An Overview of Antimicrobial Efficacy of an Electroceutical Wound Care Device

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Abstract

Next generation approaches to control and prevent hard-to-eradicate and antibiotic-resistant wound pathogens are being developed and used in clinical settings. Energy-based technologies have significant therapeutic utility in wound care, with growing recognition in the healthcare field. A microcurrent generating bioelectric dressing (BED) without an external power source consisting of silver and zinc microcell batteries impregnated on polyester is activated in the presence of a conductive fluid and generates a physiologic level of electrical energy. We provide an overview of antimicrobial efficacies of this BED against wound pathogens and their biofilms. We postulated that the BED could treat various wounds and exert an electricidal antimicrobial effect. It demonstrated *in vitro* broad-spectrum antimicrobial activities against most nosocomial wound pathogens as well as multidrug-resistant (MDR) isolates such as MDR Gram-negative bacilli (GNB), MRSA (methicillin-resistant *Staphylococcus aureus*), VISA (vancomycin-intermediate *S. aureus*), and VRSA (vancomycin-resistant *S. aureus*). Its antimicrobial property is derived from effects of microcurrent in addition to silver and zinc.

Chronic wound pathogens are mostly engaged in biofilm formation, therefore the treatment and eradication for infection control and prevention becomes complicated and remains hard to treat. The BED was tested against biofilms using both poloxamer and colony drip-flow reactor (CDFR) biofilm models. Using poloxamer biofilms, it demonstrated 2- or 3-fold $\log_{10}$ reductions against mono-species and 1- or 2-fold $\log_{10}$ reduction against multi-species biofilms. In the CDFR biofilm model, the BED was applied directly onto the biofilms, which were continuously deposited onto a filter membrane for 72 h. The BED efficacy against the biofilms was more than 10-fold effective in reducing bacterial numbers compared to that of blank polyester, which showed accumulation of more than 10^9 CFUs/mL. The results presented herein describe the efficacy and demonstrated effectiveness of a BED capable of delivering electric microcurrent against both planktonic and biofilm forms of wound pathogens.

Keywords: Microcurrent generating bioelectric dressing (BED), electroceutical device, multidrug-resistant (MDR) isolates, poloxamer and colony drip-flow reactor (CDFR) biofilm models