THE REDUCED PH METHOD WITH INDIRECT PLASMA FOR SAFE AND EFFECTIVE DISINFECTION IN DENTISTRY AND SURGERY

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For the purpose of disinfecting human bodies in dental and surgical therapies, sterilization experiments in solution have been conducted with low-temperature atmospheric-pressure plasmas. For the plasma disinfection in the body fluid, we have successfully developed the reduced pH method that stronger bactericidal activity can be achieved when the solution is sufficiently acidic [1]. It is interesting that a critical pH value of about 4.7 exists for the bactericidal activity. This critical value may be associated with pH of the dissociation equilibrium between superoxide anion radicals (O2•-) and hydroperoxy radicals (HOO•), which is known to be approximately 4.8. As the nature without electric charge, HOO• can diffuse into bacterial cytosol via hydrophobic cell membrane, therefore HOO• shows extremely stronger bactericidal activity than negative charged O2•-. O2• generated in gas penetrate into liquid via plasma–air–liquid interactions [2, 3]. For the enough long lifetime of O2• in gas as air ion, O2• can be supplied into liquid by non-contact plasma. The non-contact plasma with 400 cm extra tube has equivalent strong bactericidal activity only with the reduced pH method. In addition, we found that the plasma treated water has strong bactericidal activity for a few minutes with the reduced pH method. This suggests that the disinfection can be done by the plasma treated water which contains short-lived active species (cannot supplied by chemical reagent) and it would bring safety plasma medicine considering usual contact or non-contact plasmas to human body. Currently, animal experiments for root canal therapy in dentistry [4] and surgical site infection prevention in surgery have been done with indirect plasma disinfection techniques of non-contact plasma and plasma treated water.