

EVALUATION OF *IN-VIVO* ANTIMICROBIAL EFFICACY OF THREE FORMULATIONS CONTAINING BENZOYL PEROXIDE ON *P. ACNES*

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INTRODUCTION

Propionibacterium acnes (*P. acnes*) is a gram positive anaerobic bacterium that colonizes the sebaceous follicles and is implicated in the pathogenesis of acne.¹ Benzoyl peroxide (BPO) is a potent topical acne therapy and anti-*P. acnes* drug that dramatically reduces the density of bacteria within the first few days of application.² Benzoyl peroxide has a relatively large particle size and is insoluble, such that currently marketed products are emulsions that may make only a fraction of the drug available within the follicle. NOA 210 is a novel homogeneous solution of BPO that may increase the penetration and availability of BPO in the pilosebaceous duct, thereby resulting in greater bactericidal effect. The objectives of this pilot study were to evaluate the *in vivo* anti-*P. acnes* activity of a novel 5% BPO solution (NOA 210) in comparison to two currently marketed 5% BPO products: Benzoyl Peroxide 5% Gel, (Glades Pharmaceuticals, Duluth, GA) and a combination 5% BPO-1% Clindamycin Gel (BenzaClin, Dermik Laboratories, Bridgewater, NJ). Outcomes measured were time required and relative efficacy of reduction of surface *P. acnes* as well as follicular *P. acnes* after a single application, and duration of activity of each treatment after one application.

METHODS

In this split-face, randomized study, 24 subjects were randomly divided into two groups of 12 subjects each. Each subject underwent mapping of the forehead and cheeks for location of treatment and sampling (Figures 1-2). Each side of the forehead (right and left) and each cheek received a different treatment and separate sampling. The forehead and cheeks were treated by a technician and a uniform 0.20 ml amount applied: one side received one of the marketed BPO products, while the opposite side received the novel 5% BPO solution (NOA 210). Subjects refrained from washing the face after 10 pm on the evening prior to test start and the morning of the test to establish baseline *P. acnes* count and for each count thereafter. Bacteriologic sampling was performed using both a cyanoacrylate follicular biopsy technique and scrubs. For the follicular biopsy, a drop of cyanoacrylate glue (Loctite) was applied on a plastic slide to an area of approximately 1 x 1 cm. The slide was then pressed against the skin until polymerization occurred and gently peeled off. Under a microscope, 20 of the largest follicular plugs were extracted from across the entire cast surface and transferred into the carrier broth. The same medium, letheen broth (Difco, Sparks, MD), was used for bacteriologic scrubs. All samples were subsequently plated onto *Brucella* agar (Difco) supplemented with yeast extract, dextrose, and cysteine. Plates were incubated anaerobically at 35°C to 37°C for 7 days and colony-forming units (cfu) of *P. acnes* counted. For all samples the density of *P. acnes* was expressed as log₁₀ cfu(s) per square centimeter (cm²).

FIGURE 1 Forehead Mapping: The forehead was divided into 2 treatment areas and sampling performed symmetrically by color. Each site on the forehead received both the scrub and the cyanoacrylate follicular biopsy.

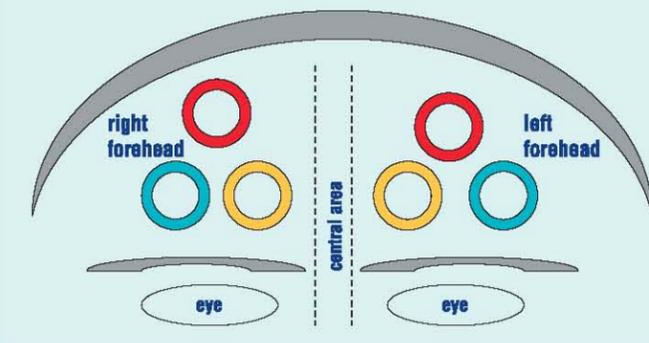


FIGURE 2 Cheek Mapping: Each cheek received a different treatment and the sampling was performed symmetrically by color. Cheek sites received bacteriologic scrubs only.

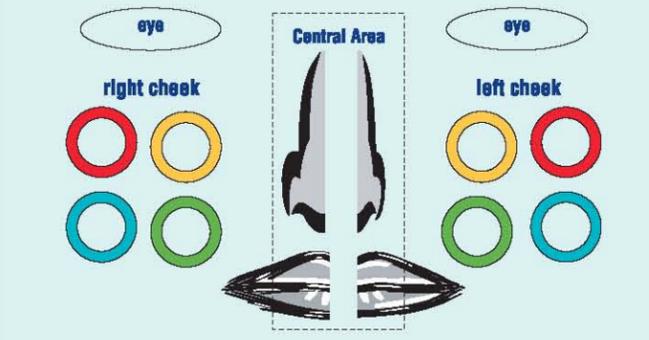
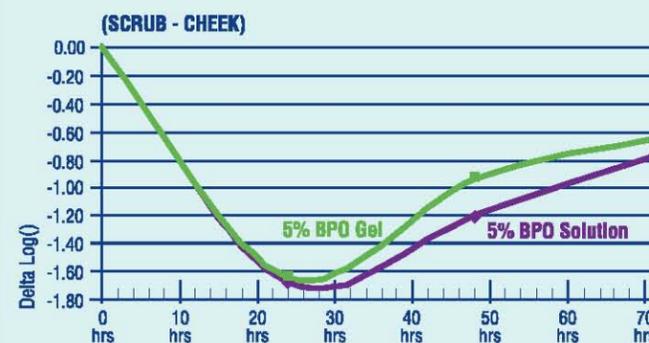


FIGURE 3 5% BPO Solution compared with 5% BPO Gel (Cheeks). Bactericidal activity over 72 hours after a single product application based on data from bacteriologic scrubs.



Baseline sampling consisted of one scrub and one cyanoacrylate follicular biopsy on right and left forehead and one scrub on right and left cheeks. The follicular biopsy (forehead) was taken from the same site as the scrub. At 3 and 8 hours after application, bacteriologic sampling was repeated. Subjects returned at 24, 48, and 72 hours (each ± 1 hour) for further bacteriologic samples, and a total of 14 scrubs and 6 cyanoacrylate follicular biopsies were conducted on each subject during the 3-day study.

RESULTS

Twenty-four subjects completed the study. All BPO products yielded between 1-2.5 log reductions in *P. acnes* colony count at the surface after a single application and regrowth after 72 hours (Figures 3-4). **Based on data from follicular biopsies of the forehead, the novel 5% BPO solution yielded a 0.2 log greater reduction in *P. acnes* than 5% BPO gel (Figure 5), and a 0.8**

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FIGURE 4 5% BPO Solution compared with 5% BPO/1% Clindamycin Gel (Cheeks). Bactericidal activity over 72 hours after a single product application based on data from bacteriologic scrubs.

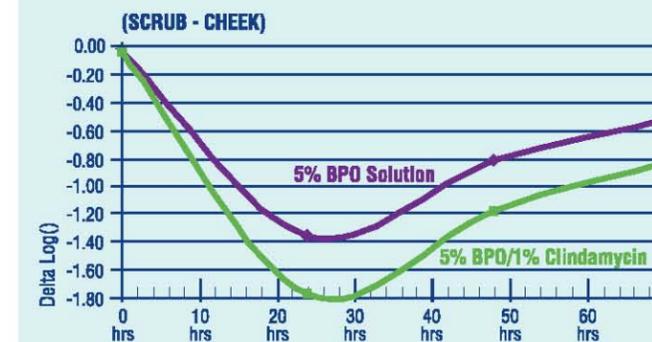


FIGURE 5 5% BPO Solution compared with 5% BPO Gel (Forehead). Bactericidal activity over 8 hours after a single product application based on data from follicular biopsy.

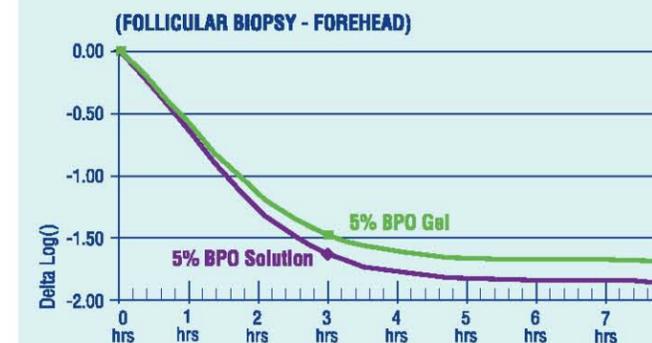
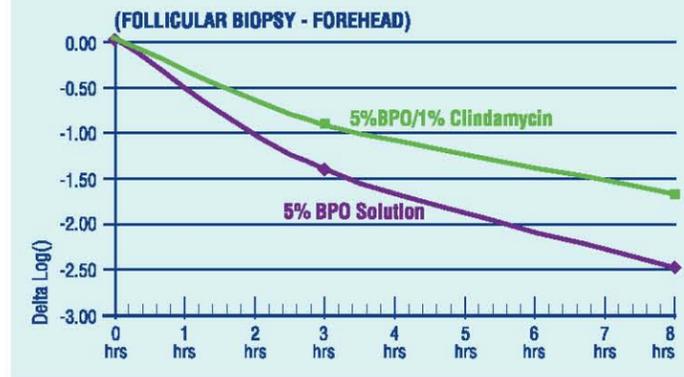


FIGURE 6 5% BPO Solution compared with 5% BPO/1% Clindamycin Gel (Forehead). Bactericidal activity over 8 hours after a single product application based on data from follicular biopsy.



log greater reduction in *P. acnes* than the 5% BPO/1% Clindamycin gel (Figure 6) after 3 and 8 hours.

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CONCLUSIONS

Benzoyl peroxide has been shown to be an effective therapy for acne; however, currently marketed formulations may be limited in their anti-*P. acnes* activity due to relatively low absorption and bioavailability in the follicle. **A novel 5% benzoyl peroxide solution, NOA 210, demonstrated greater *in vivo* bactericidal activity against *P. acnes* in the follicle after a single application during this 72 hour study compared with two currently marketed BPO-containing products, a 5% BPO aqueous gel and a combination 5% BPO/1% Clindamycin gel.** Further study to evaluate the clinical effect of NOA 210 on acne lesions is indicated.

REFERENCES

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DISCLOSURES

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