
The effect of tissue and medium on the penetration of RONS generated by plasma

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For many of the applications of plasma medicine, such as cancer treatment, one of the key questions is how deep the reactive species generated by plasma jet can penetrate and how the status of the tissue will affect the RONS concentration. In this presentation, firstly, a tissue liquid model is utilized to measure the penetration of the long life time RONS (H_2O_2 , NO_2^- and NO_3^-) and pH value in the pig muscle tissue. Results show that the six different type of liquid (inorganic group: double distilled water, 1% PBS, 0.9% NaCl; organic group: 5% glucose, 2% serum and 10% serum solution) only have minor influence on the depth of the long life time RONS penetrating through the tissue and the maximum penetration depth is about 1500 ± 250 mm. However, the concentration of H_2O_2 , NO_2^- and NO_3^- at the surface layer 500mm underneath the tissue slice shows great differences in six liquid phase. H_2O_2 concentration at 500mm in organic solution is about 20-30 times of that in DDW. And the RNS (NO_2^- and NO_3^-) concentration in serum solution is much larger than in the other solutions presumably due to the plasma reacting with the amino acid and other protein. In addition, the NO_3^- concentration in inorganic solution is larger than the NO_2^- concentration at the same condition.

Besides, the concentration of reactive oxygen and nitrogen species (RONS) generated by a plasma jet penetrating through and stored in the skin after plasma treatment are measured, and the effects of stratum corneum in the penetration are also investigated. It is found that the RONS generated by the plasma jet can penetrate through the skin and the penetration could be enhanced largely by stripping the stratum corneum. Further investigation found that the typical ROS species OH, 1O_2 , O_3 , H_2O_2 , can't even penetrate the mice skin no matter with or without the stratum corneum, whose thickness is about 200-300 μ m, this result is very different from the experiments results in muscle tissue model and gelatin model. In those models, it is found that the H_2O_2 generated by the plasma jet can penetrate through about 1mm thickness tissue. Finally, we found that amounts of long life RONS (H_2O_2 , NO_2^- and NO_3^-) are stored in the skin after plasma treatment, which indicate that the plasma medicine may be a long-time scale therapy method, this possible effect is mentioned firstly in the plasma medicine community.

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