Bone defect healing

Bone defect healing refers to the natural process by which the body repairs a damaged or missing section of bone. This process typically involves the migration of bone-forming cells to the damaged area, the deposition of new bone tissue, and the gradual remodeling of the bone to restore its original shape and strength. Depending on the size and severity of the defect, the healing process may take several weeks to several months to complete. In some cases, medical intervention such as bone grafting or the use of bone substitutes may be necessary to facilitate the healing process.

Integrating a biomimetic extracellular matrix to improve the microenvironment of 3D printing scaffolds is an emerging strategy for bone substitute design. Here, 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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Liu Q, Chen M, Gu P, Tong L, Wang P, Zhu J, Xu Y, Lu G, Luo E, Liang J, Fan Y, Zhang X, Sun Y. Covalently Grafted Biomimetic Matrix Reconstructs the Regenerative Microenvironment of the Porous Gradient Polycaprolactone Scaffold to Accelerate Bone Remodeling. Small. 2023 Feb 11:e2206960. doi: 10.1002/smll.202206960. Epub ahead of print. PMID: 36772909.