

Antimicrobial Resistance Reversal at physiologic temperatures in MRSA present in the Nares utilizing an 870 nm and 930 nm dual wavelength Noveon® laser

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Background and Objective

The Noveon® laser specifically employs only two wavelengths of near infrared light (870 nm and 930 nm). Both of these wavelengths have been shown to have photo-lethal effects on bacteria.[†] In previous *in vitro* studies using Noveon exposure, at temperature levels inherently not lethal to the organisms, we have accomplished successful reversal of methicillin-resistant *Staphylococcus aureus* (MRSA) resistance to methicillin, penicillin, erythromycin and tetracycline. In addition, we have established a non-damaging threshold Energy Density (ED) in human tissue that does not raise temperatures beyond physiologic norms. The present study was undertaken to replicate in human subjects our previous *in vitro* results with the Noveon. Our goal was to initiate a photo-damage effect on proven erythromycin-resistant MRSA and erythromycin-resistant methicillin-sensitive *Staphylococcus aureus* (MSSA) with these wavelengths and demonstrate resistance reversal in these organisms present in the nares.

Materials and Methods

Positive anterior nares cultures were obtained in six patients (12 nostrils) before laser treatment. One patient had MRSA only, 3 had MSSA only, and 2 had both MRSA and MSSA. All MRSA and MSSA cultured were tested and shown to be resistant to erythromycin. Utilizing a prototype 10 cm flat-top diffuser, each patient underwent exposure with the Noveon for 7 minutes (ED - 207 J/cm²) to each anterior nostril on Day 1 and on Day 3. Temperatures from the nares were recorded every 30 seconds with an infrared thermometer. Generic erythromycin paste (2%) was then applied 3X/day for 5 days. Quantitative cultures from each nostril were obtained and plated in triplicate on chromogenic agar before and 20 minutes after exposure on day 1 and day 3. A final culture was taken on day 5.

Results

As seen in the tables below, the erythromycin-resistant MRSA was completely cleared by culture in all 3 carriers, as was the erythromycin-resistant MSSA in four of the five carriers after the second laser treatment on day 3 and remained clear on day 5. In one patient the erythromycin-resistant MSSA (baseline count > 1000 CFU's) showed a 3-log reduction in MSSA on the day 5 culture. No sequelae or adverse events were observed. The average maximum temperature of the nares reached in all subjects was 99° F.

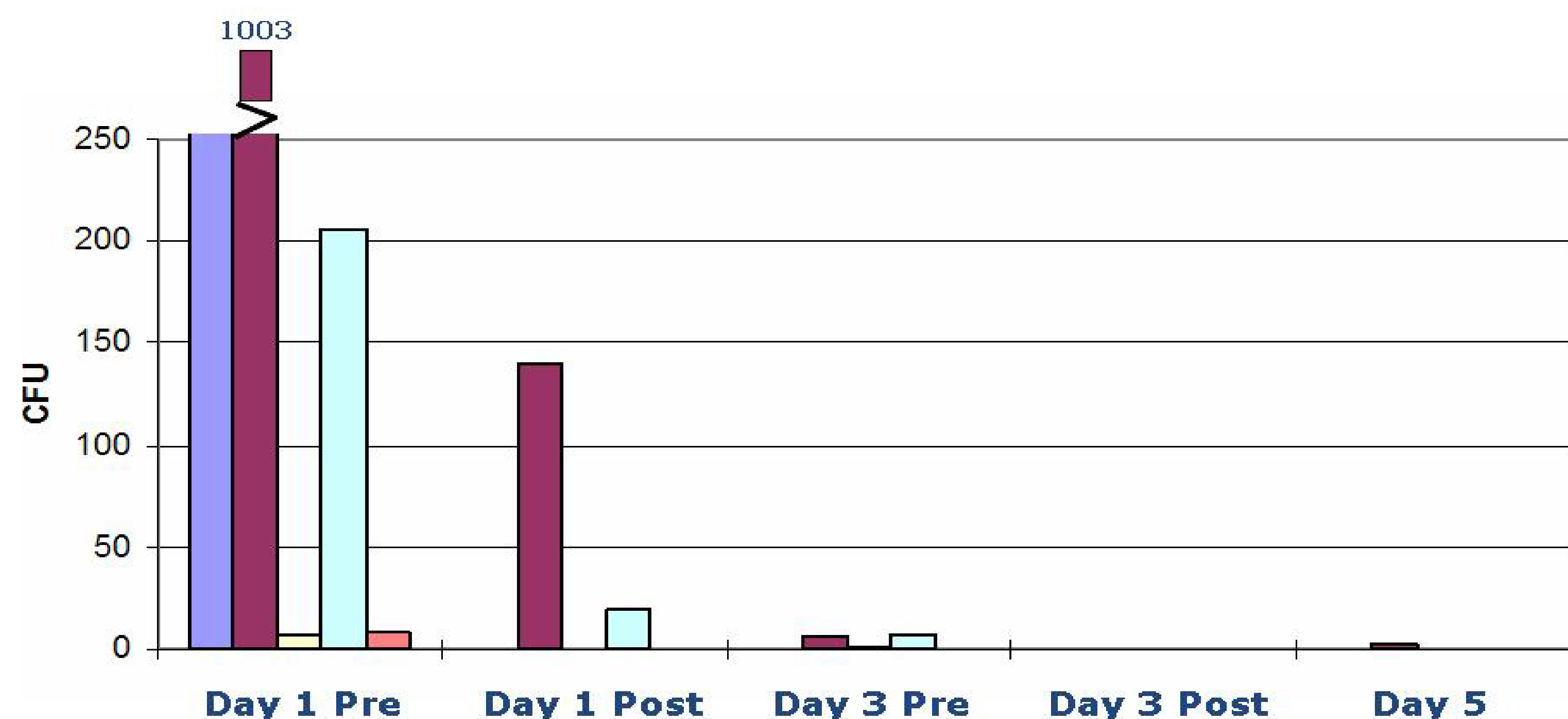


Table 1. Five Subjects cultured positive for erythromycin-resistant MSSA.

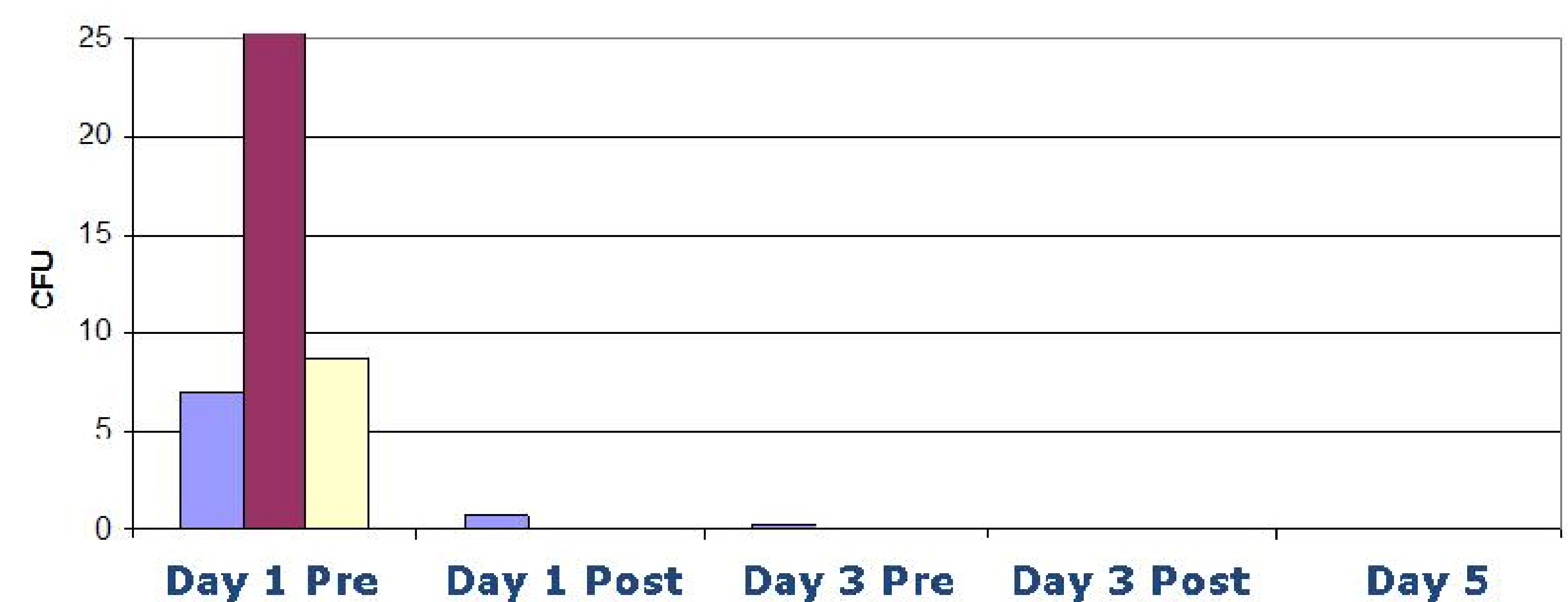


Table 2. Three Subjects cultured positive for erythromycin-resistant MRSA.

Conclusions

Noveon laser exposure at a non-damaging energy density and physiologic temperatures, re-sensitized erythromycin-resistant MRSA and MSSA to generic erythromycin paste (2%). The proposed method of action is a novel infrared photo-damage to the organism. This opens the possibility for local cutaneous reduction of resistant bio-burden in wounds and other areas.

[†] Neuman, et al. Biophys J. 1999 Nov;77(5):2856-63