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Title: Fabrication and analysis of a novel tissue engineered scaffold for annulus fibrosus

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摘要: 目的　探讨新的静电纺丝方法制备聚乳酸-聚己内酯[P(LLA-CL)]纳米纱作为组织工程纤维环支架的可行性，检测其理化性能及细胞相容性。　方法　在传统静电纺丝方法制备P(LLA-CL)纳米纤维支架的基础上，改用动态水流接收装置制备相同成分的纳米纱支架，并对材料的表面形态、纤维直径、孔径、孔隙率、力学性能进行评估，分离培养兔纤维环细胞种植到支架上，观察细胞在材料上的生长形态、黏附、增殖、渗透情况。　结果　P(LLA-CL)纳米纤维支架表面呈致密的网状结构，纤维排列无方向性，而P(LLA-CL)纳米纱支架表面呈疏松的网状结构，纤维排列有一定的取向；纳米纤维支架的孔径为(4.57±1.87)μm，孔隙率(74.2±1.5)%，纳米纱的孔径为(38.43±15.54)μm，孔隙率(86.7±9.3)%，两者比较差异有统计学意义（$P<0.05$）；两者的力学性能相似。扫描电镜（SEM）显示纤维环细胞在纳米纤维支架上呈多边形生长，在纳米纱支架

上呈长梭形生长；CCK-8结果显示细胞在两种支架材料上的黏附均很好，细胞在纳米纱上的增殖较纳米纤维支架明显增加；HE染色提示细胞虽然只能生长在纳米纤维支架表面，但却很好地渗透到纳米纱支架内部。　　结论　　静电纺丝方法制备的P(LLA-CL)纳米纱支架具有良好的三维孔隙结构和细胞相容性，有望成为较理想的组织工程纤维环支架。

Abstract:　Objective　To investigate the feasibility of Poly(L-lactide-co-caprolactone) [P(LLA-CL)] nanoyarn prepared by a novel electrospinning method as annulus fibrous tissue engineering scaffold, and evaluate the physicochemical properties and cytocompatibility of the scaffold.　Methods　On the basis of traditional electrospinning method which used to prepare P(LLA-CL) nanofiber scaffold, a novel P(LLA-CL) nanoyarn scaffolds were prepared by dynamic liquid electrospinning. These scaffolds were characterized in terms of fiber morphology, fiber diameter, pore size, porosity, and mechanical properties. Rabbit annulus fibrous (AF) cells were isolated and seeded on the scaffolds. Cell morphology, attachment, proliferation and infiltration of AF cells on the scaffolds were evaluated respectively.　Results　The surface of nanofiber scaffolds presented compact reticular structure in random fibers arrangement. Surface of nanoyarn scaffolds showed loose porous structure but in certain orientation arrangement. The pore size and porosity were 38.43±15.54 μm, and (86.7±9.3)% respectively of the nanoyarn scaffolds, significantly higher than the nanofiber scaffolds [4.57±1.87 μm, (74.2±1.5)%, P<0.05]. The mechanical properties of both scaffolds were similar. CCK-8 assay results showed that cell proliferation in the nanoyarn scaffolds were obviously higher than in the nanofiber scaffolds (P<0.05). Hematoxylin-eosin staining showed considerable AF cells were infiltrated into the nanoyarn scaffolds, while only grew on the surface of the nanofiber scaffolds.　Conclusion　Electrospinning P(LLA-CL) nanoyarn scaffolds present 3-D porous structure and good cytocompability. It would be a promising scaffold for annulus fibrosus tissue engineering.

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