Skin infection treatments: the combined effect of photodynamic therapy and antibiotics

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Bacterial resistance is undoubtedly recognized as a major medical challenge in most healthcare systems. Staphylococcus aureus is a common bacterium that belongs to the natural microflora present on skin surface and on mucous membranes but can become pathogenic in conditions such as breakage of the skin barrier or decreased immunity. S. aureus also tends to accumulate on medical devices, such as heart pacemakers and catheters and the infections are usually treated with antibiotics. However, the hospital-acquired infections by S. aureus have grew dramatically, being accompanied by an increase in antibiotic-resistant strains, particularly methicillin-resistant S. aureus (MRSA) and vancomycin-resistant strains (VRSA), which are collectively recognized as a very serious health threat. Consequently, it is urgent to develop new alternative approaches to conventional antibiotics to deal with bacterial infections. Antimicrobial photodynamic therapy (aPDT) is being considered a very promising alternative with a multi-target action and no emergence of resistances.

Although it is recognized that aPDT is effective to combat bacterial infections, little effort has been made to use the combined effect of aPDT and antibiotics. In this context, it was evaluated how the efficiency of aPDT to treat S. aureus skin infections is affected by the presence of conventional antibiotics. The studies were performed in porcine skin, a good ex-vivo model for human skin, and the treatment was mediated by a cationic photosensitizer (Tetra-Py+-Me) in the pre-sence and in the absence of ampicillin (Figure 1). The results showed that aPDT is an effective approach to control S. aureus infection in skin, inactivating the bacterium efficiently after three successive cycles of treatment or after one cycle by using the combination aPDT and ampicillin (Figure 2).

This work is a milestone in understanding the rationale of the combined effect of aPDT and antibiotics for the treatment of skin bacterial infections, which represents a potential alternative treatment strategy in face of the antibiotic resistance crisis.

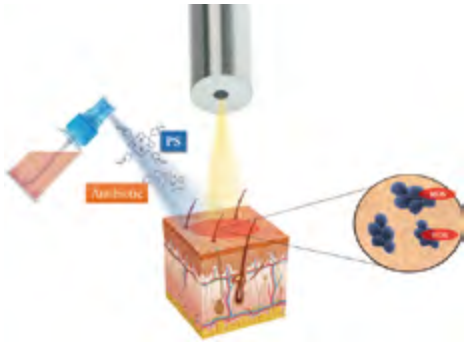

FIGURE 1
Combined action of antimicrobial photodynamic therapy (aPDT) and antibiotics in the inactivation of Staphylococcus aureus.

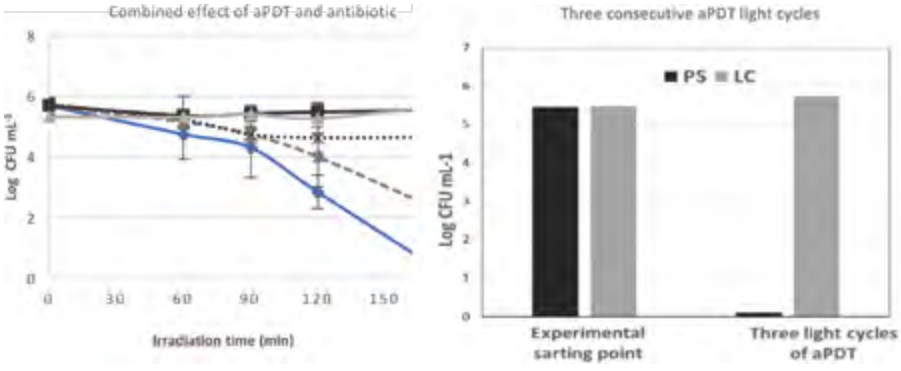

FIGURE 2
Inactivation of S. aureus on porcine skin.