

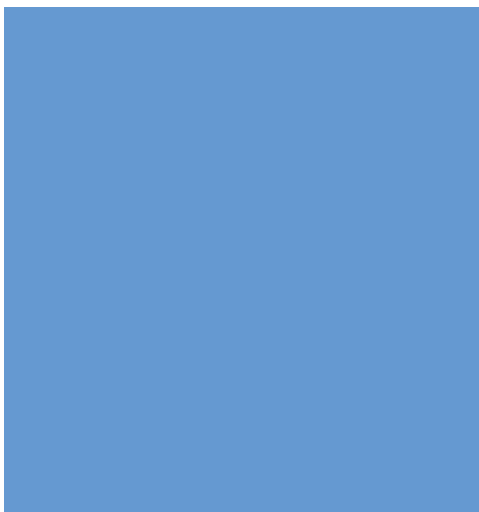
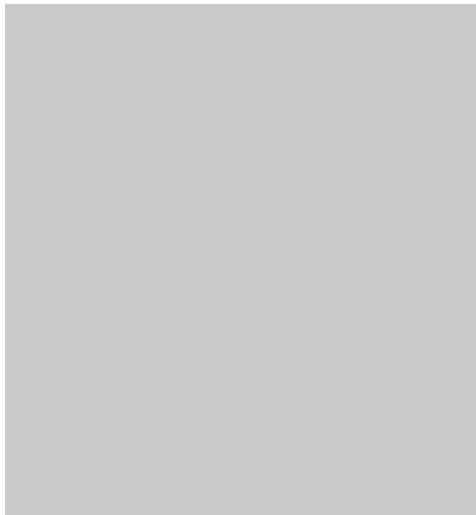
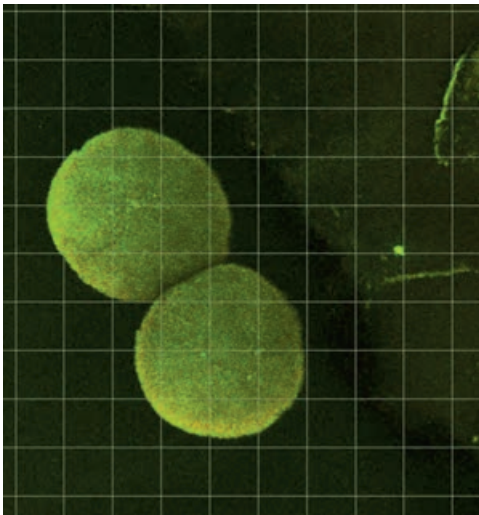
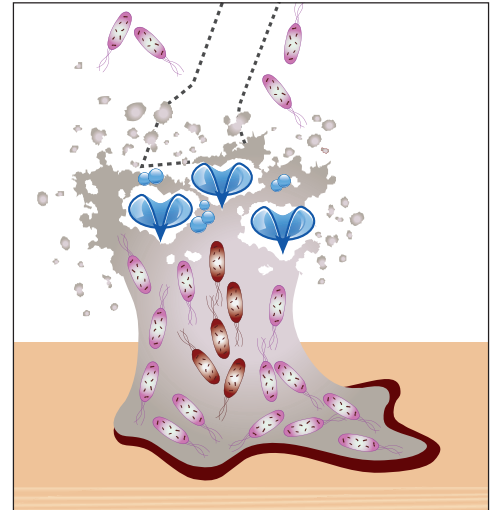


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INNOVATIVE SURGERY



New research shows
**Ultrasonic-Assisted
Wound Debridement (UAW)**
effective on biofilms

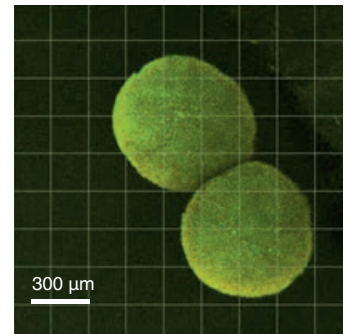


→ Biofilm in wounds: an attachment with consequences

Biofilms in chronic wounds are gaining increasing importance. Studies show that biofilms can be found in 60% of chronic and 6% of acute wounds. They cause a delay in the wound healing process*.

Biofilm can form wherever bacteria have colonised a moist environment **1**. The formation of biofilm comprises several phases. At first, free floating bacteria (planktonic) adhere to a surface **2**. This initial attachment is reversible, but then becomes increasingly permanent. In the firm attachment phase the bacteria then form a matrix of extra-cellular polymeric substance (EPS matrix) composed of polysaccharides and proteins **3**.

A biofilm is fully mature after only 24 hours and its EPS matrix protects the bacteria living inside of it from external influences**. Consequently, this results in a significant delay or prevention of wound healing.

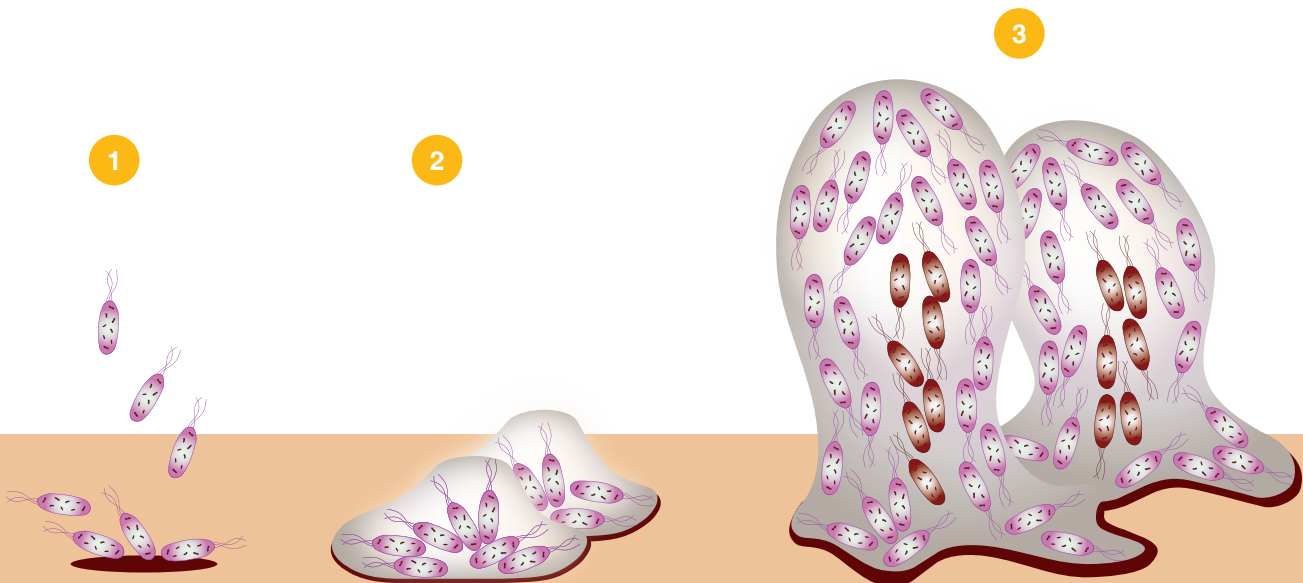


48 hours old biofilm
(*Staphylococcus aureus*)
Source: Biofilm Test Facility,
University of Copenhagen

Significance of biofilm in wound treatment:

- Treating wounds with biofilms is extremely difficult
- The EPS matrix protects bacteria from the body's own defence mechanisms
- The penetration of antimicrobial substances is made more difficult or prevented

Outer sessile bacteria 
Inner sessile bacteria 
difficult to attack

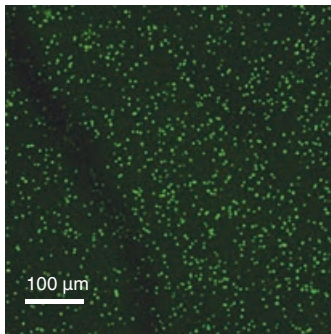


* Ref: Metcalf DG, Bowler PG. Biofilm delays wound healing: A review of the evidence. Burns & Trauma 2013; (1) 1: 6-12

** Ref: James GA, Swogger E, Wolcott R, et al. Biofilms in chronic wounds. Wound Rep Reg 2008;(1):37-44; Bjarnsholt T. The role of bacterial biofilms in chronic infections. APMIS 2013

Effective removal of biofilms: using Ultrasonic-Assisted Wound Debridement

Wound debridement is a generally recognised method for cleansing wounds, and thus also for the removal of biofilm. Ultrasonic-Assisted Wound Debridement (UAW) is an effective and gentle method of wound debridement.



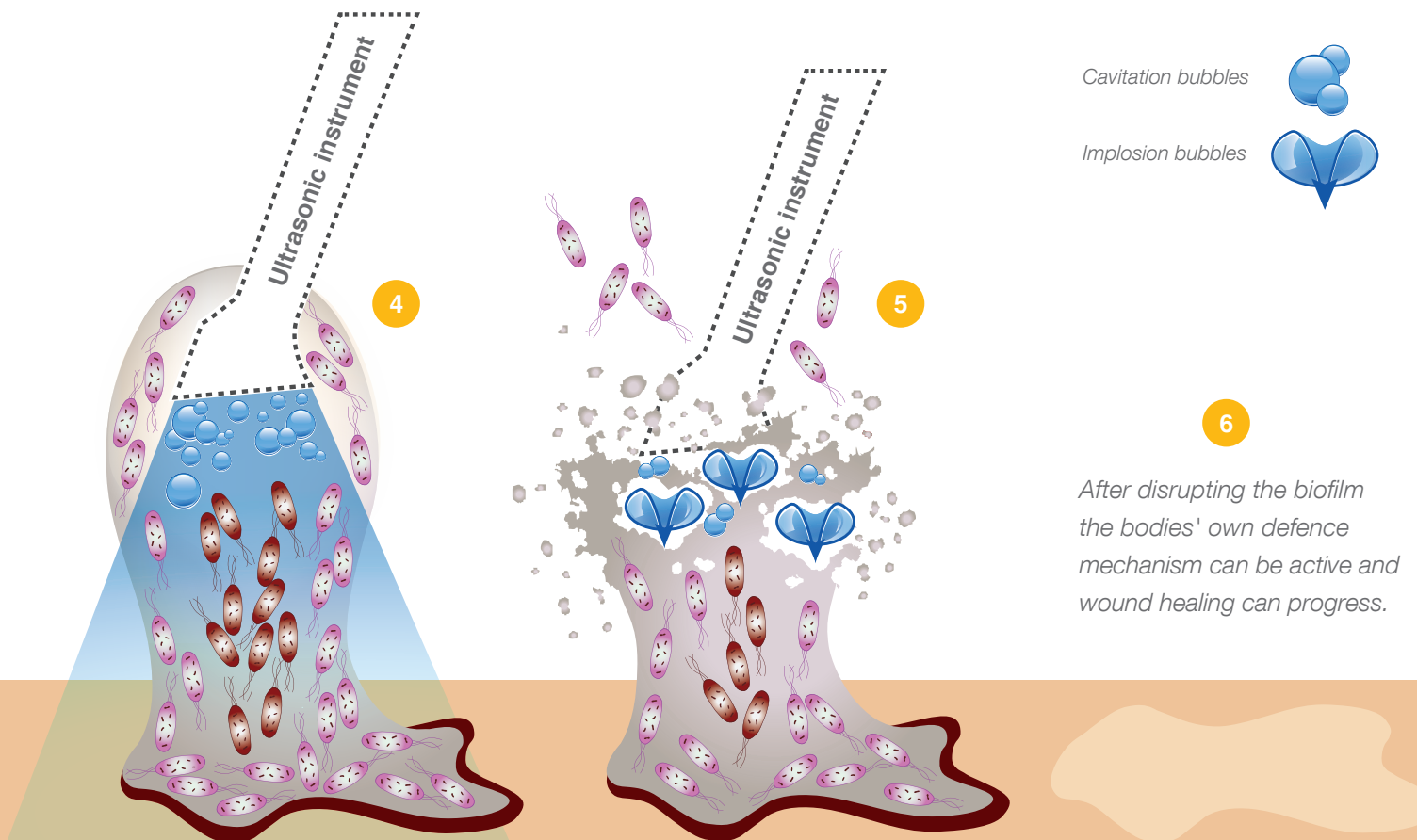
Disrupted biofilm after 10 seconds UAW with 10% ultrasound intensity, 25 kHz

Source: Biofilm Test Facility, University of Copenhagen

This innovative wound cleansing method is based on the cavitation principle. The vibrations from an ultrasonic instrument in an irrigation solution results in the formation of **4** and the implosion of vacuum bubbles **5**. This destroys the EPS matrix. The bacteria previously protected in the biofilm break apart and their membranes are damaged^{***}. Now they can be attacked with assistance from the immune system or antimicrobial therapies^{****}. Because the procedure does not damage healthy tissue the healing process can proceed more rapidly.

Effective removal of biofilms by Ultrasonic-Assisted Wound Debridement (UAW):

- Breaks down biofilm via cavitation
- Affects bacterial membrane
- Effective bacteria control via immune reaction or antimicrobial therapy



^{***} Ref: Runyan CM, Carmen JC, Beckstead BI et al. Short Communication. Low -frequency ultrasound increases outer membrane permeability of *Pseudomonas aeruginosa*. *J. Gen. Appl. Microbiol.* (2006) 52: 295-301

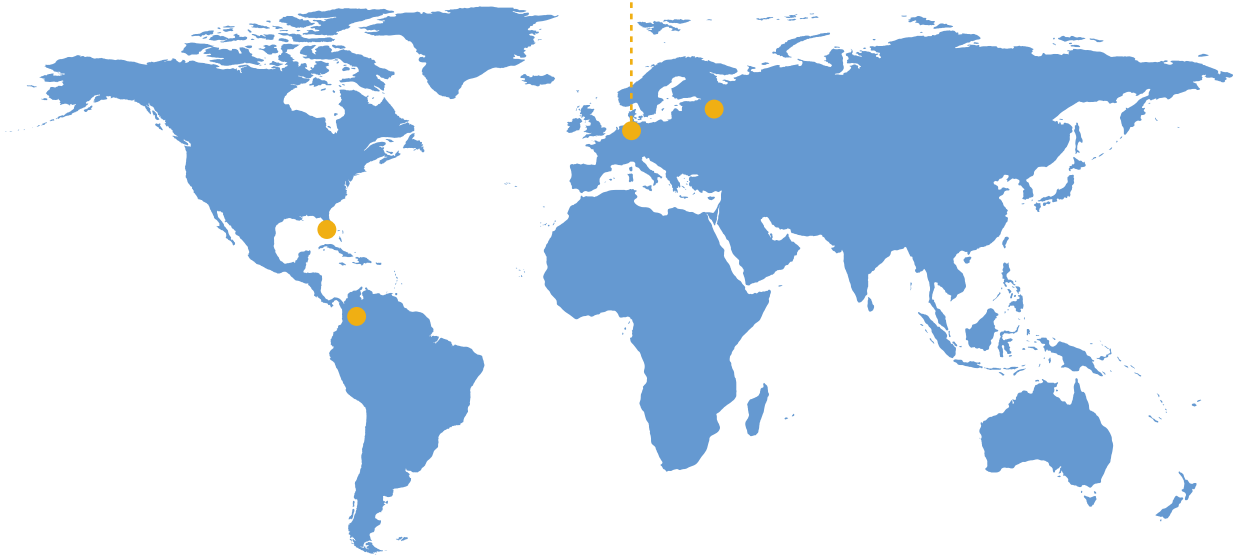
^{****} Ref: Alhede M, Geisler Crone S, Bjarnsholt T. Improving antibiofilm efficacy PHMB with a low intensity ultrasound wound debridement device. Oral presentation, EWMA, Conference, May 14-16, 2014; Madrid, Spain

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