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论文

改性纳米羟基磷灰石/PLGA复合材料的制备及生物活性

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摘要:

以低聚乳酸接枝改性的羟基磷灰石纳米粒子(op-HA)和聚丙交酯-乙交酯(PLGA)制备的生物可降解纳米复合材料(op-HA/PLGA)为研究对象, 采用FTIR, TGA, ESEM和EDX分析其接枝反应、接枝率、表面形貌和钙磷沉积情况, 通过在材料膜表面接种兔成骨细胞进行体外培养, 采用荧光染色、NIH Image J图像分析和Real-time PCR综合评价细胞在材料表面的形态、黏附面积比、增殖能力和基因表达水平, 以此评价新型骨修复纳米复合材料op-HA/PLGA的表面性质和生物活性. 研究结果表明, op-HA的表面接枝率为8.3%, 掺入至PLGA后可形成富含钙磷的粗糙表面, 促进成骨细胞的黏附、扩展和增殖, 提高Ⅰ型胶原蛋白(Collagen-Ⅰ)、骨形态蛋白-2(BMP-2)和骨连接蛋白(Osteonectin)的基因表达水平, 提高材料的钙磷沉积能力. op-HA/PLGA具有良好的细胞相容性和成骨活性.

关键词: 羟基磷灰石(HA); 聚丙交酯-乙交酯(PLGA); 表面改性; 纳米复合材料; 成骨活性

Preparation and Bioactivity of the Composite of PLGA and Hydroxyapatite Nanocrystals Surface-grafted with L-lactic Acid Oligomer

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Abstract:

The hydroxyapatite(HA) nanocrystals of 100—200 nm in length and 20—30 nm in width were hydrothermally synthesized by the reaction of phosphoric acid and calcium hydroxide. Lactic acid oligomer surface grafted HA(op-HA) nanoparticles were obtained by oligomeric lactic acid with a certain molecular weight grafting onto the HA surface to form a Ca carboxylate bond in the absence of any catalyst. The op-HA was further blended with poly(lactide-co-glycolide)(PLGA) to prepare the nanocomposite of op-HA/PLGA. FTIR, TGA, ESEM and EDX were used to analyze grafting reaction, the graft ratio of op-HA, surface topography and calcium deposition of the composites, respectively. The rabbit osteoblasts were seeded and cultured on the surface of composites *in vitro*. The cell morphology, adhesion, proliferation and gene expression were evaluated with FITC staining, NIH image J software and the analysis of real-time PCR, respectively. The results show that the graft ratio of op-HA is 8.3% (mass fraction). The op-HA/PLGA nanocomposite possessed more suitable surface properties, including roughness and plenty of calcium and phosphor. It exhibited better cell adhesion, spreading and proliferation of rabbit osteoblasts compared to pure PLGA. Its gene expression of Collagen-I, Bone Morphogenetic Protein 2(BMP-2) and Osteonectin were higher than that of PLGA. It indicated that the biocompatibility and osteogenic bioactivity of the op-HA/PLGA nanocomposite were improved obviously than that of the pure PLGA.

Keywords: Hydroxyapatite; Poly(lactide-co-glycolide); Surface grafting; Nanocomposite; Osteogenic bioactivity

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