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Innovative wound infection treatment using electrospun antimicrobial wound matrices

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Non-healing wounds and wound infections are a major problem for society due to increased healthcare costs and significant burden to patients. As microbial biofilms are one of the main reasons for the development of non-healing skin wound infections, novel treatment strategies are sought to fight them. We have started to design and develop antimicrobial wound matrices by electrospinning. This method allows obtaining nanofibrous wound matrices that have several advantages such as resemblance of the natural extracellular matrix, high surface area to volume ratio, tunable porosity, sufficient gas-exchange and possibility to include antimicrobial agents such as antibiotics, antimicrobial peptides (AMPs). Delivery of AMPs by electrospun fibrous matrices enables to improve their stability and lower the toxicity of AMPs, and provides a controlled delivery profile together with prolonged activity. AMPs eradicate the infections more effectively due to their mechanisms of action which is usually related to the direct damage of bacterial plasma membranes and/or penetration within the bacterial cytoplasm to access intracellular targets. Topical application of AMPs is known to promote the migration of keratinocytes and fibroblasts, and this contributes significantly to an accelerated wound healing. In this presentation, the results from two case studies will be given where wound matrices functionalized with different antimicrobial agents have been prepared and fully characterized *in vitro* and *ex vivo* on relevant wound pathogens. Safety and biocompatibility of the matrices has been tested on eukaryotic cells. We have shown that the design, selected materials and electrospinning methods have a huge effect on the potency and efficacy of the antimicrobial matrices and futher studies will determine the clinical efficacy and safety of these novel antimicrobial wound matrices.

Recent publications

1. Gera S. Kankuri, E, Kogermann K. Antimicrobial peptides – Unleashing their therapeutic potential using nanotechnology. Pharmacology & Therapeutics. (2021).
2. Ramos Celia, Lanno Georg-Marten, Laidmae Ivo, Meos Andres, Harmas Riinu, Kogermann Karin. High humidity electrospinning of porous fibers for tuning the release of drug delivery systems. International Journal of Polymeric Materials. (2020).
3. Lanno, Georg-Marten, Ramos, Celia, Preem, Liis, Putrinš, Marta, Laidmäe, Ivo, Tenson, Tanel, Kogermann Karin. Antibacterial porous electrospun fibers as skin scaffolds for wound healing applications. ACS Omega, 5 (46), 30011−30022.

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