

## **Plasma Medicine: State and Perspectives**

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Plasma medicine is an innovative and emerging field combining plasma physics, life science and clinical medicine. It has been developed as innovative medical research field during the last years. Besides partially established applications of plasma to treat materials or devices to allow effective medical applications with respect to biocompatibility or microbiological safety, respectively, the primary focus of plasma-medical research is the direct application of plasma as part of therapeutic concepts.

Attractiveness of medical application of cold atmospheric-pressure plasmas is mainly based on the fact that plasma is generated by supplying electrical energy to a not directly effective gas (Ar, He, O<sub>2</sub>, N<sub>2</sub>, air, or mixtures thereof), i.e. active components are provided locally and only for the required duration of the application.

Recently, extensive basic research on plasma effects on living cells and microorganisms resulted in some more insight into basic mechanisms of biological plasma effects:

- Biological plasma effects are significantly mediated via liquid phases.
- Biological plasma effects are dominated by reactive oxygen species (ROS) and reactive nitrogen species (RNS, RONS).

According to the actual state of knowledge, therapeutic plasma application is promising in dermatology, plastic surgery or dentistry, and is up to now focused on tissue regeneration, infected and/or chronic wounds as well as infective and inflammatory skin diseases. Another field of big interest is oncology. Intended plasma applications are both individual applications as alternatives to already established therapies, as well as supplementary applications to support other therapies.

Besides experimental and pre-clinical research results which are broadly documented in literature, there is first promising experience from the clinical practice. Clinical plasma medical research has so far been done almost exclusively in Germany. First atmospheric pressure plasma sources are certified as medical devices. Consequently, introduction of plasma medicine into clinical daily routine is imminent! Nevertheless, further understanding of mechanisms of plasma effects on living systems is actually the main challenge of plasma-medical basic research both to secure a solid research basis for therapy and to provide a safe application. Additionally, further technical development is indispensable to adapt atmospheric-pressure plasma sources to the specific demands of different medical applications.

### **References**

1. Clinical Plasma Medicine Core Group: Clinical plasma medicine – position and perspectives in 2012. Clin. Plasma Med. 1 (2013) 3-4

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