

# Increased Pressure of Antisepsis Application in Reduction of *Cutibacterium* from Dermal Structures: **A Randomized Controlled Trial**

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**INTRODUCTION:** 2% chlorhexidine gluconate (CHG) with 70% isopropyl alcohol (IPA) is the most common formulation of perioperative antisepsis around the shoulder and typically utilizes an applicator stick (Chloraprep™). Manufacturer instructions are to “gently press the sponge against the patient’s skin, ” but these manufacturer recommendations are based on studies on the groin and abdomen. It is well known that the shoulder is primarily sebaceous in nature which allow for *Cutibacterium acnes* to live in the dermal structures concealed against standard skin surface antiseptics. Deeper penetration of the antiseptic solution into the sebaceous glands with increased pressure of application could theoretically lead to greater effectiveness. Given the lack of literature regarding increased pressure application of Chloraprep, we designed a randomized controlled trial testing the effect of varying pressure of application in reducing cutaneous *Cutibacterium* loads in the skin. We hypothesized that reduction of cutaneous *Cutibacterium* would be larger in shoulders in which increased pressure is applied to the skin during Chloraprep application.

**METHODS:** 10 male volunteers (20 shoulders) were recruited for this study. The two shoulders of each volunteer were randomized to receive a low-pressure application of 0.5 kPA (control group) or high-pressure application of 5.0 kPA for 30 seconds. A small load cell embedded in a custom 3D printed adaptor was attached to the Chloraprep applicator stick (Figure 1). The load cell was attached to an Arduino controller and numeric display to provide real-time feedback of the force applied to the skin during application. This ensured consistent pressure throughout application of the antiseptic solution. 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. Statistical analysis included a Chi-Square test of the primary outcome – the proportion of shoulders with reduction in and elimination of *Cutibacterium*.

**RESULTS:** Prior to skin preparation, 100% of the control (low-pressure application) shoulders and 90% of study (high-pressure application) shoulders had positive skin surface cultures for *Cutibacterium*. Reduction in *Cutibacterium* levels on the skin at 60 minutes occurred in 50% of control and 45% of study shoulders ( $p=0.827$ ) (Figure 2). Elimination of *Cutibacterium* from the skin occurred in 30% of control and 22% of study shoulders ( $p=0.891$ ).

## DISCUSSION AND CONCLUSION:

In this randomized controlled study, there was no additional benefit of increased pressure application of Chloraprep skin preparation in the reduction of cutaneous *Cutibacterium* levels.

