Retained cement on orthopedic surgical instruments: should we worry about infection risk? An investigation of autoclave efficacy against contaminated surgical materials

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INTRODUCTION: Retained polymethylmethacrylate (PMMA) in surgical instrument trays and on instruments is a rare, but disquieting situation for the arthroplasty operating room team. Although retained debris may be sterile after autoclaving, there is no peer-reviewed literature to support this assumption. This study was conducted to determine if heavily contaminated PMMA surfaces, crevices, and instruments covered in PMMA could be effectively sterilized by three clinically utilized autoclave protocols.

METHODS: Mature methicillin-susceptible *Staphylococcus aureus* (*MSSA*) and *Escherichia coli biofilms* were grown on identically sized PMMA coupons that were either smooth or dented to produce deep crevices. Mature biofilms were also grown on threaded screws, which were then inserted over halfway into polymerizing PMMA. (Figure 1) PMMA coupons and PMMA-covered screws were subjected to three commonly used autoclave sterilization protocols. Colony forming unit (CFU) counts and adenosine triphosphate (ATP) swabs were utilized to determine if viable bacteria could be detected on the contaminated screws, exposed PMMA coupon surfaces, and PMMA crevices. Scanning electron microscope (SEM) images were obtained to determine if biofilm could be structurally identified on the autoclaved surfaces.

RESULTS: Non-autoclaved, control coupons showed high contamination with CFU counts in the range of 10^6 CFU/mL for *S. aureus* and for *E. coli*. ATP levels were the range of 10^3 RLU for *S. aureus* and 10^2 RLU for *E. coli*. Following autoclaving, CFU counts of 0 and ATP levels well beneath the hygienic threshold for sterility were recorded on all PMMA coupon surfaces, all PMMA crevices, and all screws previously embedded in PMMA. SEM confirmed the persistence of structural features indicative of biofilm.

DISCUSSION AND CONCLUSION: Our findings demonstrate that PMMA-covered instruments contaminated with gram-positive or gram-negative biofilms can be effectively sterilized using standard clinical autoclaving protocols.