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The investigation of Dielectric Barriers Discharge Plasma Jet (DBDJ) for bactericidal in chronic wound

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The cold atmospheric pressure plasma (CAPP) technique has been recognized in medical fields to bring a new innovative approach in biomedical applications such a chronic wound healing enhancement as well as relieving the patient's pain without side effects. Chronic wounds are a major health problem in many countries. Factors of patient health problems are such as diabetes, contaminated wounds, bacteria as well as others. The patients must endure pain and require long treatment periods using antibiotics or other therapies. Moreover, using antibiotics for a long period of time bacterial resistance occurs, such as methicillin-resistant *Staphylococcus aureus* (MRSA). Bacteria have the ability to develop resistance to antibiotics faster than one can develop new drugs. This being the main problem in chronic wound healing. In this study, the dielectric barrier discharge plasma jet (DBDJ) was used for bactericidal and treated the Primary Human Dermal Fibroblasts Adult (HDFa) cells to study the side effect of DB95DJs. This DBDJ is driven by high voltage dc pulse at 20 kHz and using 1 L/min of helium (He) as plasma gas. The DBDJ plasma varied the plasma dissipated power from 0.27 to 0.50 watt and the treatment time 15 to 60 s. Plasma radical species were utilized by using an optical emission spectroscopy (OES). The results of the OES study found NO and OH radical groups which play an important role in bactericidal and chronic wound healing. The increase of radical plasma density depends on the dissipated power. The Colony Forming unit (CFU) method was used to monitor the efficiency of bacteria killing. *Staphylococcus aureus* (*S. aureus*) and *Pseudomonas aeruginosa* (*P. aeruginosa*) were used in the vitro bacteria killing test. The results showed that the plasma dissipated power and treatment time were major factors for bactericidal. When increasing the plasma dissipated power to 0.50 watt and treatment time to 60 s, the effect of bacteria killing increased to 100%. Studying the effects of DBDJ on HDFa cells using Muse Cell Analyzer with the Muse Count & Viability Assay Kit the result showed the DBDJs being highly efficient for bactericidal as well as not having any side effects on HDFa cells under the same conditions. Therefore, the DBDJ has a high bactericidal efficiency and assist in chronic wound healing.

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