Assessing the speed of antimicrobial activity within a nitric oxide-generating dressing against antibiotic-resistant wound pathogens

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Introduction

- Hard-to-heal wounds, such as diabetic foot ulcers (DFUs), are at high risk of developing local infection, which is associated with increased risk of systemic infection and lower limb amputation[1]
- A new nitric oxide (NO)-generating dressing (NOGD†) exhibits antimicrobial properties[2]
- The reactive and short-lived free radical, NO, is used by innate immune system to combat pathogens[3,4]

Objective

To evaluate the speed of antimicrobial activity of NOGD† against common wound pathogens, multidrug-resistant *Pseudomonas aeruginosa* (RPA) and methicillin-resistant *Staphylococcus aureus* (MRSA), using an *in vitro* direct inoculation model

Methods

- Challenge microorganisms were antibiotic-resistant RPA (NCTC 8506) and MRSA (NCTC 14245)
- An adaptation of a global antimicrobial textile efficacy standard, AATCC TM100,[5] was employed
- NOGD† (N=3 for each timepoint) or non-antimicrobial gelling fiber control dressing†† (N=1) were inoculated with ~1×10^6 colony-forming units (CFU) of challenge microorganism in simulated wound fluid, by placing 24 mm-diameter dressing samples onto 300 µL volumes of challenge microorganism pipetted into wells of 6-well plates
- Plates were sealed and dressings incubated at 35±3°C for 5, 10, 15, or 30 minutes, or 1, 4, or 24 hours
- Following neutralization of NO activity, viable cells within the dressing were enumerated

Results

- NOGD demonstrated rapid antimicrobial activity:
  - Reducing RPA to undetectable levels (<30 CFU) within 1 hour (Fig 1)
  - Reducing MRSA to undetectable levels within 4 hours (Fig 2)
- Initial rapid reductions were seen:
  - At 10 minutes (0.8 $\log_{10}$) and 15 minutes for RPA (1.8 $\log_{10}$; Fig 1 inset)
  - At 30 minutes (0.8 $\log_{10}$) and 1 hour for MRSA (3.5 $\log_{10}$; Fig 2 inset)
- The non-antimicrobial dressing maintained and then increased viability of both challenge microorganisms throughout the test period (Figs 1-2)

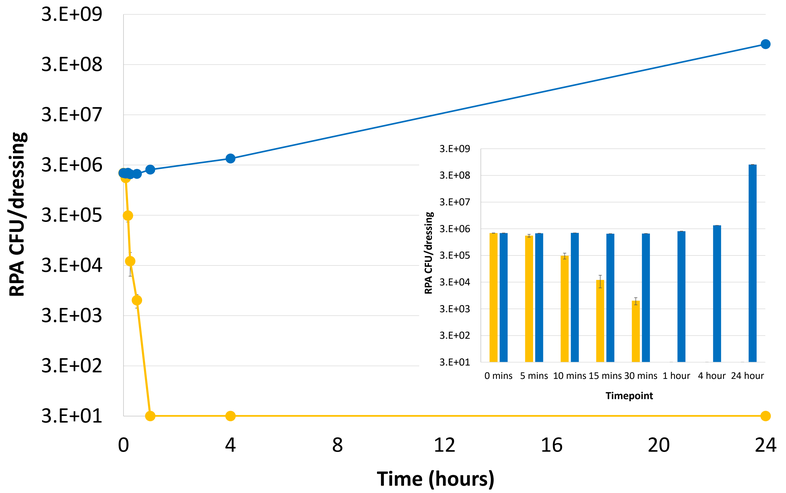

Figure 1. Speed of antimicrobial activity of NOGD against RPA. (■) NOGD (N=3); (●) control (N=1). Inset shows early timepoint kinetics

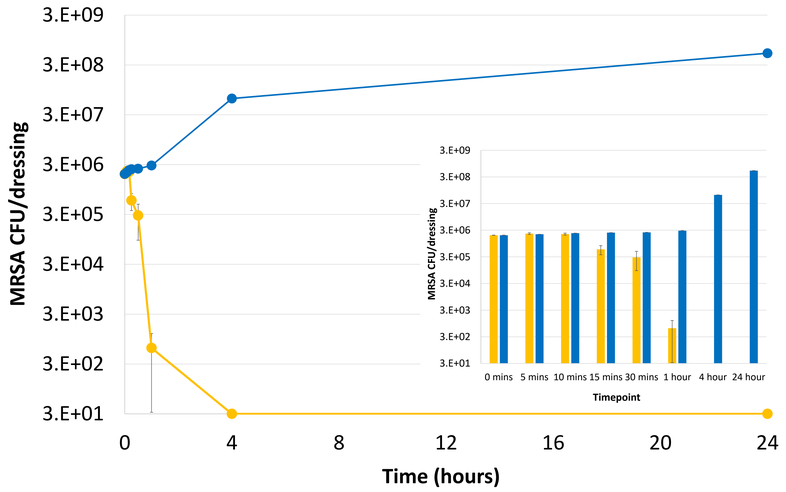

Figure 2. Speed of antimicrobial activity of NOGD against MRSA. (■) NOGD (N=3); (●) control (N=1). Inset shows early timepoint kinetics

Discussion

- Gaining rapid source control in colonized, at-risk, or locally infected wounds is an appealing prospect for clinicians, especially in wounds at high risk of infection-related complications
- NOGD achieved notable reductions of challenging bacteria in minutes, and complete kill within single-figure hours
- NO has multiple modes of action against numerous microbial cellular targets: destruction of cell walls, membranes, and DNA; inhibition of ribosomes and metabolic enzymes, etc.
- The speed of action of NOGD has the potential to support improved infection prevention and resolution efforts in hard-to-heal wounds

Conclusion

A novel NO-generating wound dressing† demonstrated rapid antimicrobial activity against clinically relevant, antibiotic-resistant pathogens *in vitro*; this technology offers promise for the management of wounds that are infected or at risk of infection

References
1. Armstrong et al. *N Engl J Med* 2017;376:2367-237.
2. Waite et al. *Int J Antimicrob Agents* 2018;52:338-343.
3. Bogdan C. *Nature Immunol* 2001;2:907-916.
4. Roberts et al. *Microorganisms* 2024;12:2543.
5. AATCC 100 Antimicrobial Fabric Test

† ConvaNiox™ (Convatec) – available in the EU and UK. ConvaNiox™ is not available in the US. †† Aquacel® Extra™ (Convatec).

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