Comparison of the antimicrobial effect of two superabsorbent polymer-containing wound dressings in vitro

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Introduction
Today, a variety of occlusive dressings for the treatment of chronic wounds is available in different forms, including films, foams, and gels, as well as of diverse materials such as alginates, polyurethane, hyaluronic acid, or collagen. Not all of them are able to handle the excess amount of exudate of highly exuding chronic wounds. Hence, wound dressings containing superabsorbent polymers (SAP) have been developed. SAP's are able to absorb a multiple amount of fluid of their own dry weight while keeping the wound environment moist. An additional inhibition of microbial growth would be a beneficial attribute as infection of the wound site can severely impair healing. Nosocomial infections have multiplied dramatically in the last years. Important pathogens of nosocomial infections are Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae, Escherichia coli, and Candida albicans. Hence, we have tested two SAP-containing wound dressings for their antibacterial and antifungal activity according to JIS L 1902:2002 [1,2].

Material & Methods
According to the JIS L 1902:2002, samples of 400mg of the SAP dressings were used for testing. The samples were incubated up to 24h at 37°C under aerobic conditions with the pathogens Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae, Escherichia coli, and Candida albicans. Additionally, effect on Staphylococcus aureus and Pseudomonas aeruginosa growth was investigated after a prolonged incubation period of 7 days. Furthermore, both SAP dressings were repeatedly inoculated with Pseudomonas aeruginosa suspension and after 7 days microbial growth under the dressings was evaluated.

Results
Both SAP dressings achieved a strong reduction (> 3 log) of Pseudomonas aeruginosa, Klebsiella pneumoniae, and Escherichia coli (Figure 1). They were also able to significantly inhibit the growth of Staphylococcus aureus and Candida albicans (app. 2 log). Moreover, each SAP dressing was able to reduce the growth of Staphylococcus aureus over the prolonged incubation period of 7 days (Figure 2) and both were even able to completely inhibit the progeny of Pseudomonas aeruginosa (Figure 3). No significant differences were observed between the two different dressings tested. In addition, both SAP dressings showed no microbial growth repeated inoculation with Pseudomonas aeruginosa for 7 days (Figure 4).

Conclusions
SAP-containing wound dressings show distinct antibacterial and antifungal properties. Their use should aid treatment of wound infections by entrapment of the microorganisms in the forming gel during uptake of wound exudate and the inhibition of microbial growth.

References

Figure 1: The growth of Staphylococcus aureus and Candida albicans was significantly reduced by both SAP dressings tested. Moreover, both dressings were able to strongly reduce the growth of Klebsiella pneumoniae, Pseudomonas aeruginosa, and Escherichia coli (data presented as mean ± SE, n=3).

Figure 2: The SAP dressings tested exhibited a significant to strong inhibitory effect on Staphylococcus aureus during the prolonged incubation period of 7 days (data presented as mean, n=3).

Figure 3: The growth of Pseudomonas aeruginosa was completely inhibited over the 7-day period by both SAP dressings (data presented as mean, n=3).

Figure 4: After 7 days an almost confluent growth of P. aeruginosa was observed under a gauze dressing (a) while no microbial growth was found underneath the tested SAP dressing 1 (b) and SAP dressing 2 (c).