生物物理学报 2011, 27(6) 507-516 DOI: 10.3724/SP.J.1260.2011.00507 ISSN: 1000-6737 CN: 11-1992/Q

研究论文

50 Hz正弦交变电磁场促进体外培养成骨细胞分化成熟的双“强度窗”效应

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摘要:

为研究频率为50 Hz不同强度正弦交变电磁场对体外培养成骨细胞分化及基因表达的影响，体外分离培养大鼠颅骨成骨细胞，传代后随机分为15组，分别用频率50 Hz、强度为0 mT（对照）和0.9～4.8 mT（每组间隔0.3 mT）的正弦交变电磁场处理。发现：正弦交变电磁场处理3～5 d后，成骨细胞呈漩涡样分布；第9 d，1.8和3.6 mT组的碱性磷酸酶活性极显著高于对照组；第0、12、24和96 h，1.5、1.8、3.0和3.6 mT组碱性磷酸酶、骨形态发生蛋白-2和*Osterix*基因表达水平显著高于对照组；第10 d，1.8和3.6 mT组钙化结节数明显多于对照组。说明 50 Hz、0.9～4.8 mT的正弦交变电磁场能促进体外培养成骨细胞分化成熟，并且具有较明显的双强度“窗效应”，其中1.8和3.6 mT作用最为明显。

关键词: 成骨细胞 电磁场 碱性磷酸酶 骨保护素-2 Osterix

Double Effect Intensity of 50 Hz Sinusoidal Electromagnetic Fields at Different Intensity on Differentiation and mRNA Expression of Osteoblasts *in Vitro*

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Abstract:

To investigate the effects of 50 Hz sinusoidal electromagnetic fields (SEMFs) at different intensity on differentiation and gene expression of osteoblasts *in vitro*. The newborn rat calvarial osteoblasts were isolated by enzyme digestion and randomly divided into 15 groups after one passage. The intensities of the SEMFs were 0 mT (control) and 0.9~4.8 mT (SEMFs groups, interval 0.3 mT) respectively, and the frequency was 50 Hz. The cells were exposed in the SEMFs for 30 min/d. Those without SEMFs exposure were used as control. The cells were observed under the contrast phase microscope each day. The calcified nodules were stained by vonkossa. After first treatment in SEMFs, bone morphogenetic protein-2 (BMP-2), alkaline phosphatase (ALP) and osterix (OSX) mRNA expression were analysed at 0, 12, 24 and 96 h, respectively. The SEMFs groups were arranged in spiral appearance after 3~5 d. The calcified nodule numbers of 1.8 and 3.6 mT groups were significantly increased, ALP activity accord was the same as the result of calcified nodule numbers. The SEMFs treatment groups had different results，but there was a common result that 1.5, 1.8, 3.0 and 3.6 mT significantly increased the ALP, BMP-2 and OSX mRNA expression. The SEMFs at 50 Hz and 0.9~3.0 mT enhanced the maturation, mineralization and BMP-2, ALP and OSX mRNA expression of the osteoblasts, and SEMFs at 1.8 and 3.6 mT had the strongest activity.

Keywords: Osteoblasts Sinusoidal electromagnetic fields Alkaline phosphatase Bone morphogenetic protein-2 Osterix

收稿日期 2010-10-12 **修回日期** 2010-12-30 **网络版发布日期**

DOI: 10.3724/SP.J.1260.2011.00507

基金项目:

甘肃省科技重大专项资助项目(09ZNKDA025)

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