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Low temperature Plasma is a novel technology to process organ, tissue and biomaterials - From the view point of blood coagulation by low temperature plasma treatment.

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In the last dedicate, accumulating evidence has succeeded to illustrate the feasibility to use LTPs at atmosphere for oozy bleeding. Blood clot formation (blood coagulation) by low temperature plasma (LTP) treatment was pointed out in earlier reports as shorten whole-blood clotting time. The underlined mechanism to accelerate blood coagulation was linked with the activation of platelets and coagulation factors upon LTP treatment, while no effects on the shape of erythrocytes in formed clot and serum proteins such as albumin and immune globulins were demonstrated [1-3]. On the contrary, treatment with our developed LTP equipment stopped bleeding by forming membrane like structures from both serum proteins and materials from hemolysate [4]. The mechanism of hemostasis is to coat the breaking points on blood vessels, which is different from not only treatment with the other plasma equips but also the common electrical hemostatic devices that cauterize the tissues around the bleeding to stem the blood flow.

In this paper, we sought to determine the effect of LTP treatment on red blood cells (RBCs) to form clot. Our developed two plasma instruments, namely BPC-HP1 and PN-110/120TPG formed clots from whole blood, whereas only LTP treatment with BPC-HP1 could form clots in red RBCs in phosphate-buffered saline (containing 2×10^9/mL RBCs). Light microscopic and electron microscopic analysis elucidated that membrane-like structures and hemolysis were in both the formed clots from whole blood and PBS-suspended RBCs. It is noteworthy that membrane-like structures and hemolysis was disappeared with the decrease in the current through the targets contacting with the plasma flare and clot formation ceased (Figure 1). Taken these results and previous studies[5] together, it is suggested that both hemolysis and serum proteins aggregation linked with the current through the targets can be used as indicators of clot forming using LTP treatment [6].

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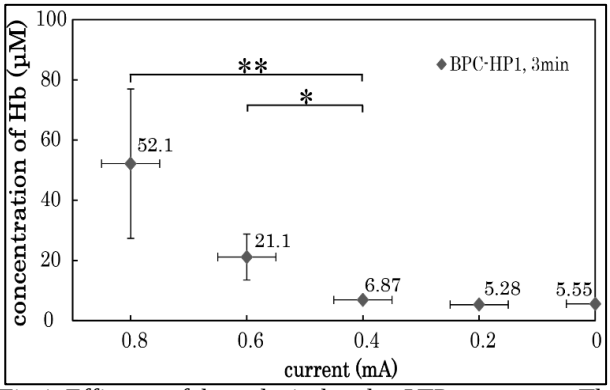

Fig.1 Efficacy of hemolysis by the LTP treatment. The hemoglobin concentration in PBS after plasma treatment. ($n = 3$; $p < 0.05$; bars represent the mean values per microliter ± SD) (K. Miyamoto et al Archives of Biochemistry and Biophysics, 605, 95-101, 2016.)