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O1132 Limiting *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus* biofilm formation in wounds using cold atmospheric plasma

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Background: Antibiotic resistance is rapidly increasing at a rate disproportionate to discovery of new treatment options. Cold atmospheric plasma (CAP) is a jet of ionized inert gas which on interaction with air and water produces reactive oxygen and nitrogen species (RONS): predominately hydrogen peroxide, while sustaining a "cold" temperature. CAP is able to decontaminate wounds via oxidative stress so may be a non-antibiotic treatment option for infection.

Materials/methods: CAP conditions were as follows: Helium gas flow (2 standard liters per minute) fixed voltage (10kV), fixed power (25kHz), distance between the jet and substrate (5mm) and treatment time of 5 minutes. *Pseudomonas aeruginosa* (PA01) and Methicillin resistant *Staphylococcus aureus* biofilms were grown in triplicate on polycarbonate membranes inoculated with artificial wound fluid to mimic wound for a total of 24 hours with CAP treatment intervention at 0, 4, 8, 12, 20 and 24 hours into growth.

Results:

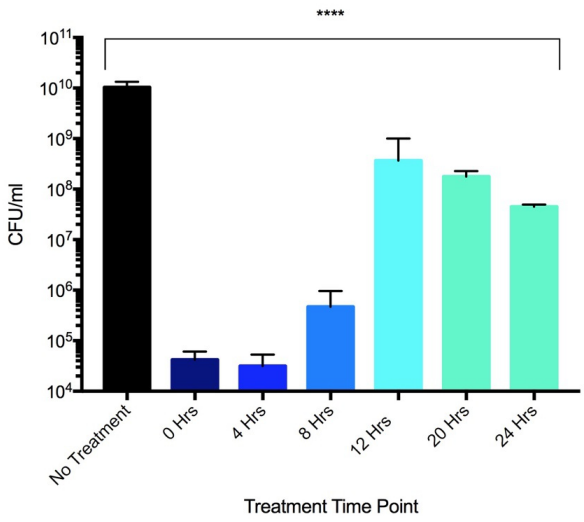

Figure 1: Effect of CAP treatment at various stages of growth of developing *P. aeruginosa* biofilm following initial inoculation at 10^6 CFU /mL. Early intervention (< 8 hours) gave effective reduction in final viable cells.

CAP treatment of an established 24-hour biofilm (10^{12} CFU/mL) produced a 1.5 log reduction in viable cells (Figure 1). Developing biofilms were CAP treated at various stages of growth, when applied at 0, 4 and 8hrs into total 24hr growth time, final viable bacterial count (after 24hrs) was $<10^7$ CFU/mL. Therefore, CAP treatment was found to be effective at limiting biofilm growth. However, CAP treatment 12 hours after incubation did not prevent

a biofilm from forming, but does reduce the final cell count relative to untreated controls.

Conclusions: CAP treatment administered prophylactically onto a simulated wound could prevent the formation of biofilms even after inoculation with a significant bacterial load. In principle this may improve wound care, decreasing healing time and hospital stay. We propose future development of this technology in tandem with a Theranostic hydrogel capable of detecting infection at the critical colonisation threshold (~6-8 hours). CAP may reduce the bacterial bioburden as well as providing a trigger for the release of an antimicrobial agent within the hydrogel.