Porous gradient scaffold

A porous gradient scaffold is a type of tissue engineering scaffold that has a gradient in its porosity or pore size. The scaffold is typically composed of a biocompatible material, such as a polymer or ceramics, and is designed to promote tissue regeneration by guiding the infiltration of cells and nutrients into the scaffold. The gradient structure allows for the controlled transfer of mechanical stress from the surrounding tissue to the implanted scaffold, which can promote tissue growth and integration. The pore size and distribution can be varied along the scaffold to optimize the scaffold's properties for a specific tissue engineering application. Porous gradient scaffolds have been investigated for a variety of tissue engineering applications, such as bone and cartilage regeneration, and have shown promising results in preclinical studies.

A “soft-hard” bone implant (BM-g-DPCL) consisting of a bioactive matrix chemically integrated on a polydopamine (PDA)-coated porous gradient scaffold by polyphenol groups is constructed. The PDA-coated “hard” scaffolds promoted Ca2+ chelation and mineral deposition; the “soft” bioactive matrix is beneficial to the migration, proliferation, and osteogenic differentiation of stem cells in vitro, accelerated endogenous stem cell recruitment and initiated rapid angiogenesis in vivo. The results of the rabbit cranial defect model (Φ = 10 mm) confirmed that BM-g-DPCL promoted the integration between bone tissue and implant and induced the deposition of bone matrix. Proteomics confirmed that cytokine adhesion, biomineralization, rapid vascularization, and extracellular matrix formation are major factors that accelerate bone defect healing. This strategy of highly chemically bonded soft-hard components guided the construction of the bioactive regenerative scaffold [1].

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