OR1703

Comparison of microbiological effects in long fine-lumen tubes by low and atmospheric pressure plasmas

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Minimal invasive treatment using tubes such as catheters and endoscopes is well-established. Since the introduction of flexible endoscopy into medical practice, many cases of infectious complications involving bacteria, fungi and viruses have been linked to endoscopic procedures. Inadequate cleaning and disinfection during the reprocessing of the instruments have been reasonable factors as well as insufficient final rinsing and incomplete drying of the endoscope or contaminated flushing equipment for the air/ water-channel.
Flexible endoscopes are thermo-labile and cannot withstand heat sterilization processes. Common disinfection processes like ethylene oxide or hydrogen peroxide vapour as well as formaldehyde are more or less effective, but require long contact and aeration times. Furthermore, these processes use toxic and explosive substances. Therefore, the development of new methods for the sterilization of thermo sensitive devices especially with long fine lumen is very important.
A promising possibility is the decontamination by plasma discharge treatment. Various plasma setups have been developed. However, due to the complexity of plasma techniques and technologies, setups and parameters, it is impossible to compare their antimicrobial efficacy by single experiments. A standardization of microbiological parameters is necessary to attribute the observed effects solely to the plasma efficacy. We developed a new and innovative procedure for the investigation of plasma techniques used for decontamination of long fine lumen of thermo-labile tubes and the possibility to get comparable results which rely on the antimicrobial effects of plasma. Furthermore, new plasma setups for the decontamination of PTFE-tubes were developed. Round robin tests were done by three laboratories with tubes contaminated with endospores of Bacillus atrophaeus and of Geobacillus stearothermophilus. The PTFE tubes were plasma treated with new non-thermal low and atmospheric pressure plasma sources. Finally, the comparison of the antimicrobial efficacy of very different plasma setups was possible and a decontamination of 6.2 log cfu $\cdot$ specimen^{-1}, respectively, 5.3 log cfu $\cdot$ specimen^{-1} was achieved.

Keywords
decontamination