The Effects of Electrical Discharge Plasma Treatment on Cellular Growth and Wound Healing

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Plasma is an ionized gas consisting of charged particles and UV photons. When plasma interacts with water, reactive oxygen species (ROS) are produced. These compounds are recognized for their bactericidal properties. Previously, I found that low doses of plasma led to larger muscle cell size in vitro and may enhance wound healing. The present study examined the effects of plasma on artificial wound healing in vitro using myoblast cells, and also wound healing in vivo using planarian flatworms. Myoblasts were grown to confluence, and a 1 cm artificial wound was produced on the culture plates. Both low and high plasma doses led to significantly enhanced cell recruitment to the wound and higher rates of wound closure. Planarian worms, which can regenerate when cut into pieces, were then bisected and subjected to control or plasma treated conditions. Both low and high plasma doses led to greater lengths of both the head and tail segment of the worm after 6 days of treatment. Further, the rate of wound closure in the cut region was greater in the plasma treated groups. In a separate experiment, I measured ROS production in the plasma treatment and found that my plasma device significantly increased ROS in the media. Together these results demonstrate that plasma enhances cell growth and wound healing both in vitro and in vivo and the effects of plasma are likely mediated by ROS. Given plasma's antibacterial properties and potential for wound healing, plasma activation therapy could be used in medical applications such as treatment of burns, ulcers and sore to closure of surgical wounds.

Awards Won:

Coalition for Plasma Science (CPS): First Award of 2,500.00

Drexel University: Full tuition scholarship $194,000