SCIENTIFIC MEDICAL CLINICAL AFFAIRS

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Research Compact

Tags Octendine, biofilm model, wound

Title ## Quantitative Insights and Visualization of Antimicrobial Tolerance in Mixed-Species Biofilms

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Aim of the study

Wound biofilms are one of the greatest local challenges in hard-to-heal wounds, as most of chronic wounds are densely populated with such, and the species within often protect themselves from antimicrobial agents. The quality and quantity of the biofilm are influenced by the human environment and differ for every patient. Moreover, in a multispecies biofilm there are many possible interspecies interactions. It is reasonable that the response of the biofilm to antimicrobial agents is dependent on the composition and interactions of the species. But the extent to which the diversity of species in the biofilm is clinically relevant, is still unclear.

Methods

Two dual-species wound biofilm models M1 (*P. aeruginosa* + *S. aureus*) and M2 (*P. aeruginosa* + *E. faecium*) were prepared using the Leucocyte-Rich Human-Plasma Biofilm Model (lhBIOM). The biofilms were treated after 24, 48 and 72 h with antiseptic and antimicrobial solutions containing the active ingredients octenidine-dihydrochloride/ phenoxyethanol (0.1% OCT/ 2% Phe) and polyhexamethylene biguanide (0.1% PHMB) and compared to the untreated control. To determine the differences in bacterial response to the antimicrobial solutions, the mixed-species biofilms were also evaluated based on DIN EN 13727. The solutions were diluted to 10%, 50% and 80% of their original strength.

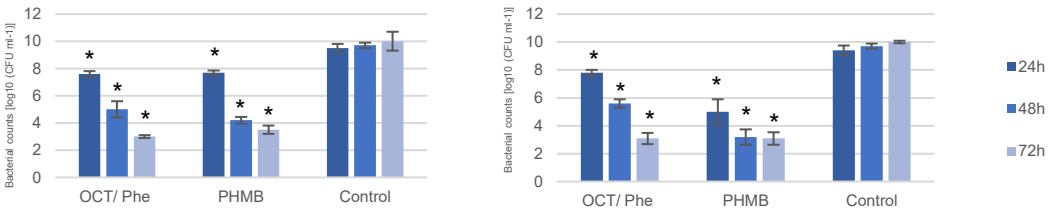
Results

OCT/ Phe and PHMB acted as bactericidal at 50% and 80% concentration and showed a complete bacterial eradication (reduction factor 5 log, according to EN 13727:2015, high organic load, 60 s treatment). At a concentration of 10% OCT/ Phe, all species were eradicated regardless of the combination except for *P.aeruginosa*. No bactericidal effect (reduction factor <5 log) was achieved for all species at 10% PHMB concentration. Both irrigation solutions induced a significant reduction of ≥5 log after 72 h, whereas the bacterial counts of the control slightly increased. After 72 hours, there were hardly any differences between the models in the response to OCT/ Phe and PHMB. After 24 hours, there was a stronger effect of PHMB on M2 than on M1.

Fig. 1: Log10 reductions in mixed-species suspensions after the application of antimicrobial solutions

Concentration	M1 lgN0: 7.62				M2 lgN0: 7.20			
	OCT/ Phe		PHMB		OCT/ Phe		PHMB	
	P. aeruginosa	*S. aureus*	*P. aeruginosa*	*S. aureus*	*P. aeruginosa*	*E. faecium*	*P. aeruginosa*	*E. faecium*
10%	2.77	≥5.47	3.64	4.96	3.63	≥5.05	3.38	3.89
50%	≥5.47	≥5.47	≥5.47	≥5.47	≥5.05	≥5.05	≥5.05	≥5.05
80%	≥5.47	≥5.47	≥5.47	≥5.47	≥5.05	≥5.05	≥5.05	≥5.05

Fig. 2: Bacterial counts of M1 and M2 after treatment with antimicrobial solution after 24, 48 and 72 h



Conclusion

OCT/ Phe exhibited a bactericidal effect against all species examined from a concentration of 50%. At 10% concentration, OCT/ Phe is able to kill more species than PHMB. The effect of OCT/ Phe is less dependent on the exact composition of the biofilm.