

Biomedical applications of non-thermal atmospheric pressure plasma – prospects and challenges

Development of the non-thermal atmospheric pressure plasma sources has brought fresh blood to the area of biomedical applications of plasma. Applications range from wound healing, bacteria sterilization, tooth bleaching, skin therapy, blood coagulation, cancer cell destruction and so on. Due to its non-equilibrium nature and production of wide range of species (ions, neutrals, electrons, radicals, metastables) in rich and controllable chemical processes, as well as light, electric fields, electrical currents, plasma can induce subtle cell responses at sample temperatures below 40 °C. The design of the plasma sources has to provide a good balance of the above mentioned agents to match the desired effects. The interaction between the plasma and the biomedical samples is not fully understood. In order to clarify the complex interaction we have used the plasma needle to treat the two types of bacteria *Escherichia coli* and *Staphylococcus aureus*. The results are among the first to show the influence of the plasma on planktonic samples of bacteria. Effects of the plasma on human peripheral blood mesenchymal stem cells (hPB-MSC) are also investigated. The two bio-systems represent a simplified starting biological model on the route towards the in-vivo application of the plasma needle for the treatment of parodontopathy. The research is continued towards more realistic models. Plasma influence on the MRSA biofilms of *Staphylococcus aureus* is investigated. Furthermore, responses of periodontal ligament stem cells (PDLSCs) to plasma treatment are studied. Standard diagnostics are performed for plasma characterization (mass spectra, light emission profiles, delivered power).