

Mechanical Properties, Elution Profile and Antimicrobial Activity of a

Silver-Coated Foam Dressing for Use with V.A.C.[®] Therapy

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Statement of Purpose: V.A.C.[®] Therapy (KCI, San Antonio, TX) has been shown to aid in wound healing through the application of localized negative pressure to the wound via a foam dressing.¹ Ionic silver is recognized as an effective antimicrobial against a broad spectrum of pathogens.² V.A.C.[®] Therapy with the use of a silver foam dressing can therefore be an effective therapy to help promote wound healing by combining the benefits of localized Negative Pressure Wound Therapy with the antimicrobial activity of silver. V.A.C.[®] GranuFoam[®] Dressing (KCI, San Antonio, TX), an open-celled, reticulated polyurethane foam having a pore size range of 400-600 μm , was coated with metallic silver to impart antimicrobial properties to the resulting foam dressing - V.A.C.[®] GranuFoam[®] Silver[™] Dressing (KCI, San Antonio, TX). Previous studies suggest that the structure of the foam and its mechanical properties are key characteristics needed to achieve the desired clinical outcome by providing even distribution of pressure and micromechanical forces to the wound.^{1,3} Therefore, it was important that the coating process did not negatively affect the structure and mechanical properties of the foam. The objective of this study was to compare the structure and mechanical properties of the silver-coated foam dressing to that of the uncoated foam. Additionally, the silver elution profile and antimicrobial activity of the dressing was evaluated.

Methods: SEM images of pieces of freeze-fractured foam were taken using a Hitachi 3000H SEM with an accelerating voltage of 20 kV. The mechanical properties of the foam dressings were determined following the ASTM D 3547-01 Standard Test Methods. Silver elution was determined as follows. A 5/8" core of the foam was placed in 100 mL of 0.1M KNO_3 solution maintained at 37°C with continuous agitation to create infinite sink conditions. At predetermined time points, the solution was analyzed for silver concentration using a Silver/Silver Sulfide ion-selective electrode with an internal standard of KNO_3 . Antimicrobial testing against VRE and MRSA was performed following the ASTM E2149 Standard Test Method.

Results / Discussion: SEM imaging of the silver-coated foam indicated that the approximately 3- μm silver coating was thin enough to maintain the same 400-600 μm pore size range as the uncoated foam (Fig. 1). The mechanical properties of the silver-coated foam and the uncoated foam were similar except for tear strength (Table 1). The significantly higher tear strength of the silver-coated foam can be an added benefit in wound dressing changes. Upon contact with wound fluid, silver is oxidized and silver ions are released into the surrounding fluid. Elution data indicated that the silver-coated foam released silver ions continuously for up to 72 hours, which exceeds the time frame recommended for dressing changes with

V.A.C.[®] Therapy (Fig. 2a). Antimicrobial testing against VRE and MRSA demonstrated that the silver-coated foam dressing was effective against these antibiotic-resistant bacteria after only 30 minutes of contact (Fig. 2b).

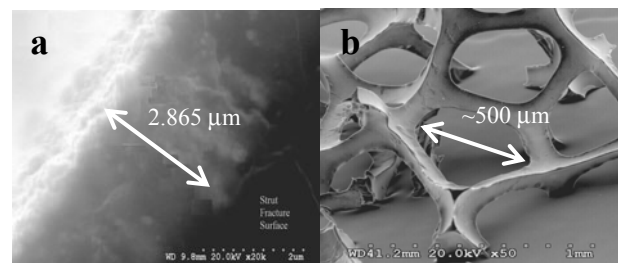


Figure 1. SEM of silver-coated foam showing a) silver coating thickness, and b) pore size

Table 1. Mechanical properties of uncoated and silver-coated foam

Property (n = 3)	Uncoated Foam	Silver-Coated Foam
Density (kg/m^3)	24.02 ± 0.26	25.30 ± 0.44
Compression Resistance at 50% deflection (kPa)	4.84 ± 0.06	4.08 ± 0.14
Ultimate Elongation (%)	94.44 ± 9.62	106.67 ± 11.55
Tear Strength (N/m)	511.61 ± 97.02	732.58 ± 60.14

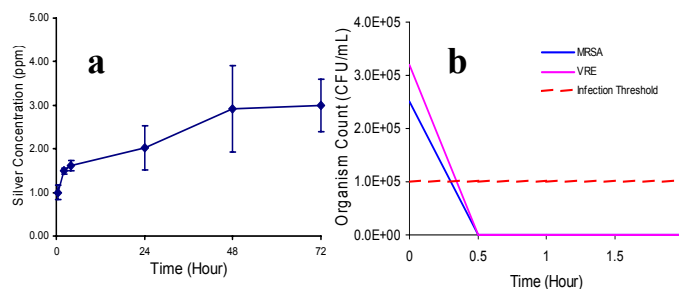


Figure 2. Elution profile (a) and antimicrobial activity (b) of silver-coated foam

Conclusions: The V.A.C.[®] GranuFoam[®] Silver[™] Dressing provided continuous release of silver ions for up to 72 hours and provided antimicrobial protection against the antibiotic-resistant bacteria tested. Results indicated that the silver-coating process had no detrimental effect on the structure or mechanical properties of the foam.

References:

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