

AN *IN VITRO* ANALYSIS OF THE ANTIMICROBIAL ACTIVITY OF A SILVER CONTAINING COLLAGEN DRESSING OVER SEVEN DAYS

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INTRODUCTION



Benefits of a Collagen Dressing with EDTA

- Collagen dressings are often used in the treatment of recalcitrant wounds due to their ability to act as a sacrificial substrate for proteases while maintaining a moist wound environment.¹
- Matrix metalloproteinases (MMP) are essential to wound healing, however high concentrations of MMPs can cause the wound to become chronic. While collagen can be broken down by MMPs (diverting them away from newly formed tissues), ethylenediaminetetraacetic acid (EDTA) within the dressing can chelate essential zinc ions from MMPs leading to deactivation.

Antimicrobial Protection

- The addition of silver to collagen dressings is useful in preventing dressing colonization and potential wound infection.²
- A novel biopolymer dressing* composed of collagen, carboxymethylcellulose (CMC), alginate, ethylenediaminetetraacetic acid (EDTA), and silver was evaluated in this study. The dressing was designed to create a suitable environment for wound healing by balancing moisture and inhibiting MMPs.

The antimicrobial activity of the collagen-biopolymer dressing with silver* was assessed *in vitro* through 24-hour log reduction testing and a 7-day Kirby-Bauer assay against five common wound pathogens.

1. Gibson D, Cullen B, Legerstee R, Harding KG, Schultz G. MMPs Made Easy. *Wounds International* 2009; 1(1): Available from <http://www.woundsinternational.com>

2. Antimicrobials Made Easy. *Wounds International* 2011; 2(1): Available from <http://www.woundsinternational.com>

* ColActive® Plus Ag (Covalon Technologies Ltd. Mississauga, ON Canada) ColActive is a registered trademark of Covalon Technologies Ltd.

METHODS

- **Log Reduction:** antimicrobial activity was evaluated using the AATCC 100 test method, in which samples of the collagen-biopolymer dressing with silver* were directly inoculated with *C. albicans*, *E. coli* and *vancomycin-resistant E. faecalis (VRE)*, and incubated for 24 hours.
 - The reduction of microorganisms (log reduction) was calculated relative to the initial concentrations and control sample.
- **Kirby-Bauer assay:** performed by transferring samples of collagen-biopolymer dressing with silver* daily to fresh Mueller Hinton Agar plates inoculated with *methicillin-resistant S. aureus (MRSA)*, *P. aeruginosa*, *E. coli*, *VRE*, or *C. albicans*.
 - The zone of inhibition (ZOI) was calculated by subtracting the sample width from the diameter of the clear zone (in mm).

RESULTS

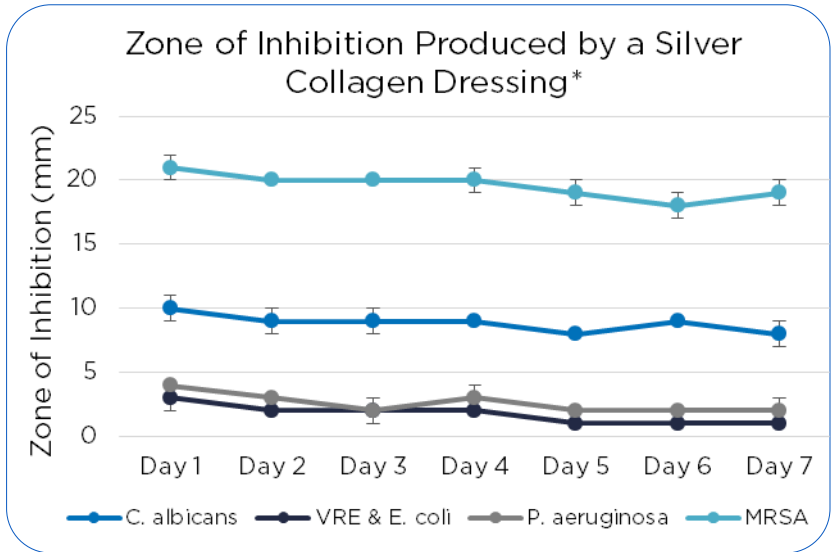
- ✓ The collagen-biopolymer dressing with silver* reduced the initial microbial challenge to zero for *C. albicans* (yeast) and *P. aeruginosa* (gram-negative) after 24 hours of contact (>5 log reduction)
- ✓ *VRE* (gram-positive) was reduced by 99.9981% (> 4-log reduction).

Microorganism	Contact Time	CFU/swatch	Microbial Reduction (%)
<i>C. albicans</i>	Time Zero	1.15 x 10 ⁶	99.9996
	24 hours	0	
<i>P. aeruginosa</i>	Time Zero	1.08 x 10 ⁶	99.9996
	24 hours	0	
VRE	Time Zero	1.20 x 10 ⁶	99.9981
	24 Hours	25	

Table 1: Average antimicrobial activity for a collagen-biopolymer dressing with silver* using AATCC 100 test method.

RESULTS & DISCUSSION

- ✓ The collagen-biopolymer dressing with silver* produced a ZOI every day of the 7-day study for all organisms tested (Graph 1).
- ✓ The largest ZOIs were observed for *MRSA* (18-21 mm) and *C. albicans* (8-10 mm), indicating that these microorganisms are particularly sensitive to silver present in the dressing.
- ✓ *VRE*, *E. coli* and *P. aeruginosa* showed similar ZOIs between 1 and 4 mm, indicating a lower sensitivity but a continued prevention of colonization on or near the dressing.
- ✓ *In vitro* data suggests that antimicrobial activity of the collagen-biopolymer dressing with silver* can be maintained for up to 7 days.



Graph 1: Zone of inhibition (mean \pm standard deviation) produced by a collagen-biopolymer dressing with silver* when tested against 5 common wound pathogens (n=6).

CONCLUSION

- Log reduction testing of the collagen-biopolymer dressing with silver* demonstrated greater than 99.99% of bacteria are killed after 24 hours of contact.
- The collagen-biopolymer dressing with silver* sustained antimicrobial activity in a 7-day ZOI challenge with *MRSA*, *P. aeruginosa*, *E. coli*, *VRE*, and *C. albicans*, making it a suitable dressing for management of full and partial thickness wounds. Silver reduces the incidence of bacterial colonization within the wound dressing.
- These results demonstrate the ability for the collagen-biopolymer dressing with silver* to protect the wound from external contamination (bacterial colonization).

