

Plasma Medicine – its perspective for wound therapy

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Editorial

Biological and medical plasma applications are an increasing field of research and development. Plasma surface modification is a state-of-the-art technique to optimize medical implants and biological diagnostic tools. Several efforts have been made for recent years to use plasma for antimicrobial treatment of heat as well as moisture sensitive medical products and devices as well as pharmaceutical packaging and drug preparations.

However, there is a huge potential of low temperature plasma application remaining. This is true not only for a fundamental new approach of combined microbiological decontamination/sterilisation of medical devices including inactivation of prions and endotoxins and remove of organic pollution and environmentally harmful by-products, but also for fields as bio-waste management, air purification, selective blood coagulation as alternative for electro-surgery, and tissue processing using atmospheric pressure plasmas.

The main challenge to open up systematically new fields of plasma application in life science is to understand basically the mechanisms of plasma interaction with living cells and tissue.

A new and revolutionary application of plasmas seems to be the treatment of microbial contaminated, colonized or infected acute and chronic wounds. As long as a wound is infected, the healing process remains impeded. Up to now the treatment of acute and chronic wounds is mostly

limited to antiseptic treatment using chemical or physical agents. After surgical debridement the elimination of wound pathogens is only one important step in the wound treatment. It must be followed or combined, respectively, with stimulation of reparative inflammation and with support and increase of cell proliferation and cell functions (phagocytosis, releasing of growth factors). Despite the fact that cytotoxic side effects of chemical antiseptics which may delay the wound healing process have to be accepted there is no broad fundamental working hypothesis for the effectiveness of wound healing agents.

Stating this lack of basic understanding both in the field of plasma cell interactions and in wound healing mechanisms, the Leibniz Institute of Plasma Science and Technology Greifswald (INP) together with the Institute of Hygiene and Environmental Medicine and the Pharmaceutical Institute of the Ernst Moritz Arndt University Greifswald have organized the “First International Workshop on Plasma Tissue Interactions” in October 2007 in Greifswald to force the scientific intercommunication in this field of interdisciplinary basic research in plasma physics and life sciences. The intention of this workshop was to bring together experts of quite different specialities to discuss scientific challenges in the field of interactions of physical plasmas and living systems with special emphasis to possible therapeutic applications.

As a result of this workshop the following statements are accepted:

- Wound healing as well as combat of infections are of great medical importance. Both are extremely energy-consuming processes.
- There would be an ideal constellation for wound treatment which could be combined in nearly ideal manner using atmospheric pressure plasmas:
 - completion of surgical debridement together with
 - deletion of the microbial biofilm including endotoxins of the wound without damage of living wound tissue
 - stimulation of cell proliferation in deeper layers of the wound.
- This work offers great challenges but has to take some risks due to its really new approach. Careful study of the processes and effects is necessary in a well defined environment with highly motivated staff. To open this new and highly innovative field of plasma application an extremely careful handling of the claims of potential application is needed to avoid an early overstraining of this new field.
- In close transdisciplinary collaboration with the international scientific community basic research in the field of plasma tissue interactions will lead to significant new insights in this special and important topic. The international scientific community should work together in this new field and support each other to fasten the process of basic research in the field of plasma tissue interactions and to transfer into practice.

Up to now there is no centre claiming this special topic in the world. To force the basic research in this field, under the lead management of the Leibniz Institute of Plasma Science and Technology Greifswald (INP) the start-up of a Centre for Innovative Competence “plasmatis” is planned to investigate basically the interaction of plasma with cells and tissue with a special focus on tissue regeneration and wound healing. The “First International Workshop on Plasma Tissue Interactions” was financially supported by the German Federal Ministry of Education and Research as a part of the strategic development process for this centre of basic research. In this special issue of “GMS Krankenhaushygiene Interdisziplinär” the key presentations of the “First International Workshop on Plasma Tissue Interactions” are made available for a broad scientific community to open as well as to force the scientific discussion and cooperation in the highly innovative field of biological and medical plasma applications.

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