Does Adding Hydrogen Peroxide to Chlorhexidine Gluconate Increase the Effectiveness of Skin Preparation in Reducing Cutaneous *Cutibacterium* Levels? A Randomized Controlled Trial

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INTRODUCTION: Shoulder periprosthetic joint infection (PJI) is most commonly caused by *Cutibacterium*. Effective removal of these bacteria from the skin is difficult because *Cutibacterium* live protected in the dermal sebaceous glands well beneath the skin surface to which surgical preparation solutions, such as chlorhexidine gluconate (CHG), are applied. A previous study demonstrated that after CHG skin preparation, repopulation of *Cutibacterium* from sebaceous glands onto the skin surface occurs in 90% of shoulders by 60 minutes after application. There is conflicting evidence on the additional benefit of using hydrogen peroxide (H2O2) as an adjunct to CHG in removing *Cutibacterium* from the skin. The objective of this randomized controlled study was to determine the effectiveness of adding H2O2 to CHG in reducing skin *Cutibacterium*.

METHODS: 18 male volunteers (36 shoulders) were recruited for this study. The two shoulders of each volunteer were randomized to receive the control preparation ("CHG-only" – 2% CHG in 70% isopropyl alcohol [ISA] alone) or the study preparation ("H2O2+CHG" – 3% H2O2 followed by 2% CHG in 70% ISA). Skin swabs were taken from each shoulder prior to skin preparation and again at 60 minutes after preparation. Swabs were cultured for *Cutibacterium* and observed for 14 days. *Cutibacterium* skin load was reported using a semi-quantitative system based on the number of quadrants growing on the culture plate. A power analysis was calculated using an alpha of 0.05, power of 0.80, and effect size based on 50% reduction in the proportion of shoulders with repopulation of *Cutibacterium* onto the skin.

RESULTS:

Prior to skin preparation, 100% of the CHG-only shoulders and 100% of the H2O2+CHG shoulders had positive skin surface cultures for *Cutibacterium*. Repopulation of *Cutibacterium* on the skin at 60 minutes occurred in 78% of CHG-only and 78% of H2O2+CHG shoulders (p=1). Reduction of *Cutibacterium* skin levels occurred in 56% of CHG-only and 61% of H2O2+CHG shoulders (p=0.735). *Cutibacterium* levels were significantly decreased from before skin preparation to 60 minutes after preparation in both the CHG-only (2.1 ± 0.8 to 1.3 ± 0.9, p=0.003) and the H2O2+CHG groups (2.2 ± 0.7 to 1.4 ± 0.9, p<0.001). Substantial skin surface levels of *Cutibacterium* were present at 60 minutes after both preparations.

DISCUSSION AND CONCLUSION: In this randomized controlled study, there was no additional benefit of using hydrogen peroxide as an adjunct to chlorhexidine gluconate skin preparation in the reduction of cutaneous *Cutibacterium* levels. Both preparations can reduce skin surface bacterial loads but cannot prevent the rapid repopulation of *Cutibacterium* on the skin surface from the dermal sebaceous glands.

Figure 1. Proportion of shoulders in the chlorhexidine-only and the hydrogen peroxide + chlorhexidine gluconate that had reduction and elimination of *Cutibacterium* from the skin at 60 minutes after skin preparation.