Artificial White Light vs Daylight Photodynamic Therapy for Actinic Keratoses
A Randomized Clinical Trial

Susan M. O’Gorman, MBChB; Julienne Clowry, MBChB; Michael Manley, MSc; Jackie McCavana, MSc; Linda Gray, MSc; Ann Kavanagh, BSc; Aoife Lally, MD; Paul Collins, MD

IMPORTANCE Daylight photodynamic therapy using topical methyl 5-aminolevulinic acid (MAL) for actinic keratoses (AKs) is as effective as conventional photodynamic therapy but has the advantage of being almost pain free. Daylight photodynamic therapy, however, requires dry and warm weather conditions.

OBJECTIVE To establish if topical MAL photodynamic therapy using a white light light-emitting diode (LED) lamp is as effective and well-tolerated as daylight photodynamic therapy for the treatment of AKs.

DESIGN, SETTING, AND PARTICIPANTS Overall, 22 men with significant photodamage and a high number of AKs were enrolled in this prospective, randomized, single-blind study, employing a split-scalp design, comparing the effectiveness and adverse effects of daylight photodynamic therapy and artificial white light (AWL) LED photodynamic therapy for the treatment of AKs on the forehead and scalp. Organ transplant recipients were excluded. Patients were treated and evaluated at an academic tertiary referral dermatology center. Treatment lasted from April 2014 to July 2014 and follow-up visits occurred for 9 months posttreatment.

INTERVENTIONS Two symmetrical treatment fields were defined and AKs counted, mapped, and photographed at baseline, 1, 3, 6, and 9 months. Patients had half of their scalp treated with daylight photodynamic therapy and the other half treated with AWL photodynamic therapy 1 week apart and randomly allocated. MAL was applied, and treatment commenced 30 minutes later and lasted 2 hours. Irradiance, illuminance, and light spectra measurements were performed. The integrated dose in J/cm² was measured. The effective light dose, weighted to the absorption spectrum for protoporphyrin IX, was calculated.

MAIN OUTCOMES AND MEASURES The primary end point was the reduction in total AK count per treatment field. Secondary end points included adverse effects and patient satisfaction.

RESULTS We enrolled 22 men with a median age of 72 years (range, 47-85 years) at baseline, the total (median of AKs per field) were 469 (20.5) for the DPDT group and 496 (20.5) for the AWLPDT group (P = .34). The median number and percentage of reduction in AKs per field were 12 and 62.3% for DPDT and 14 and 67.7% for AWLPDT at 1 month (P = .21 and P = .13, respectively). There was no significant difference in the reduction percentage of AKs for either treatment at 1, 3, and 6 months. At 9 months, the median number and percentage of reduction in AKs per field was 9.0 and 48.4% for DPDT and 12.0 and 64.4% for AWLPDT (P = .13 and P = .05, respectively). Pain was reported by 14 patients with DPDT and 16 patients with AWLPDT at 9.5 and 6 (P = .13) months. Moderate erythema was reported by 11 (4 patients with DPDT and 7 patients after AWLPDT at 1 month, 9 months). On a scale of 0 (intolerable) to 10 (very tolerable) patients rated DPDT as 9.5 and AWLPDT as 9 (P = .37).

CONCLUSIONS AND RELEVANCE Photodynamic therapy using an AWL source was as effective and well-tolerated as daylight photodynamic therapy.

TRIAL REGISTRATION clinicaltrials.gov Identifier: NCT02520700

Published online February 3, 2016.

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Topical methyl 5-aminolevulinic acid (MAL) photodynamic therapy (PDT) is effective for the treatment of actinic keratoses (AKs). The main limitation of conventional PDT (CPDT) is pain, particularly with large treatment fields. Daylight PDT (DPDT) solves this problem by reducing the application time of the prodruk MAL to 30 minutes prior to light exposure so that low levels of protoporphyrin IX (PpIX) are generated and continuously photodegraded. Daylight exposure for 2 hours, between April and October in Copenhagen, Denmark (latitude 55°N), was well tolerated, effective, and popular with patients, as well as proven in a large Scandinavian multicenter trial. Other research groups in Australia and Finland have confirmed their findings. We compared the effectiveness, adverse effects, and remission data of DPDT with artificial white light (AWL) PDT (AWLPDT) to compare our experience with published data and to see if AWLPDT was feasible.

Methods

Study Design
This was a randomized, controlled, single-blind, split-scalp or forehead study. Trial protocol can be found in Supplement 1. Treatment was conducted at our institution at latitude 53°N from April 2014 to July 2014. Follow-up continued for 9 months after treatment. The study design was approved by the Saint Vincent’s University hospital’s ethics committee, and all patients provided written informed consent. Treatments for AKs were discontinued for 1 month prior to the study. Exclusion criteria included immunosuppressed patients, those with abnormal photosensitivity, contact allergy to topical therapy for use in the study, or pregnancy and breastfeeding. Each patient had bilateral symmetrical treatment areas 10 cm × 7 cm (70 cm²) defined on the scalp or forehead. Palpable AKs within those areas were counted and mapped by 2 investigators pretreatment, at 1 month (S.M.O., P.C.), and at 3, 6, and 9 months (P.C., J.C., and A.L.) (Figure 1). The investigators (P.C., J.C., and A.L.) were blinded to the treatment. Photographs were taken at each visit. Patients were randomized by selecting a sealed envelope to which side would receive DPDT. Keratotic lesions were pretreated with paraffin gel and gentle curettage to remove keratotic debris before applying MAL (Metvix cream 16%; Galderma). Patients had the first side of their scalp or forehead treated with DPDT between 11 AM and 3 PM in all weather conditions except rain. Patients were positioned so that the treatment area received maximum sunlight exposure. One week later, the second side was treated with AWLPDT. If it was raining on the first day of treatment, the order of treatments was reversed. For the DPDT session, sunscreen with a protector factor of 20 (P20; Riemann & Co), chosen to avoid overlap with potential absorption of wavelengths in the PpIX activating spectrum, was applied to all sun-exposed areas, including the treatment areas. Approximately 1 g of MAL cream was applied on the treatment field for 30 minutes and covered with a light-protected dressing. Patients were positioned for exposure that continued for 2 hours. No patient received pretreatment analgesia. No restrictions were placed on patient light exposure for the remainder of the day. Our response rates represent complete resolution of the AK visually and by palpation.

Patients rated their pain using a visual analog scale by moving a counter along a 100 mm scale between “no pain” and “worst pain ever” at 1, 30, 60, 90, and 120 minutes. Patients were evaluated for adverse effects at 24 hours and daily if there were symptomatic adverse effects. The primary end point was the reduction in total AKs per treatment field and remission data. Secondary end points included adverse effects, patient satisfaction, and preference for each treatment. If a patient had prior experience of CPDT in our department, they were asked to compare it with DPDT and AWLPDT.

Daylight and Artificial White Light Measurement
Irradiance, illuminance, and light spectra measurements were recorded using calibrated instruments with detectors lying flat on a table. The integrated dose (in J/cm²) was measured for the duration of treatment. The effective light dose, weighted to the absorption spectrum for PpIX, was calculated from spectral data.

The particular operating room light source was chosen because it had a suitable spectrum, output, distribution of the light emitting diodes (LEDs), and design for this study (eFigures 1 and 2 in Supplement 2). The prescribed dose of 50 J/cm² in the red waveband (dose prescribed for conventional topical PDT in our department) was delivered in a treatment time of 120 minutes. The nonuniform distribution of irradiance from the operating room light resulted in dose variation over the treatment area between 50 J/cm² at the edge to 125 J/cm² at the center of the treatment area. The irradiance in the red waveband ranged from 6.9 to 17.4 mW/cm². The patients wore shade-5 intense pulsed light glasses and custom single-use visors made from light black cardboard to block out all light from their eyes.

Statistical Methods
We calculated that 22 patients needed to be enrolled in this study for a significance level of 0.05 and a power of 0.80 based on the assumption that the smallest clinically important mean difference was 15% and the standard deviation (SD) of the difference in response was 25%. The Shapiro-Wilk test was used to calculate the probability that the data comes from a normal distribution. The median was used as a measure of centrality to describe the data with the interquartile range (IQR) and the 25th and 75th percentiles were used to describe the dispersion. The Wilcoxon signed rank test was used to compare paired data. Associations were tested using scatter plots and Spearman ρ correlation. Statistical analyses were carried out using SPSS version 22 (IBM Corp, released 2013, IBM SPSS Statistics for Macintosh, version 22.0.). A P value of less than .05 was considered significant.

Results

Patients
Twenty-two patients were enrolled. No patient was lost to follow up (Figure 2). All patients were male, and median age
was 72 years (range, 47-85 years). Nine patients had their scalp treated, in 12 patients the treatment fields overlapped the scalp and forehead, and 1 patient’s forehead dominated the treatment fields. There was no significant difference in AK count at baseline between treatment groups (Table 1). The mean (SD) number of days between the treatment of each side was 7.14 (2.88). The minimum was 1 day, and the maximum was 14 days. One patient was treated with DPDT between 1500 and 1700 hours. The effective dose measured was 24 J/cm². Two patients had DPDT rescheduled because of rain after; 30 minutes for one case and after 15 minutes for the other. Daylight PDT was rescheduled for the following week. A Wood light was used to assess fluorescence prior to each treatment; there was minimal fluorescence prior to 5 treatments, no fluorescence in 38 treatments, and fluorescence was not recorded in 1 case.

Effectiveness
Both DPDT and AWLPDT were effective, with a significant reduction in AKs from baseline at each time point. The therapeutic effect was sustained at 9 months. There was no significant difference in the reduction percentage of AKs between the treatments at 1, 3, and 6 months (Figure 3), but there was a trend favoring superior remission after AWLPDT at 9 months (Table 1).

Daylight and Artificial White Light Doses
The mean (SD) effective daylight dose (weighted daylight dose by PpIX activation spectrum) was 21.38 (13.25) J/cm². The minimum daylight dose was 3.20 J/cm² and the maximum was 43.00 J/cm² (eFigure 3 in Supplement 2). Daylight irradiance varied substantially depending on weather conditions (5-77 mW/cm²). There was no association between the effective light...
Figure 2. Study Flow Diagram

24 Patients assessed for eligibility for study
- 2 Patients excluded
  - 1 Organ transplant recipient
  - 1 Unable to attend for treatments
- 1 Organ transplant recipient
- 1 Unable to attend for treatments

22 Patients enrolled in study
- 22 Patients treated with DPDT and AWLPDT
- 22 Patients followed up for adverse effects
- 22 Patients followed 1 month, 3 months, 6 months, and 9 months after final treatment for clinical effectiveness endpoints

*Patients were randomized by selecting a sealed envelope as to which scalp side would receive DPDT.
All 22 patients completed both treatments and no patients were lost to follow-up. AWLPDT indicates artificial white light photodynamic therapy; DPDT, daylight photodynamic therapy.

Figure 3. Reduction in Median Actinic Keratosis Count at 1, 3, 6, and 9 Months

![Graph showing reduction in median actinic keratosis count over time.](https://jamanetwork.com/)

The reduction in actinic keratosis count at 1 month equates to a 62.3% reduction for the actinic keratosis count in the DPDT fields and 67.7% reduction for AWLPDT fields. There was no significant difference in the actinic keratosis counts at any time point between the 2 fields and the benefit of treatment was maintained at 9 months (at baseline \(P = .34\); 1 month, \(P = .19\); 3 months, \(P = .22\); 6 months, \(P = .65\); and 9 months, \(P = .16\)). AWLPDT indicates artificial white light photodynamic therapy; DPDT, daylight photodynamic therapy.

### Table 1. Absolute Reduction and Reduction Percentage in AKs

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Field</th>
<th>DPDT (N = 469)*</th>
<th>AWLPDT (N = 496)*</th>
<th>P Valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>AKs per treatment field, No.</td>
<td>20.5 (10.0 (15.5-25.5))</td>
<td>20.5 (13.0 (16.0-29.0))</td>
<td>.34</td>
</tr>
<tr>
<td>1 Mo</td>
<td>AKs per treatment field, No.</td>
<td>8.5 (8.0 (5.0-13.0))</td>
<td>7.5 (7.0 (3.8-11.0))</td>
<td>.19</td>
</tr>
<tr>
<td></td>
<td>Absolute reduction in AKs, No.</td>
<td>12.0 (10.0 (6.0-16.0))</td>
<td>14.0 (13.0 (9.0-22.0))</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>Reduction in AKs per field, %</td>
<td>62.3 (32.0 (42.0-74.0))</td>
<td>67.7 (34.8 (50.0-84.8))</td>
<td>.13</td>
</tr>
<tr>
<td>3 Mo</td>
<td>AKs per treatment field, No.</td>
<td>8.0 (7.0 (5.0-12.0))</td>
<td>9.0 (5.0 (6.8-11.3))</td>
<td>.22</td>
</tr>
<tr>
<td></td>
<td>Absolute reduction in AKs, No.</td>
<td>11.5 (8.0 (6.8-14.3))</td>
<td>12.5 (11.0 (7.0-17.8))</td>
<td>.43</td>
</tr>
<tr>
<td></td>
<td>Reduction in AKs per field, %</td>
<td>52.3 (29.7 (41.0-71.0))</td>
<td>58.0 (24.8 (47.0-72.0))</td>
<td>.29</td>
</tr>
<tr>
<td>6 Mo</td>
<td>AKs per treatment field, No.</td>
<td>9.0 (10.0 (4.0-14.3))</td>
<td>10.0 (10.0 (4.8-15.0))</td>
<td>.65</td>
</tr>
<tr>
<td></td>
<td>Absolute reduction in AKs, No.</td>
<td>11.0 (7.0 (7.0-14.0))</td>
<td>12.0 (10.0 (7.5-17.8))</td>
<td>.73</td>
</tr>
<tr>
<td></td>
<td>Reduction in AKs per field, %</td>
<td>59.3 (25.6 (41.1-66.7))</td>
<td>50.3 (31.7 (41.6-73.2))</td>
<td>.99</td>
</tr>
<tr>
<td>9 Mo</td>
<td>AKs per treatment field, No.</td>
<td>8.5 (9.0 (6.0-15.0))</td>
<td>8.5 (7.5 (5.8-13.3))</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>Absolute reduction in AKs, No.</td>
<td>9.0 (9.0 (5.5-14.3))</td>
<td>12.0 (7.3 (8.5-15.8))</td>
<td>.13</td>
</tr>
<tr>
<td></td>
<td>Reduction in AKs per field, %</td>
<td>48.4 (42.4 (28.3-70.7))</td>
<td>64.4 (32.7 (36.9-69.6))</td>
<td>.05</td>
</tr>
</tbody>
</table>

**Abbreviations:** AKs, actinic keratoses; AWLPDT, artificial white light PDT; DPDT, daylight photodynamic therapy; IQR, interquartile range; NA, not applicable; PDT, photodynamic therapy; SD, standard deviation.

*a Total numbers of AKs at baseline.

b All P values are based on Wilcoxon signed rank test unless otherwise stated.
dose and either the actual reduction or reduction percentage in AKs on the daylight side. The exposure across the visible spectrum from the operating room light was maximum at the center of the treatment field and decreased radially to just under half the maximum exposure at the edges. The effective dose was between 4.00 and 9.00 J/cm² at an irradiance of 24 to 59 mW/cm² during 2-hour AWLPDT session.

Adverse Effects
Overall, pain scores were low and affected 14 patients with DPDT (median maximum pain score [range], 4 [0-19]) and 16 with AWLPDT (median maximum pain score [range], 6 [0-50]) (P = .51) (eFigure 4 in Supplement 2). Maximal scores were recorded at 120 minutes in 7 patients with each modality, whereas maximal scores after 30 minutes were recorded in 3 patients after DPDT and 6 after AWLPDT.

After DPDT, 12 patients (55%) had mild erythema, 9 (41%) had moderate erythema, and 1 was not recorded. After AWLPDT, 7 patients (32%) had mild erythema, 14 (59%) had moderate erythema, and 1 was not recorded. However, 1 patient who had moderate erythema on initial review 24 hours post-DPDT developed severe erythema and erosive pustular dermatosis 3 days after both treatments. He had skin type 1 with significant photodamage and had been unable to tolerate CPDT. He responded quickly to potent topical corticosteroid and emollient use. He reported that he would be happy to undergo either DPDT or AWLPDT again but not CPDT.

Tolerance of Treatment
Patients were asked to rate their tolerance of each treatment with 10 as “very tolerable” and 0 as “intolerable.” The median (IQR) score for DPDT was 9.5 (2) and 9 (2) for AWLPDT (P = .37).

Discussion
Significant photodamage and AKs, also called field cancerization, is common, particularly in elderly bald men with an increased risk of squamous cell carcinoma. Topical PDT is superior to alternative treatments for patients with diffuse AKs because of high response rates and excellent cosmetic outcome. Our experience with DPDT in this study confirms the published DPDT results; namely, that it is effective, well tolerated, and popular with patients compared with CPDT. Daylight PDT solves the problem of significant pain with CPDT. Spontaneous complete field regression rates have been reported between 0% and 7% in small cohorts, but this would not account for the therapeutic effect recorded in this or other DPDT studies. Our response rates with topical DPDT and AWLPDT are similar to what we and others have reported with CPDT. In this study, AWLPDT was as effective as DPDT, and remission was sustained at time points up to 9 months with a trend showing less relapse with AWLPDT. We recorded partial clearance of AKs, recurrence of AKs, and new AKs within both fields as early as 1 month as noted by others. In a small subgroup of patients (n = 4), we recorded that at 3 months 27 AKs (54%) present in either treatment field were persistent, 15 AKs (30%) were recurrent, and 8 AKs (16%) were new. We did not grade AKs because the number of AKs and significant photodamage made it difficult to do so accurately for this cohort in a pretrial pilot (SOG, PC; departmental data). We found total AK count to be the best way of monitoring AKs compared with grade, size, or area of involvement. Grade 1 AKs are the predominant type in DPDT studies, and responses varied from 75% to 93% for grade 1 AKs; 39% to 76%, grade 2; and 30% to 52%, grade 3. Our experience was similar, and partial response was more likely to occur with thicker and also larger AKs. Our results indicate that patients with moderate to severe disease would benefit from a second treatment.

There are variables that may explain why not all AKs clear regardless of their grade. The distribution of PpIX within AKs after application of MAL is determined by the rate of diffusion of the prodrug, the rate of synthesis and distribution of PpIX, and the rate at which it is cleared. The exact level of PpIX required in AKs to generate a clinically significant photodynamic effect is unknown but low levels are effective as shown in DPDT studies. Previous work showed a marked variation in the level and distribution of PpIX between sections of the same biopsy sample and between biopsies from different patients with psoriasis. This suggests that cytotoxic species may be generated at tissue sites or within cells where they have little or no effect. The photodynamic effect may not be uniform throughout the treatment field. Posttreatment erythema assessed clinically was uniform and confined to treatment fields, confirming a photodynamic reaction in apparently uninvolved skin within the field. This did not prevent new AKs from developing as early as 1 month after treatment. The surface of the scalp and forehead is curved so irradiance and light doses were not uniform across treatment fields, nor was the output from daylight and artificial sources uniform (departmental data of The Charles Center, Department of Dermatology, Saint Vincent's University Hospital; unpublished).

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Our medical physics data confirm the Copenhagen and Australian experience, showing a significant range of doses after 2 hours daylight exposure with lowest values on overcast days (eFigure 3 in the Supplement) (Table 2). The mean (range) effective daylight light dose of 21.38 (3.20-43.00) J/cm² is comparable to the multicenter studies in Scandinavia (9.40 (0.20-28.30) J/cm²) and Australia (22.80 (3.00-46.00) J/cm²) and less than the first Danish study (43.20 (11.70-65.90) J/cm²), which was performed on sunny days only. Few patients have been treated with low light doses, but recently, 37 patients received lower than 3.50 J/cm² and showed a 57% reduction in AKs compared with a 72% reduction with doses higher than this. In our study, the dose measured during 5 patient treatments was less than 8.00 J/cm², and these patients responded similarly to those receiving higher doses as reported by other studies. Our spectral data showed that the blue light
activation peak was the main contributor to the photodegradation of PpIX in low-dose cases. In contrast, the effective light dose with our white light source ranged between 4.00 and 9.00 J/cm², but the emission spectrum had a similar amplitude to a bright sunny day—between 450 nm and 700 nm—so it is very effective across this portion of the PpIX absorption spectrum. The minimum red light dose (600-660 nm) for this source (50 J/cm² in the treatment area at 65 cm from the light source) was equivalent to 2 red light sources that we use for phototherapy; PDT, photodynamic therapy.

A study of ultra-low-intensity artificial daylight by Wiegell et al.²⁰ found it to be less effective than red light LED PDT for the treatment of multiple AKs. They used 4 Xenon H4 light bulbs, and 20 patients, divided into 4 groups, were treated with different light intensities. The mean (range) effective PpIX dose during their 2.5 hours of exposure was 2.23 (0.46-5.86) J/cm². Quantification of PpIX demonstrated accumulation, indicating that this ultra-low-intensity light was insufficient to photobleach it.²⁰ The higher effective light dose and dose rates may explain the more favorable clinical response seen in our study. In Northern Europe, AWLPDT will facilitate treatment all year round because cold weather (<10°C) is the limiting factor for outdoor DPDT unless patients are treated through window glass in a sheltered area, a clinic, or home environment.⁸

Pain scores were low in this and other daylight studies.⁶,⁹,¹⁰,¹⁵ Hospital-based DPDT studies have recorded lower scores than home-based studies because the incubation time of 30 minutes is strictly adhered to, and breaks during treatment are curtailed to brief periods to prevent PpIX accumulating.⁶-⁸ More patients in this study recorded maximum scores at 120 minutes compared with 30 minutes that resolved after exposure, but scores were low and did not require any intervention. There was no association between pain scores, light doses, response to treatment, and remission data.

All patients had mild or moderate erythema 24 hours following treatment that lasted up to 7 days. One patient with skin type I and severe photodamage had moderate erythema at 24 hours that progressed to erosive pustular dermatosis with both treatments, but both episodes responded to superpotent topical steroids and emollients. Our results are similar to published series. In theory, PpIX should be metabolized in photodamaged skin to the photodynamically inactive heme within 24 hours²⁴,²⁵ or on normal forearm skin within 48 hours.²¹ However, PpIX has been demonstrated in plaques of psoriasis for up to 14 days following a single aminolevulinic acid application, using a CPDT protocol, and at distant sites where no prodrug was applied.²³,²⁶,²⁷ The photodynamic effect continues after CPDT on photodamaged skin.²⁸ Photoprotection with clothing in preference to sunscreen after treatment may reduce the risk of severe erythema and erosive pustular dermatosis in patients with severe photodamage.²⁸ Application of clobetasol propionate 0.05% before CPDT reduces erythema without reducing effectiveness and may represent a useful treatment modification for patients with severe disease.²⁹

This study confirms that DPDT is popular with patients, and 9 patients who had previous experience with CPDT reported to prefer DPDT or AWLPDT for future treatment as less painful options. Our cohort was equally divided when asked to select between DPDT and AWLPDT.

### Conclusions

Daylight and AWLPDT are important advances for the growing population of patients with field cancerization who cannot tolerate CPDT. All patients will be able to undergo DPDT during summer months, and many patients will be able to manage home DPDT, making it a more convenient option compared with hospital-based CPDT or AWLPDT. Year-round DPDT will be possible at some latitudes.³⁰ Remission data in this study suggest that annual treatment each summer will suffice for many patients. Artificial white light PDT in this study was effective and offered a more sustained remission at 9 months in a cohort with significant field cancerization; it can also be used as a suitable pain-free alternative to CPDT and DPDT all year round if required.

### Table 2. Comparison of Light Sources for PDT

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Light Sourcea</th>
<th>Light Sourceb</th>
<th>Light Sourcec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum treatment area, cm</td>
<td>Unlimited</td>
<td>10 × 10</td>
<td>21 × 22.5</td>
</tr>
<tr>
<td>Treatment time, min</td>
<td>120</td>
<td>120</td>
<td>15.5</td>
</tr>
<tr>
<td>Irradiance, mW/cm²</td>
<td>5-77³</td>
<td>59⁶</td>
<td>60</td>
</tr>
<tr>
<td>Effective dose, J/cm²</td>
<td>3.2-43⁴</td>
<td>9.0⁶</td>
<td>0.9</td>
</tr>
<tr>
<td>Red component (600-660 nm)</td>
<td>5-78⁶</td>
<td>125⁶</td>
<td>50</td>
</tr>
<tr>
<td>Irradiance, mW/cm²</td>
<td>5-78³</td>
<td>125³</td>
<td>68</td>
</tr>
</tbody>
</table>

Abbreviations: AWLPDT, artificial white light PDT; DPDT, daylight photodynamic therapy; PDT, photodynamic therapy.

* A minimum dose of 50 J/cm² in red component was prescribed for all 3 artificial sources.
* Overall pain scores were low.
* Overall pain scores were high.

The variation for daylight doses is owing to the weather on the day of treatment. These values for the AWLPDT and Aktilite are the maximum values. Owing to the nonuniform distribution of irradiance from both sources, the minimum values within the treatment sizes in the table are 40% and 80% of the maximum value, respectively.


