Lightning in a Bottle: Effect of Plasma Activation on Muscle Cells

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Plasma is an ionized gas consisting of charged particles, electric fields, ultraviolet photons, and reactive oxygen species. When discharged into liquids, plasma affects chemical and physical constituents in water and may stimulate cell growth. This project examined how application of plasma to muscle cells in vitro affect cell length, growth, and muscle development. I hypothesized that plasma application would enhance cell growth and wound recovery and that growth would be proportional to intensity of plasma application. Undifferentiated C2C12 muscle cells were cultured in growth media under sterile conditions. Once cells reached confluency, they were placed in differentiation media to initiate myotube formation. A micro-plasma cutter fabricated from 9V batteries, wire, graphite, and aluminum foil was used to generate a small plasma stream applied either directly to cells in media or to media that was then applied to cells (indirect treatment). The results indicate that direct application of low doses of plasma resulted in significantly longer cells and higher growth rates while direct application of high plasma doses resulted in significantly shorter cells and high cell mortality. Indirect plasma application also resulted in shorter cells in the high treatment and longer cells in the low treatment. Indirect plasma application also affected wound healing. Cell recolonization in wound areas of the low treatment was significantly higher than the controls while cell recolonization in high treatments was significantly lower compared to controls. My results suggest that application of plasma has both positive and negative effects on cell growth and that there appears to be an optimal plasma dose that has beneficial effects on cell growth and wound healing.