3D Printed Silicone Wound Care Dressing With Carbon Composite Structure Containing Porous Fibers for Reinforcement and Uniform Biocide Delivery

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Mainstay of the treatment of wounds is the appropriate wound dressing. The purpose of dressing is to provide a clean surface, inhibit the pathogens using biocides, insert nutrients, promote wound healing and avoid pressure on the wound. Current wound dressings cannot deliver a constant level of biocides in the wound. As the biocide levels decline, it promotes bacterial resistance. Most dressings lack the strength to protect the granulation tissue from external pressure. The objectives of the research were to create a microporous dressing with carbon fiber reinforcement and an attached biocide regulatory mechanism. The hypotheses were that the microporous membrane would provide a mechanism to maintain constant levels of biocide in the wound, while the carbon fibers would provide support. A dressing was designed and prototyped using silicone and micropores were created using sodium acetate crystals. Carbon fibers were inserted to provide strength to the membrane. The shape and size of the dressing was customized via 3D printing. Using a standard FDA wound training dummy, three commercially available dressings were tested against the 3D printed dressing using saline and an infrared camera and hygrometer. Images and temperatures were recorded. Results showed the 3D printed dressing was wet for over 25 hours - substantially longer than the other three dressings. In addition, 50g of weight was placed over the dressings, and lowest point of sag was measured. The sag of the microporous membrane was the least, indicating better strength. The hypotheses were supported. The major application of the 3D printed dressing is that a stable biocide concentration can be delivered for longer periods, thus reducing the frequency of dressing change, and lessening bacterial infections.

Awards Won:
Second Award of $2,000