Cell Proliferation Enhanced by Atmospheric-Pressure Plasma Application for Cells of Interest in Orthopedics

[1]Kazuto Masuda, [1]Satoshi Hamaguchi, [2]Yu Moriguchi, [1]Tatsuya Kanazawa, [1]Ayumi Ando, [2]Kiyoshi Okada, [2]Akira Myoui, and [2]Hideki Yoshikawa

[1] *Center for Atomic and Molecular Technologies, Graduate School of Engineering, Osaka University, Suita 565-0871, Japan*
[2] *Department of Orthopaedics, Graduate School of Medicine, Osaka University, Suita 565-0871, Japan*
E-mail: hamaguch@ppl.eng.osaka-u.ac.jp

It has been known that chemically reactive species generated by atmospheric-pressure plasmas (APPs) can enhance cell proliferation [1,2]. In this study, we have examined effects APP application on growth of mesenchymal stem cells and other cells that are of interest in orthopedics, using low-temperature low-frequency APP jets with He [2]. The cells examined here are rat bone marrow cells (Rat-BMC), rat adipose derived stem cells (Rat-ADSC), mouse Schwann cells, mouse osteoblastic cell line (MC3T3-E1), mouse embryonic mesenchymal cell line (C3H-10T1/2), mouse myoblast cell line (C2C12), mouse embryonic fibroblast cell line (NIH 3T3), human synoviocytes (HS) derived from a synovial membrane, and human osteosarcoma cells (HOS). In the experiments, three conditions were tested. In the 1st condition, low-temperature APPs were directly injected into a culture medium [Dulbecco's Modified Eagle Medium (DMEM) with fetal bovine serum (FBS)] containing cells and the cells were cultures in the same medium for a few days. In the 2nd condition, immediately after the medium containing cells was exposed to plasmas, the plasma-exposed medium was discarded and replaced with a fresh medium of the same kind and the cells were cultured for a few days in the new medium. In the 3rd conditions, plasma jets were injected into the same medium without cells, and then the cells were cultured in the plasma treated medium for a few days. In each case, cell proliferation (or cell death in the case of overexposure of the plasmas) was observed, which indicates that the presence of either chemically reactive species dissolved in the medium or solutes modified by such chemically reactive species affects cell viability. The level of free radical generation in the medium was examined by dROMs tests [3] and correlation between cell proliferation and oxidative stress were observed.

References

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