ANTI-BIOFILM ACTIVITY DEMONSTRATED FOLLOWING TREATMENT WITH A NOVEL PLASMA DEVICE

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Introduction:

A plethora of data describes the presence of biofilms within chronic wounds and links the presence of biofilm to delayed wound healing. Clinical case studies have demonstrated that the appropriate removal of biofilm can restore the normal progression of healing. This study investigates the efficacy of a novel non thermal gas plasma device used to treat *Staphylococcus aureus* biofilms.

Methods:

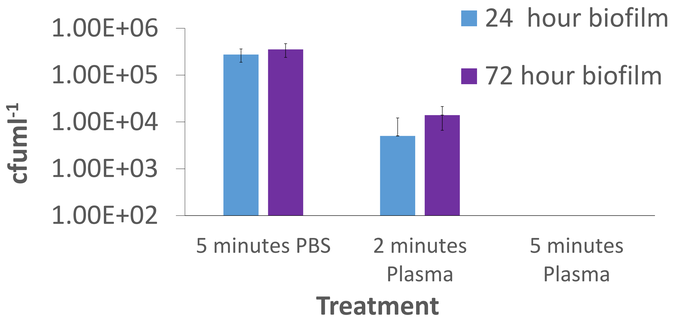
- A twenty-four hour culture of *S. aureus* was harvested from a Tryptone soya agar (TSA) and re-suspended in Tryptone Soya Broth (TSB).
- The suspension was diluted in TSB to give an overall concentration of 10^7 cfuml^{-1} and used as the initial inoculum.

CDC reactor

- Polycarbonate coupons were used as the surface for biofilm growth.
- Once prepped, the CDC reactor was incubated for 24 and 72 hours at 37°C with shaking at 50rpm.
- Following incubation coupons were removed from the reactor and washed three times in sterile PBS to remove planktonic organisms.
- Washed coupons were treated with gas plasma for 2 minutes or for 5 minutes. Control coupons were treated with PBS for 5 minutes (N=3).
- Coupons were transferred into 2ml of TSB and sonicated for 5 minutes in order to recover remaining viable microorganisms. Recovered microorganisms were quantified using serial dilutions and colony counts.

Results:

- No viable organisms were recovered from coupons that had been treated for 5 minutes with gas plasma.
- Compared to PBS controls 2 minute treatment of the 24 hour biofilms and 72 hour biofilms resulted in a 1.74 and 1.40 log reduction in recoverable viable bacteria respectively.



Discussion:

- Five minute treatment with gas plasma at the settings used in this study effectively reduced the number of recoverable viable organisms so that no viable organisms were recovered.
- A reduction in microorganisms was seen after 2 minutes of treatment however repeated treatments, or a longer duration of treatment may be required in order to effectively treat biofilm infections *in vivo*.
- The CDC reactor model provides a reliable and repeatable hard surface model for the investigation of biofilms however it uses surface attachment as a measure of biofilm formation and does not attempt to address the complexities of the wound scenario. Further testing would be required in order to determine whether the treatment is bactericidal or bactericidal in it's activity.

Conclusions:

Gas plasma treatment may be an effective method of disrupting *Staphylococcus aureus* biofilms and therefore has the potential to remove the challenge of persistent infection within a chronic wound thus allowing the wound to heal appropriately. Appropriate healing decreases wound care costs and improves patient standard of life.

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