

Accelerated blood coagulation through the stimulation with a plasma jet.

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A Plasma Coagulation Controller (PCC) device, a cold atmospheric pressure plasma source based on the Dielectric Barrier Discharge (DBD) scheme, has been specifically designed for accelerating blood coagulation. The device is controlled by a microcontroller and can explore different operational parameters in terms of discharge repetition rate (1-20 kHz) and applied voltage (2-8 kV). Helium is used as a working gas. Effective current measured on a metallic target is of the order of 1 mA and, thus, suitable for application on human body.

Several tests using the PCC in different biological processes, including reactive species production, western blot analysis, and *in vitro* blood coagulation have been performed. In particular, tests performed at different time points on blood samples exposed to helium plasma showed a significant reduction of the coagulation time compared to control samples, even in patients undergoing anticoagulant therapy. Difference in the expression of several components of blood coagulation cascade, such as Prothrombin, Thrombin, and Factor VII, has been investigated, showing an increase in downstream factors after treatments. Moreover, histological analysis of blood smears after PPC-induced coagulation displayed the presence of a reticulum of fibrin, as well as platelet aggregation. The PCC effect has been demonstrated also in a rat model of bleeding, where a significant reduction of the bleeding time was observed. The histological analysis of the biopsies from the treated area showed low levels of inflammation and negligible signs of necrosis. Our results demonstrate that plasma treatment performed by PCC is able to promote blood coagulation both *in vitro* and in an animal model, without overt signs of necrosis. Further studies are now ongoing to better understand these mechanisms, paving the way for the pilot clinical trial.