She has carried out some broad research on orthopedic fractures and has published a book and papers in this field. Her US and PCT patent achieved the rank of "Best 2008 Invention" from WIPO (World Intellectual Property Organization of the United Nations) and she has received the title of "Best 2008 Women Inventor" from WIPO and 6 Gold Medals and 6 Honorary Diplomas in the Contests and Fair of the Inventors in Geneva and South Korea. International and national awards for her research were one of the fundamental achievements that she has received.

maryam.eslami2010@gmail.com