IJAE Vol. 115, n. 1/2 (Supplement), 2010

Chondroprotective effects of low-frequency low-energy pulsed electromagnetic fields on human cartilage explants

Alessia Ongaro[1], Agnese Pellati[1], Federica Masieri[1], Angelo Caruso[1], Stefania Setti[2], Ruggero Cadossi[2], Gaetano Caruso[3], Daniela Nardo[4], Monica De Mattei[1]

[1] Department of Morphology and Embriology, University of Ferrara, Italy
[2] Laboratory of Clinical Biophysics, IGEA Carpi, Modena, Italy
[3] Department of Biomedical Sciences and Advanced Therapies, University of Ferrara, Italy
[4] Department of Experimental and Diagnostic Medicine, University of Ferrara, Italy

Objective To investigate the effects of low-frequency low-energy pulsed electromagnetic fields (PEMFs) on proteoglycans (PG) metabolism [1-2] of human articular cartilage explants derived from patients with different osteoarthritis (OA) grades in the presence and in the absence of anabolic and catabolic stimuli for cartilage.

Design Human knee cartilage explants derived from lateral and medial femoral condyles of OA patients were exposed to PEMF (1.5 mT; 75 Hz) for 1 and 7 days with and without insulin-like growth factor-I (IGF-I) (50 ng/ml) and interleukin-1β (IL-1β) (0.01-50ng/ml). Histological analysis was used to classify cartilage according to the score developed by the International Cartilage Repair Society (ICRS). PG synthesis was determined by ^{35}S-sulfate incorporation. PG release into culture media was determined by the dimethylmethylene blue assay.

Results By histological evaluation, cartilage explants derived from lateral and medial condyles were classified as OA ICRS grade I and III, respectively. After 7 days treatment, in OA grade I cartilage explants, PEMF and IGF-I alone significantly increased ^{35}S-sulfate incorporation respect to control and counteracted the effect induced by IL-1β (0.01 ng/ml) of 26% and 24% respectively. The combination of PEMF and IGF-I resulted additive in all conditions. Similar results were obtained in OA grade III cartilage, although basal ^{35}S-sulfate incorporation was lower than in OA grade I. No effect was observed on medium PG release.

Conclusions PEMF exerts chondroprotective effects on human articular cartilage. The biological responsiveness of chondrocyte to PEMF was similar in different OA grades cartilage, suggesting that human chondrocytes maintain susceptibility to PEMF during OA progression.

References

[1] De Mattei M et al. (2004) Osteoarthritis Cartilage. 12:793-800.
[2] De Mattei M et al. (2003) Connect Tissue Res. 44:154-9.

Key words
Human cartilage, pulsed electromagnetic fields, proteoglycan metabolism, osteoarthritis