ANTIBIOFILM REDUCTION ON A SCRATCHED-3D SKIN TISSUE MODEL USING NANO-ENCAPSULATED MUPIROCIN

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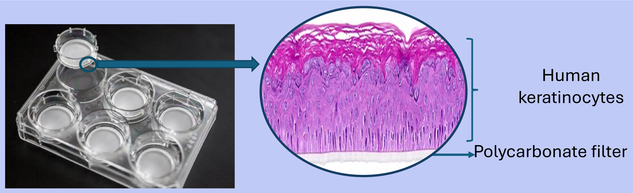
1 Introduction

Current wound management:
- Wound debridement
- Off-loading to release pressure
- Skin dressings

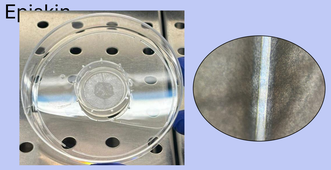
are insufficient due to their susceptibility to bacterial infections and biofilm formation[1].

Aim:
Evaluation of the potential antibacterial activity of Mupirocin (MUP) encapsulated in methacrylate hyaluronic acid (HA-MA) polysaccharide-stabilized emulsion on a 3D skin tissue model infected by Staphylococcus aureus.

2 Methods



2.1 SkinEthic™ Human epidermidis purchased from Episkin



2.2 Scratch the surface of the 3D skin model

2.3 Infect the scratch surface with 1 × 10^5 CFU/mL of *Staphylococcus aureus*

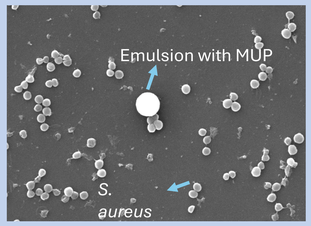
2.4 after 24 hours of incubation, a solution of nano-encapsulated MUP (1.2 µg/mL) was added and incubated for another 24 hours.

References

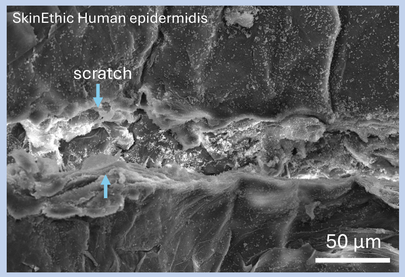
1. Ding X, Tang Q, Xu Z, Xu Y, Zhang H, Zheng D, Wang S, Tan Q, Maitz J, Maitz PK, Yin S, Wang Y, Chen J. Challenges and innovations in treating chronic and acute wound infections: from basic science to clinical practice. Burns Trauma. 2022;10:tkac014. doi: 10.1093/burnst/tkac014.
2. Khoshnood S, Heidary M, Asadi A, Soleimani S, Motahar M, Savari M, Saki M, Abdi M. A review on the mechanism of action, resistance, synergism, and clinical implications of mupirocin against *Staphylococcus aureus*. Biomedicine & Pharmacotherapy. 2019; 1809-1818, doi: 10.1016/j.biopha.2018.10.131.

3 Results

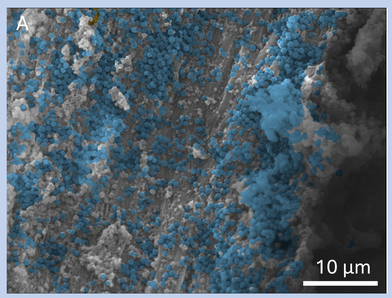
Emulsions loaded with MUP

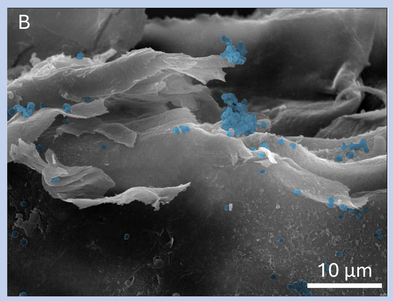


3.1 Oil-in-water (O/W) emulsions stabilized by polysaccharide methylacrylated hyaluronic acid (HA-MA) and loaded with Mupirocin, an antibiotic effective against gram-positive bacteria



3.2 Observation of scratch under the scanning electron microscope (SEM)





3.3 After infection of scratch on the skin with *S. aureus* and allowed them to create aggregations, they were exposed to the nano-emulsions with MUP (HA-MA-MUP). **Figure A** shows the microcolonies aggregates of bacteria on the SkinEthic model treated with HA-MA. In contrast, **Figure B** demonstrates the reduction of microcolonies in exposure to HA-MA-MUP.

4 Discussion

- Creating a scratch on the SkinEthic Human Epidermidis and infecting it with a high number of *S. aureus* (a Gram-positive bacterium and one of the main concerns in chronic wound infection) was performed to mimic the situation of chronic wounds.
- Applying the HA-MA-MUP in the place of the scratch demonstrated a significant reduction in bacterial numbers and aggregates in comparison to HA-MA emulsions without MUP.

5 Conclusion

- So far, MUP has been used in topical ointments for external application due to its rapid enzymatic degradation in the blood[2],
- The efficiency of MUP-loaded in this O/W emulsion system against the Gram-positive bacterial cells and their biofilms suggests its potential to extend beyond topical prescriptions.

Acknowledgment

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