Blue Light Therapy: Another Tool For Battling MRSA

BY DOUGLAS JOHNSON, ATC, EES, CLS

Light therapy devices are being used to treat an array of orthopedic, neurological, and wound care applications. With over 4,000 published studies on red and infrared light, the photo-chemical effects of light in medicine are well known. It is no longer a question of whether photo therapy works, but rather what the necessary parameters for optional outcomes are.

Recent advances in light technology have allowed for increased power of continuous wave (laser) diodes, the introduction of super-pulsed lasers, and the development of new colors of light emitting diodes. This has allowed for the investigation of wavelengths (colors) outside the traditional therapeutic window of 632.5 to 1,000 nanometers (nm). Some recent research suggests blue light therapy may be effective in other conditions, such as Staphylococcus aureus (staph), Methicillin-Resistant Staphylococcus aureus (MRSA), acne, and some hyperproliferative skin conditions.

It is already known that ultraviolet (UV) light kills bacteria. It has been used for sterilization in hospitals for its microbe-killing abilities. Exposure to blue light in the 450 to 470 nm range has been used primarily as a treatment for neonatal jaundice. (Blue light is absorbed by bilirubin and thus undergoes photo-chemical change in this instance.) However, the bactericidal effects of UV may not be unique since recent studies indicate that blue light produces a somewhat similar effect.

In 2006, Guffey and Wilborn found in vitro bactericidal effects on two bacteria: staph and Pseudomonas aeruginosa, with the use of a blue light emitting 405 and 470 nm. The effects of the blue light produced dose-dependent bactericidal effects on both bacteria. The researchers also found that appropriate phototherapy doses of 405 and 880 nm combined can kill staph and Pseudomonas aeruginosa in vitro, suggesting that a similar effect may be produced in clinical cases of bacterial infection.

In 2009, Enwemeka and colleagues concluded that relatively low doses of blue light using an LED device that emits blue light--about 100 seconds worth--killed off about 30 percent of MRSA in vitro. Longer doses were more effective, however it took nearly 10 times the exposure length to eliminate 80 percent of the MRSA in culture dishes.

Data from recent studies indicates that blue light therapies have also shown promise in treating acne, and the FDA has cleared narrow-band, high-intensity blue light therapy for treatment. Now widely advertised, this is probably the best-known light therapy for acne. In 2006, Papageorgiou and colleagues found that combining blue light with red light is even more effective for acne light therapy as it repaired skin cells, reduced acne scars, and healed skin faster.

Studies and clinical work have shown that blue light therapy can help treat bacterial infections, such as MRSA.

Experiments have demonstrated that blue light irradiation of up to 453 nm photolytically generates nitric oxide from nitrosated proteins. Hyperproliferative skin conditions, such as psoriasis, benefit from the fact that blue light penetrates rather poorly due to the almost complete absorption superficially, thereby reducing proliferation dose dependently by up to 50 percent. This can be attributed to differentiation induction as shown by an increase of differentiation markers. A photolytic release of nitric oxide from nitrosated proteins is observed indicating that they are light acceptors and signal transducers up to a wavelength of 453 nm.

Some potential considerations of prolonged exposure to blue light therapy should be taken into account. Symptoms can include jitteriness, headache, nausea, skin irritation, eye irritation, and poor vision. Very infrequently, a patient will find that blue light therapy will make them overactive, restless, and irritable, causing difficulty in sleeping. More often, patients will experience a visual glare, which is caused by short wavelength blue light. To correct this effect, there are specially designed lenses that counteract the intensity of the light.

The blue light treatment does not harm the skin tissues at all. Kleinpenning and colleagues evaluated the clinical and histological effects of blue light on normal skin in 2010. They concluded that visible blue light does not cause deoxyribonucleic acid damage or early photo-aging. Also last year, Liebmann and colleagues found that light at 453 nm is only toxic beyond a fluence of 500 joules per square centimeter.

While blue light therapy may not replace red light as it has in the case of the DVD, blue light has shown some promise in the lab, as well as clinically, for its use for treatment of bacterial infections. Further studies of single wavelengths and combinations of wavelengths may yield additional treatment options.

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TWO BENEFITS WITH ONE TREATMENT

"Blue light therapy has the capability of wound care pain relief plus the application for antimicrobial treatment," explains Glenn Streeter, exercise physiologist and CEO of Mountain's Edge Fitness clinic in Boulder, Colorado. "There really is no downside to this type of protocol for athletes who have open-skin wounds."

There are two types of lasers: stimulating lasers and resonating lasers. The type of laser to utilize in treating MRSA-related situations is the resonating type—a cold laser. "The technology of laser therapy for treating open wounds, bacterial infections and even acne is 30 years old, but it's just starting to take hold in the U.S.," adds Streeter.

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