Antimicrobial activity of a novel silver dressing against wound pathogen biofilms *in vitro* and in an *in vivo* animal model

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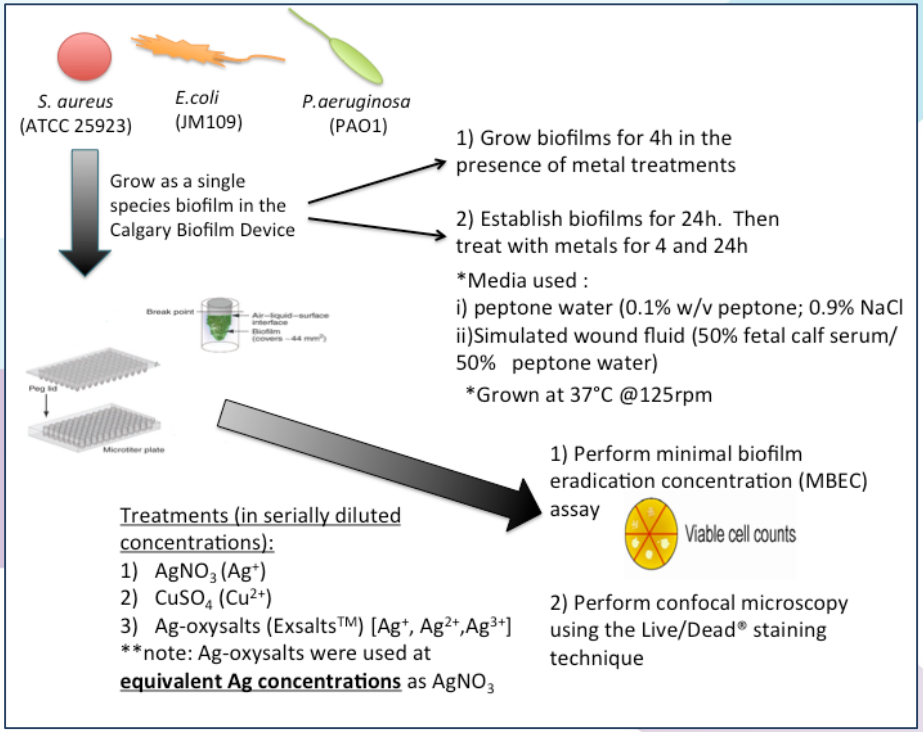
Anti-biofilm activity was measured by determining the minimum biocidal concentrations at 4h, minimum biofilm inhibition concentration and minimum biofilm eradication concentrations (MBEC) of biofilm populations of S. aureus, E. coli, and P. aeruginosa at 24h.

Methodology



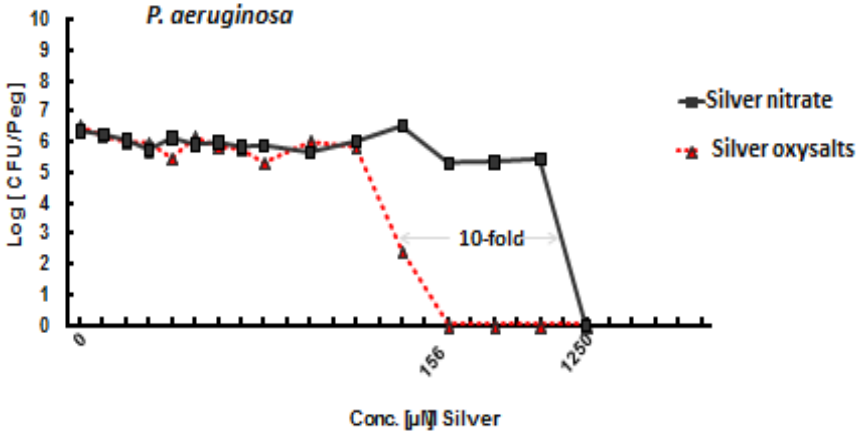
Ref: Kalan L et Al.Antimicrobial Silver in Medical Devices: Composition and Efficacy. Poster SAWC 2013

Organisms were grown in the Calgary Biofilm Device using peptone or simulated wound fluid media (SWF)- 50:50 peptone water and foetal calf serum to represent more closely the chronic woudn environment

Silver and copper salts were used as control. The MBEC assay and confocal microscopy vital staining techniques were used to determine effect.

- Media influences both Ag release and antimicrobial efficacy against both planktonic cells and those growing as a biofilm.
- Charged species and proteins in complex medium bind ionic Ag dramatically reducing bioavailability.
- The MBC 4h/MBEC 24h Ag oxy-salt for P. aeruginosa was 36/156µM) and, for AgNO3, 58/1250µM. The corresponding values for E. coli are 16µM/42µM and 8µM/38µM; and for S. aureus 250µM/1260µM.

Ag Oxysalts Eradicate Established Biofilms *in vitro*

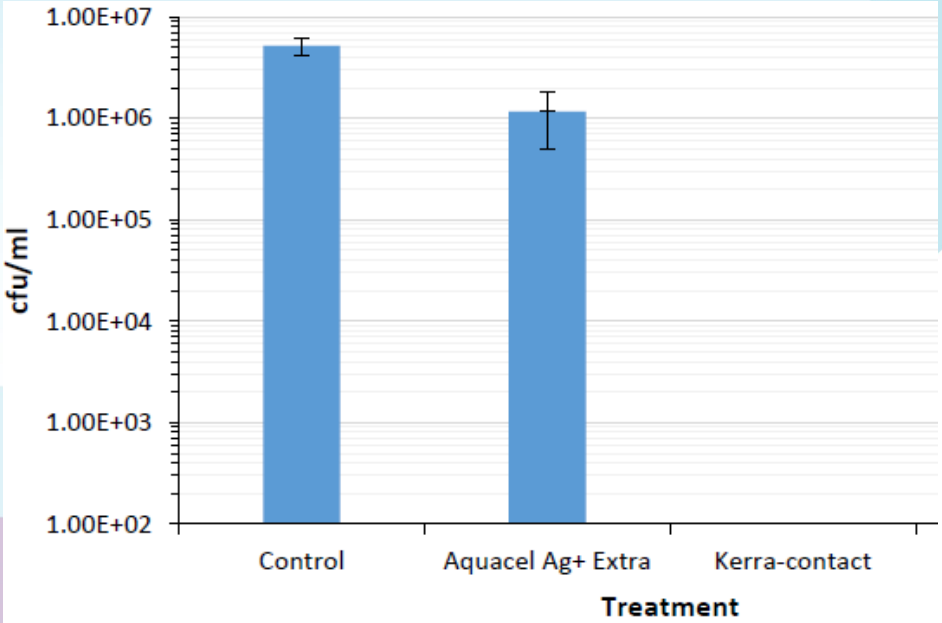


- **The concentration of Ag2+/3+ ions required to eradicate an established P. aeruginosa biofilm is 10x less than Ag+ as represented by silver nitrate.**
- **Ag2+/3+ species are able to maintain greater antimicrobial efficacy regardless of media type due to higher oxidative power.**

Ref: Costerton JW, Khoury AE, Ward KH, Anwar H. Practical measures to control device-related bacterial infections. Int J Artif Organs. 1993 16(11):765-70

This data has been coroborated *in vitro* at Perfectus labs UK.

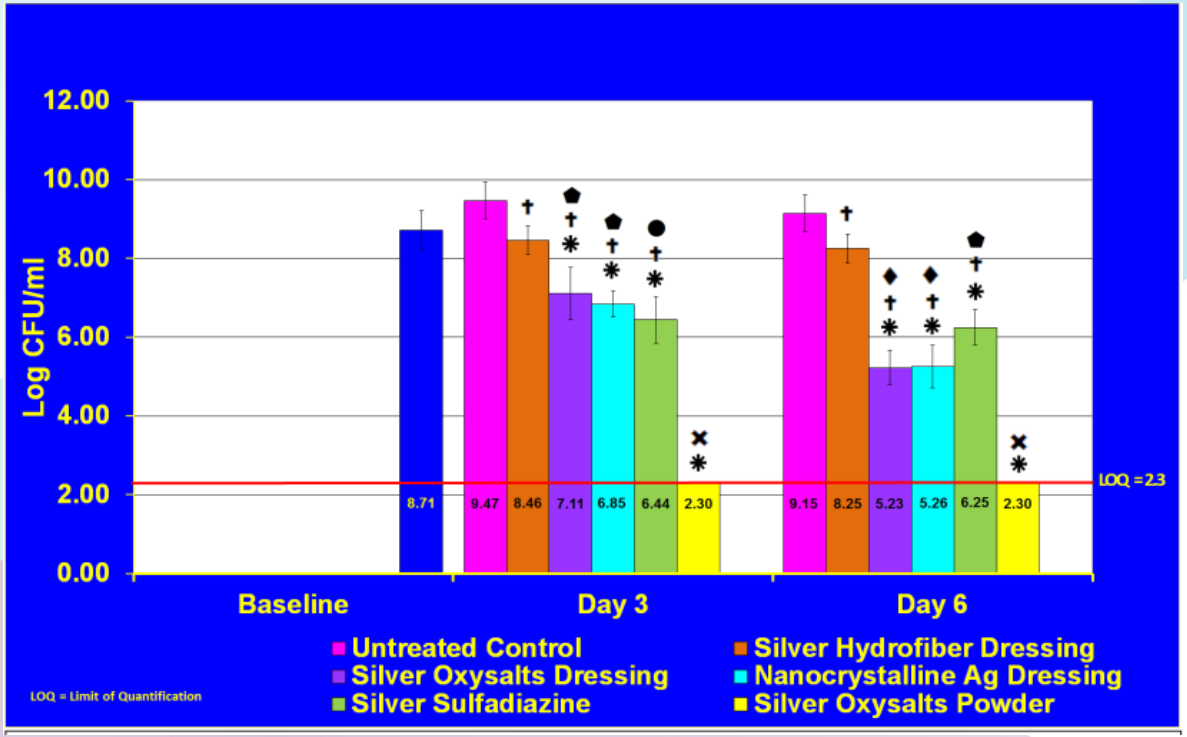
- Twenty-four hour cultures of Pseudomonas aeruginosa were harvested from a Tryptone Soya Agar (TSA) plate using a sterile swab and re-suspended in 20ml of Tryptone Soya Broth (TSB)
- The bacterial suspension was then diluted corresponding to a bacterial concentration of 108 ± 5x107 cfuml-1
- CDC reactors were incubated for 24 hours and 72 hours at 37°C, shaking at 50rpm in order to encourage biofilm growth
- The silver oxysalt dressing gave a Log 7 reduction for both 24h and 72h biofilms.



Quantity of viable *Pseudomonas aeruginosa* recovered from a pre-formed 24 hour biofilm after 72 hour treatment with test agents.

In Vivo Biofilms

- In a pig Pseudomonas biofilm model the silver oxysalt dressing gave a 4 log reduction by day 6
  Superior to some silver hydrofiber dressings with biofilm claims.



Davis S C. Effective Method to Remove Wound Bacteria: Comparison of Various Debridement Modalities in an In Vivo Porcine Model. Journal of Surgical Research 176, 701–707 (2012)

Conclusion

- Silver in higher oxidation state in the silver oxysalt dressing
- Disrupts and breakls down biofilms exposing bacteria to be killed
- Does this at far lower concentrations of Ag+
- Eradicates biofilms even in hostile environment of SWF
- In animal models sustained effect reduced bacterial load in wounds over 6 days.
- Refer to clinical