It has been hypothesized that four main causative factors, which can occur alone or in combinations, contribute to the pathogenesis of chronic wounds: tissue hypoxia, repetitive ischemia, perfusion injury, age impaired stress response, and elevated bacterial levels. Persistent bacterial biofilm is known to contribute to molecular pathologies of many diseases, including cystic fibrosis, otitis media, and periodontitis. Recently, biofilms were proposed to be a major cause of impaired wound healing, contributing to the development of chronic wounds. James et al. (2008) showed that 60% of chronic wounds and 6% of acute wounds contained biofilm structures. Development of microbial biofilm, consisting of microorganisms embedded in a self-synthesized secreted exopolymycin matrix, forming complex dense microbial communities with complex 3D architecture provides substantial protection for bacteria to host antibodies, phagocytic inflammatory cells, antibiotics, antiseptics, and disinfectants while facilitating waste removal and uptake of nutritional requirements. Biofilm development is a complex process that is greatly influenced by the bacterial microflora, the environment, and in particular, the substrate to which it attaches.

We developed an in vitro model of mature biofilm cultured on porcine skin explants and used this model to assess the efficacy of commercial antimicrobial agents. Four types of antimicrobial agents (iodine, silver, polyhexamethylene biguanide (PHMB) and doxycycline) and three types of moisture dressings (cotton gauze, sodium carboxymethylcellulose fiber, and calcium alginate fiber) were assessed. Cadoromax iodine treatment produced complete kill of Pseudomonas aeruginosa (PAO1) biofilm, whereas povidone iodine saturated gauze reduced biofilm bacteria ~1–2 log, nanocrystalline silver reduced PAO1 biofilm ~3 log compared to its direct counterpart dressing. Doxycycline did not significantly reduce PAO1 biofilm levels compared to no dressing and ~1–2 logs compared to moisture dressings. Moisture dressings, particularly calcium alginate fiber, promoted PAO1 biofilm growth compared to no dressing. This model suggests that silver, povidone iodine, PHMB and doxycycline are relatively ineffective in killing mature Pseudomonas aeruginosa biofilm, whereas cadoromax iodine is an effective microbicidal wound dressing.