

Poster PD-058

**Photodynamic therapy for actinic keratoses:
How effective are two white led light doses
compared with two standard light doses?**



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Photodynamic therapy (PDT) has proven to be an efficient treatment modality for actinic keratoses (AK). Although daylight PDT is as effective as conventional red LED PDT and almost pain free, it strongly depends on weather conditions [1]. The interest for white LED, candidate for indoor artificial daylight PDT, is therefore increasing. We propose a comparison between two published white LED light doses, the daylight dose and the standard red LED light dose through mathematical modeling.

The comparison was performed using a 200 μm thick partial ellipsoid confined into a 100 μm thick parallelepiped to represent a post-curettage AK in epidermis. The PDT process was modeled by an iterative procedure with two steps [2]. The first step is the determination of the local fluence rate by solving the one-dimensional diffusion equation. The second step is the updating of the local optical properties through standard models for both photosensitizer biological elimination and continuous accumulation and through an original photobleaching model. Following the procedure, the estimation of the total cumulative singlet oxygen produced during treatment allowed to quantify the local damage induced by PDT. This damage was estimated for two standard light doses: the red light dose (3 h incubation time, Gaussian spectral irradiance with 632 nm mean and 19 nm FWHM, 75 mW/cm^2 , 36 J/cm^2) [3] and the daylight dose (30 min incubation time, solar spectral irradiance, $\sim 50.93 \text{ mW}/\text{cm}^2$, 2h30) [4] as well as for two recently published white LED light doses: the first one (30 min incubation time, spectral irradiance provided by the authors, $\sim 0.57 \text{ mW}/\text{cm}^2$, 2 h) [5] was delivered from a 50 W white LED lamp while the second one was obtained from an operating room light source (30 min incubation time, spectral irradiance provided by the authors, $\sim 56.05 \text{ mW}/\text{cm}^2$, 2 h) [6].

With a local damage of 1.19×10^7 at the deepest part of the AK, the daylight dose appeared to be the most effective light dose. Using red light and operating room white light, close photodynamic doses of about 5.67×10^6 and 5.77×10^6 , respectively, were obtained at the deepest part of the AK. With the white LED light dose, a low photodynamic dose of about 8.29×10^4 was obtained at the deepest part of the AK.

Based on a very widely reported efficiency of the red light dose, the operating room white light dose with a slightly higher photodynamic dose compared to the red one could be considered as sufficiently lethal for AK cancer cells and seen as an interesting alternative to daylight as concluded in [6]. The low photodynamic dose obtained with the 50 W white LED lamp does not allow to conclude to its efficiency.

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