

矽藻土對骨組織生成的影響

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摘要

含矽的生醫材料常應用於骨組織工程與人工關節的開發，然而臨床應用上常因材料的生物相容性、使用年限與生物毒性而受限。矽藻土來自矽藻之細胞骨架沈澱物，主要成分為二氧化矽，具多孔性，而類似於生醫工程所用之多孔性材料。本研究之主要目的在探討矽藻土對破骨細胞分化的影響與其相關毒性作用，並探討其可能機轉，以評估其應用於骨組織工程之可行性。實驗中，取人類周邊單核球與矽藻土（100 ppm）共同培養後，分析破骨細胞相關分化因子的基因表現量與統計破骨細胞數目，並取此培養液，培養已分化之造骨細胞，利用染色法觀察造骨細胞凋亡比率。結果顯示矽藻土可促進 IL-6 與 RANKL 之基因表現量，並增加破骨細胞的分化數目。此外周邊單核球與矽藻土之共同培養液可誘發大量的造骨細胞凋亡。其可能機轉是矽藻土刺激周邊單核球增加 IL-6 與 RANKL 的基因表現量，導致破骨細胞的分化數目增加。另外，破骨細胞可分解矽藻土，而此分解產物具細胞毒性，進而造成造骨細胞凋亡。

關鍵字：矽藻土、造骨細胞、破骨細胞、二氧化矽

Effects of Diatomaceous Earth on bone tissue formation

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Abstract

Silicon containing materials are commonly applied to bone tissue engineering and the development of artificial joints. However, biocompatibility, durability and toxicity of these materials usually limit their clinical applications. Diatomaceous earth (DE) is constituted with silica, which is structurally similar to the porous materials utilized in biomedical engineering. Presently, DE is usually used to prevent pests in agriculture or eliminate parasites in medicine. This research aims to investigate the effects of DE on osteoclast differentiation, the biotoxicity relative to DE, and their possible mechanisms, as to evaluate the feasibility of DE in the application of bone tissue engineering. Experimentally, human peripheral monocytes were cocultured with DE (100 ppm), and then relative gene expression of osteoclast differentiation factors and osteoclast numbers were analyzed. Besides, the cocultured medium was also added into the medium for osteoblast culture to investigate apoptosis rate of osteoblasts by Annexin-V staining.

The culture of peripheral monocytes indicates that DE is able to enhance gene expression of IL6 and RANKL as well as to increase the differentiation into osteoclasts. Moreover, the cocultured medium was observed able to apparently increase the apoptosis rate of osteoblasts.

The results were concluded that DE might induce the differentiation of peripheral monocytes into osteoclasts possibly via stimulating the monocytes to increase gene expression of IL-6 and RANK; besides, the peripheral monocyte-DE cocultured medium might induce obvious apoptosis of osteoblasts suggested that osteoclast might decompose the silica inside DE and the decomposed product is cell toxic to cause the apoptosis.

Keywords : diatomaceous earth, osteoblast, Osteoclast, silica