Pulsed electromagnetic field mediates beneficial effects through adenosine receptor pathway

K. Varani, Medical Sciences University of Ferrara, Ferrara Italy

Several studies explored the biological effects of low frequency low energy pulsed electromagnetic fields (PEMFs, Igea Biophysics Laboratory, Carpi, Italy) on human body reporting different functional changes (Varani et al., 2017). Much research activity has focused on the mechanisms of interaction between PEMFs and membrane receptors such as the involvement of adenosine receptors (ARs). In particular, PEMF exposure mediates a significant upregulation of A2A and A3ARs expressed in various cells or tissues involving a reduction of most of the pro-inflammatory cytokines (Vincenzi et al., 2013). Of particular interest is the observation that PEMFs, acting as modulators of adenosine, are able to increase the functionality of the endogenous agonist. A double role for PEMFs could be hypothesized in vitro by stimulating cell proliferation, colonization of the scaffold and production of tissue matrix. Another effect could be obtained in vivo after surgical implantation of the construct by favoring the anabolic activities of the implanted cells and surrounding tissues and protecting the construct from the catabolic effects of the inflammatory status (Cadossi et al., 2011). Moreover, a protective involvement of PEMFs on hypoxia damage in neuron-like cells and an anti-inflammatory effect in microglial cells have suggested the hypothesis of a positive impact of this non-invasive biophysical stimulus (Vincenzi et al., 2017). Of particular interest is the observation that the PEMFs through the increase of ARs enhance the working efficiency of adenosine, producing a more physiological effect than the use of drugs. This observation suggests the hypothesis that PEMFs may be an interesting approach as a non-invasive treatment with a low impact on daily life mediating a significant increase on the effect of the endogenous modulator (Capone et al., 2017). In conclusion, PEMFs represent an important approach in the pharmacological field providing excellent therapeutic results in various inflammatory diseases, in the functional recovery of the damaged cartilage tissues, in pain or in central nervous system disorders.

Cadossi R. (2011). Aging Clin Exp Res, 23, 49-51.

Capone et al., (2017). Sci Rep, 7(1), 12145.

Varani et al., (2017). Mediators Inflamm, 2740963.

Vincenzi et al., (2013). PLoS One, 8(5):e65561.

Vincenzi et al., (2017). J Cell Physiol, 232, 1200-1208.