Contribution ID: **2958** Type: **not specified**

I5.301 Atmospheric pressure helium plasma as a tool for interacting with cells and pathogens

Friday, 12 July 2019 10:40 (30 minutes)

See the full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/I5.301.pdf

This contribution reviews recent activity of the Padova group on the use of helium plasmas in plasma medicine. Following the initial emphasis on disinfection of the cornea [1], the research activity has developed along several research lines, which cover the topics of wound healing, cancer treatment and non-thermal coagulation. Plasma source characterization from the physical and chemical point of view has been performed, comparing two different sources: a RF source for indirect plasma treatment [2] and a Dielectric Barrier Discharge jet for direct treatment, specifically designed for non-thermal blood coagulation applications. The comparison has included an assessment of disinfection properties. The specificity of helium as working gas has been emphasized by mass spectrometry measurements, which hint to the importance of metastable excited states.
The wound healing activity has seen a set of in vitro tests, which have shown the ability of a RF indirect treatment to stimulate cell proliferation and migration, processes which are related to an increase of intracellular Reactive Oxygen Species (ROS) level [3]. Subsequently, an in vivo study on large animals (sheep) has been performed, showing the ability of the plasma treatment to significantly reduce bacterial charge on the wound, to reduce inflammation, to promote the regeneration of cutaneous annexes, such as hair follicles and glands, and to lead to an anticipated induction of blood vessel formation.
The work on cancer treatment has been carried out in vitro, using primary cells cultivated from tissue samples of patients affected by laryngeal and lung cancer. The plasma treatment has been shown to lead to an increased ROS level in cells, with a stronger effect observed in cancer cells than in healthy ones. As a consequence, apoptosis is induced in a remarkable fraction of cancer cells, with a preferential effect with respect to healthy ones. This result could be enhanced by combining the plasma treatment with incubation with a molecule known to increase the ROS level in cells.
Finally, results of a project on non-thermal blood coagulation induced by the direct interaction with a helium plasma jet will be reported. In vitro studies have shown that the applications of the plasma indeed accelerates coagulation. The result has been confirmed by in-vivo tests on animal models.

References
[1] E. Martines, P. Brun, P. Brun, et al., Clinical Plasma Medicine 1, 17 (2013).
[2] E. Martines, M. Zuin, R. Cavazzana, et al., New J. Phys. 11, 115014 (2009).
[3] P. Brun, S. Pathak, I. Castagliuolo, et al., PLOS ONE 9, e104397 (2014).

pppo

Presenter: MARTINES, E. (EPS 2019)

Session Classification: LTPD

Track Classification: LTPD