PLASMA WOUND TREATMENT: FROM PHYSICS TO ANIMAL MODELS

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Non-thermal treatment of wounds has been often mentioned as one of the most promising applications of plasma in medicine. Possibility of reducing bacterial load with plasma treatment has been suggested by some experiments on fresh meat, cadavers and living mice. Initial clinical results with human patients have also been reported. Animal experiments have been carried out to test toxicity of some plasma treatments. Possibility of enhanced growth of cells following some plasma treatment has been suggested through *in-vitro* experiments.

These promising initial results often hide real complexities that exist in treatment of different types of wounds. Some complexities, for example, are related to different types of bacterial colonization and possible formation of biofilm. Depth of colonization seems to play an important role, while penetration of plasma generated species to different depths through different tissues remains poorly studied and understood. Effects of tissue moisture levels and microscopic features of topography on uniformity of plasma treatment and penetration of active species also remain unclear in many situations.

In addition to providing an overview of different efforts related to wound treatment this talk will focus on recent studies in our group on wound treatment with Dielectric Barrier Discharges. Effects of tissue topography and moisture on treatment efficacy will be discussed. It will be shown that uniform discharges created using nanosecond rise-time voltages provide an order of magnitude improvement. Assessment of microbial activity through mRNA measurement will be described. It will be shown that bacterial inactivation depends primarily on the dose of treatment, while tissue damage is strongly dependent on the dose rate. Confocal microscopy studies showing distribution of bacteria as a function of depth in tissue and bacterial activity before and after plasma treatment will be described. Tissue moisture will be shown to have a strong effect on both, bacterial inactivation and reduction of toxicity.