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Paper Poster Session
Vascular and vascular access infections

The NeutraClear® needleless connector protects from catheter colonization

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Background: *S. aureus* is a leading pathogen in skin and skin structure infections including surgical and traumatic infections that are associated with biofilm formation. Since biofilm formation refers to high phenotypic resistance of the embedded bacteria, they are almost impossible to eradicate by conventional antibiotics. Therefore, alternative therapeutic strategies are of high interest. Carbon monoxide (CO) is a toxin that inhibits the key enzymes of the essential electron transport chain, like cytochromes or cytochrome c oxidase, thus cells exposed to CO are killed. For controlled delivery and release of CO in aqueous environment, carbon monoxide-releasing molecules (CORMs) are proved as most promising for therapeutic usage. Here, we analyzed CO-releasing biocompatible organic non-wovens as promising local antimicrobial therapy for skin wound infections.

Material/methods: CORMA-1-PLA20 and PLA were electrospun to approximately 25 µm thin non-wovens and analyzed by scanning electron microscopy (SEM) and dispersive X-ray spectroscopy (EDX). The content of CORM-1 incorporated into the non-wovens was quantified by UV-VIS spectroscopy and CO-release kinetics were performed under dry and liquid conditions. Biofilms of MRSA were grown on pieces of non-wovens for 48 hours and irradiated at 405 nm (10 mW) for 5 min. The biofilms were life/dead-stained after treatment and visualized by confocal laser scanning microscopy. Viable and dead cells were quantified using an in-house algorithm (qBA). Reactive Oxygen Species (ROS) formation was determined by dichlorodihydrofluorescein diacetate as fluorescence emission at 535 nm. Toxicity tests were performed on 3T3 fibroblasts cell line.

Results: The CO content of the non-wovens was completely released by 5 min irradiation at 405 nm. Under liquid conditions CO-saturation was achieved within 60 min. Only light-induced CO treatment of mature biofilms led to high proportion of dead bacteria and strongly reduced viable cell counts within 90 min and 130 min after treatment compared to the controls. The non-wovens showed weak cytotoxicity on 3T3 fibroblasts that could be assigned to the PLA-material rather than to CO. ROS concentration increased in CO-dependent manner, but no significant differences of small colony variant portions due to CO-treatment were observed.

Conclusions: The biofilm killing effect of CORM-1-PLA20 is most likely caused by the light-induced local release of a high dose of CO that cannot be achieved by soluble CORMs. The CO-treatment by non-vowens effectively prohibits formation of SCVs despite it induces ROS formation indicating that ROS could be involved in the killing process of MRSA biofilms. Such CO-releasing non-wovens might

be potential wound dressings for the antimicrobial treatment of human pathogens in accessible positions like traumatic and surgical skin and skin structure infections or diabetic foot infections. The contribution of CO to the cytotoxicity was low and can be particularly negated with regards to short exposure periods of such non-wovens in a clinical setup.