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Plasma medicine: from bench to bedside

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Plasma medicine is a newly established and fast growing interdisciplinary field of research connecting physics, medicine and molecular biology. Cold plasma consists of partially ionized gas and contains a range of biologically active components including reactive oxygen and nitrogen species (ROS and RNS), mild heat and UV-radiation. There are numerous future applications planned in medicine, e.g. medical device disinfection, wound care, blood coagulation, and even cancer treatment. The challenge hereby is to prove that plasma treatment can have lethal effects on bacteria, whereas eukaryotic cells can be promoted to grow and proliferate under the same conditions. The aim of this study was to investigate the impact of cold plasma on the stimulation of mammalian cells with respect to chronic wound healing. Therefore, human cells from cell culture and from biopsies were treated with the atmospheric pressure plasma jet kINPen®MED. While long treatment induced apoptosis, short time plasma treatment increased the proliferation. However, the underlying processes still need to be identified in order to modulate the plasmas for future applications ? especially with respect to clinical application (including patient diversity) and comparison of different plasma sources.

Our results indicate that for an optimal plasma treatment the control of ambient conditions, as well as a careful plasma treatment harmonized to the respective cells/ patients is of tremendous importance for a successful approach of plasma therapy. Nevertheless, future plasma applications in vivo demand for thorough investigation on plasma-cell interactions ensuring safety and reliability of devices in advance of its clinical use. For future progression in the development of medical devices, the standardization of plasma generating processes as well as the biological tests is needed. This work will provide some aspects on how to compare different plasma treatment regimes, but also will give some hints what still need to be investigated regarding patient treatments.