

Microsecond-Pulsed DBD Plasma Induces Osteogenic Differentiation in Mesenchymal Cells

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Intracellular reactive oxygen species (ROS) is a known activator of cell signaling promoting differentiation. Our goal was to determine if Non-thermal Microsecond-Pulsed Dielectric Barrier Discharge plasma (NT-plasma) could induce cell differentiation. In this study, we applied NT-plasma to mesenchymal cells and evaluated osteogenic differentiation. First, we compared media containing β -glycerophosphate (β -GP), a known inducer of osteoblast differentiation, to NT-plasma treatment or H₂O₂ treatment, to evaluate redox effects. Using qPCR we measured gene expression of the osteoblast-specific differentiation genes (RUNX2, BMP2, COL I, OSTRX and ALKP). Both NT-plasma and H₂O₂ treatment resulted in only a 30% induction of β -GP's osteogenic gene expression, so a potential synergism between β -GP and NT-plasma was investigated. We cultured the mesenchymal cells for 24 hrs. in β -GP and then applied NT-plasma or Sham treatment. NT-plasma significantly enhanced both early and late osteoblast differentiation gene expression as compared to β -GP; from 2 - 20 fold depending on the gene. Taken together, these results indicate that that NT-plasma alone is not sufficient to initiate significant changes in osteogenic differentiation. However, once differentiation has been initiated, NT-plasma enhances osteogenic differentiation at both early and late time points.

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