

IN VITRO EVALUATIONS OF A HYDRO-ALGINATE WOUND DRESSING WITH SILVER FOR THE MANAGEMENT OF CHRONIC WOUNDS

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Abstract

Aims
A Hydro-Alginate dressing with silver composed of calcium alginate, carboxymethylcellulose (CMC) and silver coated Fibra (K-Direct), was evaluated in a number of *in-vitro* simulated in-use tests to determine its suitability for use as a chronic wound dressing.

Methods
Four *in-vitro* simulated in-use tests were performed looking at the following dressing characteristics for the Hydro-Alginate dressing with silver: 1) Total absorbency capacity of the dressing using the BP 1993, Addendum (1995) Alginate Dressing, Absorbency assay 2) Wet tensile strength 3) Silver release profile of the dressing over a number of days with a daily challenge in simulated wound fluid. 4) Extended zone of inhibition testing, challenging a dressing test piece to a freshly prepared microbial lawn over a number of days with different common chronic wound pathogens.

Results
The silver dressings evaluated demonstrated an absorbent capacity, with Hydro-Alginate dressing with silver recording a high tensile strength. The Hydro-Alginate dressing with elemental silver continued to release silver over the 7 day re-challenge test period providing consistent levels of silver ions. Using the same test, dressings incorporating silver in compound (ionic) form, failed to maintain these levels of silver ions. A zone of inhibition was demonstrated for up to seven days against common wound pathogens.

Conclusion
The results of the simulated in-use tests demonstrate that Hydro-Alginate dressing with silver has properties suitable for use in the management of chronic wounds. The dressing has the ability to absorb fluid, and maintain its structural integrity, aiding its removal from the wound. Hydro-Alginate dressing with silver is also effective against common wound pathogens including *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

Methods

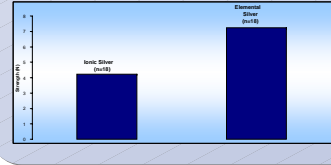
- Wet Tensile Strength using Instron Tensile Tester
- Absorbent Capacity using BP 1993, Addendum (1995) For Alginate Dressings
- Silver Release by Atomic Absorption
- 3 Day Repeat challenge zone of inhibition test using common wound pathogens. Each day the dressing was transferred to a freshly inoculated agar plate

Objectives

- Demonstrate by a combination of *in vitro* test methods the superior properties of a Hydro-Alginate dressing composed of Calcium Alginate, Carboxymethylcellulose (CMC) and Elemental Silver when compared to a dressing composed of Calcium Alginate, CMC and Ionic Silver
- Combination of tests mimic highly exuding contaminated wounds, challenging the dressing, for suitability of use in chronic wound management

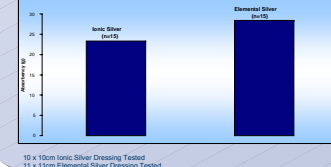
Wet Tensile Strength

Mean of cross direction and machine direction



Absorbency

Grams per dressing fold

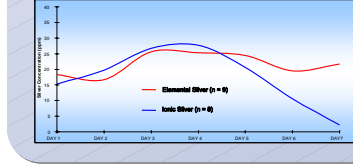


Results

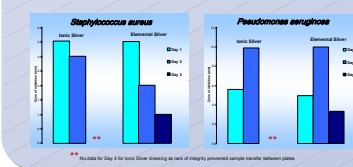
- High wet tensile strength demonstrated by the Elemental Silver dressing facilitating intact removal from wounds
- High absorbent capacity of Elemental Silver dressing ensuring excellent exudate management
- Elemental Silver content sufficient to maintain *in vitro* silver release over 7 days. Ionic silver dressing showed depleted silver levels by day 7
- Sustained *in vitro* antimicrobial activity of Elemental Silver dressing effective against *Pseudomonas aeruginosa*, and *Staphylococcus aureus*

Silver Release

Elemental Silver versus Ionic Silver Calcium Alginate / CMC

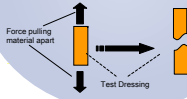


Extended Zone of Inhibition Testing



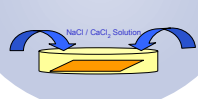
Wet Tensile Strength

1. Cut sample measuring 10cm x 2cm from the width and the length of the dressing
2. Immerse in calcium chloride / sodium chloride solution for 15 minutes
3. Remove sample and allow to drain
4. Place in the Instron tensile tester and pull apart to measure the force required to break the dressing



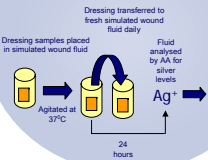
Absorbent Capacity

1. Weight test dressing
2. Add a weight equal to 40 times the dressing weight of calcium chloride / sodium chloride solution. Incubate at 37°C for 30 minutes
3. Remove dressing and allow to drain for 10 seconds, reweigh test dressing
4. Reweigh weighted test dressing



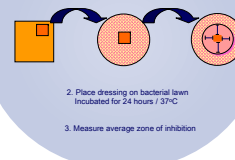
Silver Release

Silver release evaluated by Atomic Absorption (AA) Spectroscopy



Zone of Inhibition

1. Pre-wet dressing in simulated wound fluid
2. Place dressing on bacterial lawn incubated for 24 hours / 37°C
3. Measure average zone of inhibition



Conclusions

SILVERCEL® Calcium Alginate / CMC Antimicrobial Dressing with Elemental Silver has demonstrated sustained and consistent silver ion release *in vitro* in simulated wound fluid over an extended period of time when compared to Calcium Alginate / CMC antimicrobial dressing containing ionic silver

The high absorbency measured *in vitro*, in combination with the high wet tensile strength, successfully demonstrates the dressings' ability to both manage exudate and be removed from the wound bed intact

Furthermore, the dressing has shown potent antimicrobial properties when repeatedly challenged by the common wound pathogens *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Ionic Silver dressing failed to remain intact to allow antimicrobial testing beyond 2 days