Photodynamic Therapy for *Cutibacterium acnes* Decolonization of the Shoulder Dermis

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INTRODUCTION: *Cutibacterium acnes* is a common source of infection in shoulder surgery. Multiple treatment options to decolonize the dermis prior to surgical incision have been investigated as the bacteria is known to exist within the hair follicles and sebaceous glands of the skin. These regions are more concentrated on the shoulders of male patients. 5-aminolevulinic acid is a naturally occurring metabolite in synthesis pathways of *C. acnes*. When activated with blue light, these metabolites create an exothermic reaction that destroy the bacterial cells. The purpose of this study was to evaluate the efficacy of preoperative photodynamic therapy using topical aminolevulinic acid to decrease the *C.acnes* colonization of skin around the shoulder.

METHODS: A prospective, randomized control trial of male patients undergoing arthroscopic shoulder surgery at a single institution was performed. Enrolled patients were randomized to either receive a topical aminolevulinic acid HCl skin preparation activated blue light photodynamic therapy prior to standard skin preparation in the operating room or the standard of care preoperative skin preparation with no light therapy. Prior to skin incision, two 3mm skin punch biopsy specimens were taken from the location of the anterior and posterior portal sites. All cultures were held for 14 days on aerobic and anaerobic culture medium. Culture positivity rate along with biopsy site, day of culture positivity, and semi-quantitative scoring (no growth, very light growth, light growth, moderate growth, heavy growth) were analyzed. All patients were male given the known increase in bacterial burden in male patients.

RESULTS: Forty patients undergoing arthroscopic shoulder surgery were randomized. There was no significant difference between the groups in age, side of surgery, BMI, or Charlson Comorbidity Index. The overall rate of at least one positive culture was 62.5%. All cultures were positive for *C. acnes* except for one positive culture of *S. saccharolyticus* which occurred in a control patient who also had positive *C. acnes* growth. There were 15 of 24 (62.5%) patients in the control group and 10 of 16 (62.5%) patients in the light therapy group who had at least one positive culture for *C. acnes* (p=1). Five of the 15 (33.3%) patients with positive cultures in the control group had *C. acnes* in both cultures compared to 8 out the 10 (80%) in the light therapy group (p=0.04). Twenty of 48 (41.7%) of all cultures taken from the control group were positive for *C. acnes* compared to 18 of 32 (56.3%) of all cultures taken from the light therapy group (p=0.26). Only three cultures (all from the control group) demonstrated moderate growth of *C. acnes* with all other cultures showing very light growth.

DISCUSSION AND CONCLUSION: The use of preoperative photodynamic therapy on the skin of patients undergoing arthroscopic shoulder surgery did not significantly reduce the colonization of *C. acnes*. We do not recommend the routine use of photodynamic light therapy to assist with the decolonization of the shoulder dermis.