Bone remodeling

Bone remodeling is the process by which bone tissue is continuously broken down and rebuilt throughout life. It is a complex and dynamic process that involves the coordinated activity of various bone cells, including osteoblasts, osteoclasts, and osteocytes. During bone remodeling, old or damaged bone tissue is resorbed by osteoclasts, and new bone tissue is formed by osteoblasts. This process is regulated by various factors, such as hormones, mechanical stress, and calcium levels in the blood. Bone remodeling plays a crucial role in maintaining bone strength, repairing damage, and regulating calcium levels in the body.

Integrating a biomimetic extracellular matrix to improve the microenvironment of 3D printing scaffolds is an emerging strategy for bone substitute design.

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].

Bone Remodeling in Lumbar Interbody Fusion

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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.