

Evaluating the Efficacy of Disinfecting Agents on External Fixator Devices.

Max Elliott Horowitz, Alec Jay Talsania, Kaitlyn Cherie Miller Grando, Francisco Javier Albicoro, Cagla Tukel, Saqib Rehman

INTRODUCTION: There is limited data on which disinfecting agents are most efficacious when preparing an external fixator for entry into the surgical environment. The objectives of this study are to evaluate and compare the efficacy of disinfectant agents commonly used to remove bacteria from external fixator devices and to determine if bacterial growth depends on the location within the external fixator devices.

METHODS:

Sterile external fixators were configured in a way that reproduced clinically relevant junctions in a spatially efficient manner (Figure 1). The devices were colonized with *Staphylococcus aureus* overnight. After incubation, the device was treated with one of either Isopropyl Alcohol (IPA), Chlorhexidine Gluconate Scrub (CHG)+IPA, Betadine (PI)+IPA, or a ChloroPrep stick. Bacterial growth at specified locations on each device was assessed by swabbing and comparing the number of colony-forming units (CFUs) to untreated controls. Swabbing sites, swabbing techniques, and disinfection techniques were standardized across all trials.

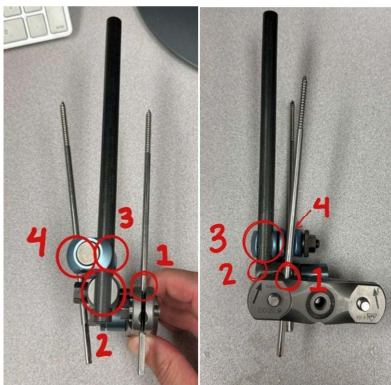
RESULTS:

All disinfectant groups had significantly less bacteria present when compared to controls ($p < 0.05$). The CHG+IPA group had a mean of 1 CFU, the most effective, whereas the Betadine+IPA group had a mean of 96 CFUs, the least effective. Figure 2 demonstrates that the CHG+IPA group had some non-zero bacterial loads at the specific locations where Betadine+IPA removed all detectable bacteria. Figure 3 demonstrates that the devices in the control group had significantly more bacteria present at the pin to 5-hole-pin-clamp junction compared to two of the other three junctions ($p < 0.05$).

DISCUSSION AND CONCLUSION:

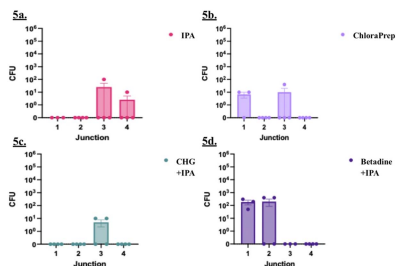
All disinfectant groups were successful at removing *S. aureus* from external fixators. CHG+IPA was the most effective disinfectant group. While this difference was not statistically significant, it is clinically meaningful. That said, specific junction analysis provides reason to think that the combination of CHG, Betadine and IPA would be the superior disinfecting procedure. Junction analysis in the control group suggests that *S. aureus* grows more effectively at the pin to 5-hole-pin-clamp junction. These findings agree with much of the current literature describing the efficacy of disinfecting procedures and provide data on *S. aureus* growth characteristics on external fixators.

Figure 1. Image of the external fixator construct and the specific junctions evaluated



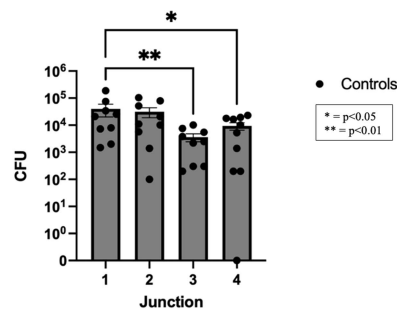
Junction 1: pin to 5-hole-pin-clamp junction
Junction 2: bar to 5-hole-pin-clamp junction
Junction 3: bar to pin-clamp junction
Junction 4: pin to pin-clamp junction

Figure 2. Junction analysis in each disinfection group



This figure demonstrates the CFUs counted at each junction after being disinfected with IPA: Sa, ChloroPrep: Sb, CHG+IPA: Sc, or Betadine+IPA: Sd.

Figure 3. Junction analysis in control group



This graph demonstrates a significant difference between the CFUs at Junction 1 and the CFUs at Junction 3 and 4.