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Original Article

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The bactericidal effect of 470-nm light and hyperbaric oxygen on methicillin-resistant *Staphylococcus aureus* (MRSA)

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Abstract

It has been shown that, in vitro, hyperbaric oxygen (HBO) suppresses 28 % bacterial growth, while 470-nm blue light alone suppresses up to 92 % methicillin-resistant *Staphylococcus aureus* (MRSA) in one application in vitro. Therefore, we determined if combined 470-nm light (55 J/cm^2) and HBO will yield 100 % bacterial suppression in experimental simulation of mild, moderate or severe MRSA infection. We cultured MRSA at 3×10^6, 5×10^6, 7×10^6, 8×10^6, or 12×10^6 CFU/ml and treated each concentration in four groups as follows: (1) control (no treatment) (2) photo-irradiation only, (3) photo-irradiation then HBO, (4) HBO only, and (5) HBO then photo-irradiation. Bacteria colonies were then quantified. The results showed that at each bacterial concentration, HBO alone was significantly less effective in suppressing MRSA than photo-irradiation or combined HBO and photo-irradiation ($p < 0.0001$). Similarly, at no bacterial concentration did combined HBO and 470-nm light treatment yield a statistically better result than 470-nm light alone ($p > 0.05$), neither did HBO treatment either before or after irradiation make a difference. Furthermore, at no bacterial concentration was 100 % MRSA suppression achieved. Indeed, the maximum bacterial suppression attained was in the mild infection model (3×10^6 CFU/ml), with blue light producing 97.3 ± 0.2 % suppression and HBO + 55 J/cm^2 yielding 97.5 ± 2.5 % suppression. We conclude that (1) HBO and 470-nm light individually suppress MRSA growth; (2) 470-nm blue light is more effective in suppressing MRSA than HBO; and (3) HBO did not act synergistically to heighten the bactericidal effect of 470-nm light.

Keywords

Methicillin-resistant *Staphylococcus aureus* Hyperbaric oxygen therapy Antimicrobial activity Phototherapy Low-level light therapy Blue light

Concepts found in this article

Blue Light

Blue Light Treatment

HBO Therapy

Low-level Light Therapy

Hyperbaric Hyperoxia

Reactive Oxygen Specie

Linezolid

Bacterial Concentration

Teicoplanin

USA300 Strain

Vancomycin

Bactericidal Effect

Focal Cerebral Ischemia

Mediastinitis

Bacterial Growth

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Blue Light | Low Level Light Therapy | MDPC-23 Cell

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Blue Light | Unilateral Blue Light | Red Light Treatment

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in *Trials (2008)*

Blue Light | Bright Light Therapy | Major Depressive Disorder

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About this Article

Title

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Keywords

- Methicillin-resistant Staphylococcus aureus
- Hyperbaric oxygen therapy
- Antimicrobial activity
- Phototherapy
- Low-level light therapy
- Blue light

Industry Sectors

- *Pharma*
- *Health & Hospitals*
- *Biotechnology*
- *Electronics*
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- *Consumer Packaged Goods*
- *Aerospace*

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