

Modeling microbial survival in buildup biofilm for complex medical devices

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ABSTRACT

Flexible endoscopes undergo repeated rounds of patient-use and reprocessing. Some evidence indicates that there is an accumulation or build-up of organic material that occurs over time in endoscope channels. This “buildup biofilm” (BBF) develops as a result of cyclical exposure to wet and dry phases during usage and reprocessing. Biofilm formation has been suggested in reprocessed flexible endoscopes in spite of adequate reprocessing; however the practical effect of such biofilm on reprocessing efficacy and infection transmission is unknown. This study investigated whether BBF matrix represents a greater challenge to disinfectant efficacy and microbial eradication than “traditional biofilm” (TBF) which forms when a surface is constantly bathed in fluid. Furthermore, this study tested the effectiveness of Accelerated Hydrogen Peroxide®(AHP®) against biofilms and compared it with other chemistries with known shortcomings.

BACKGROUND

In reprocessed flexible endoscopes, residual organic matter and biofilm is likely a result of multiple cleaning and disinfection cycles over the life of the instrument. The gradual build-up of material over repeated use forms by a very different kinetic background than traditional biofilms. The initial stages of formation such as surface conditioning from patient secretions, microbial attachment, growth and colonization are similar to TBF, however, with cyclical exposure to high levels of microbes due to contact with the mucosal surface of the gut in conjunction with the reprocessing

cycle can facilitate BBF formation that consists of dried organic material with embedded microorganisms.

STUDY

The study compared the effectiveness of high level disinfection using Glutaraldehyde (GLUT) and Accelerated Hydrogen Peroxide (PerCept 7% Concentrate) in the presence of both high and low nutrient conditions. For all test organisms, a significantly higher number of organisms survived after being challenged with GLUT and AHP when both the traditional biofilm and build-up biofilm were formed under higher nutrient conditions. However, AHP when compared to GLUT for both TBF and BBF was significantly more effective against killing microorganisms found in the biofilm.

STUDY CONCLUSION

The study with the use of BBF demonstrated that survival of a wide range of microorganisms does occur in BBF, with significantly more rapid outgrowth (an offshoot that has grown out from the main part of the biofilm) compared to TBF. This is most pronounced with the use of a GLUT than with the use of AHP. Regardless of the high level disinfectant used, meticulous cleaning is required to ensure removal of organic material as it is the presence of this organic material and their associated microorganism that prevent effective disinfection. Cross-linking compounds (compounds that are highly reactive and can connect elements, polymers or proteins together crosswise or at right angles) like GLUT are not as effective for high level disinfection when

BBF is present when compared to AHP.

REFERENCE

Alfa MJ, Howie R. (2009). Modeling microbial survival in buildup biofilm for complex medical devices. BMC Infectious Diseases 9:56.