Abstract

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Effectiveness of different light sources for 5-aminolevulinic acid photodynamic therapy.

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Abstract

Many medical applications, including photodynamic therapy for cancer (PDT), involve the use of lasers. However, the coherence of laser light is not necessary for PDT, and attempts have been made to construct non-coherent light sources for PDT, which are relatively inexpensive, stable and easy to operate, require simple maintenance but differ fundamentally from the lasers in their output characteristics. In the present work we compared two clinically used lamps, CureLight1, which is a broadband source (560-740 nm) based on a filtered halogen lamp, and CureLight2, which is a narrowband source based on light-emitting diodes (LEDs), with respect to several parameters of crucial significance for PDT efficiency in vivo: (a) depth of action in tissues, (b) heating effects, (c) pain generation, (d) photodegradation of PpIX in solution, in cells and in mouse skin and (e) photo-inactivation of cells in vitro. We conclude that CureLight2 (LED), relative to CureLight1 (halogen) has deeper PDT action in tissue, similar efficiency for bleaching PpIX in mouse skin, better efficiency for bleaching PpIX in cells and solutions and good efficiency for inactivating cells in vitro. CureLight2 gives less heating of the tissue and less pain in unsensitised human skin. All these differences are related to difference in the spectra of the lamps. Thus, PDT light sources with emissions that are visually similar have significantly different photobiological properties.