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Poster abstract submission

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Poster title

Light-Controllable Nanozyme-Based Enzyme-Mimicking Microneedle Platform for Combating Skin Subdermal Infections and Inflammation

Poster abstract

In recent decades, antimicrobial resistance (AMR) has acted like a silent pandemic, significantly increasing the complexity in treating infectious diseases. The emergence of antimicrobial resistance has diminished the effectiveness of established antibiotics and complicated the treatment of even common infections. Among antimicrobial-resistant pathogens, methicillin-resistant Staphylococcus aureus (MRSA) represents one of the most clinically significant bacteria, frequently associated with challenging infections. MRSA commonly causes skin and soft tissue infections, for which effective therapeutic options remain limited. Current treatments (e.g. creams or patches) often exhibit limited efficacy due to poor drug penetration, which further leads to incomplete bacteria killing, biofilm recurrence, and, more importantly, development of drug resistance. Microneedles, as one of the most promising transdermal drug delivery platforms, are under active investigation. However, under conditions of AMR, the drug payload remains limited, owing to bacterial resistance and the limited drug-loading capacity of microneedle systems. Reactive oxygen species (ROS)-based treatments have been considered one of the most promising antibiotic-free strategies. Pathogens and inflamed tissues rely on tightly regulated ROS homeostasis to survive and adapt; therefore, the development of novel drugs capable of deliberately disrupting this redox equilibrium can be a key strategy to simultaneously reduce infection and dampen inflammation. Here, we reported two different nanozymes (Vanadium Carbide MXenes and Boron nanoflakes) able to mimic peroxidase-like and/or catalase-like activities, which can be utilised for antimicrobial and anti-inflammatory applications. In addition, both nanozymes have effective photothermal activities, with photothermal conversion efficiency around 43% and 13% for Vanadium Carbide MXenes and Borophene, respectively. Owing to the high light responsiveness of the nanozymes, the light enhancement here can also help with increasing the effectiveness of enzyme-mimic activities while combining with photothermal activity to provide a multimodal antimicrobial strategy. Herein, we integrated nanozymes in microneedles, aiming to provide a more precise transdermal delivery of nanozymes to treat skin and soft tissue infections.

Research topic

Small molecule therapeutics

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