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| 学位の種類 | 博士（医学） |
| 報告番号 | 甲第１６８２号 |
| 学位記番号 | 第１１９９号 |
| 氏名 | 益田　秀之 |
| 授与年月日 | 平成 31 年 3 月 25 日 |
| 学位論文の題名 | Dual wavelength 5-aminolevulinic acid photodynamic therapy using a novel flexible light-emitting diode unit<br>（新たなフレキシブル LED ユニットを用いた複数波長による 5-アミノレブリン酸光線力学療法）<br><br>J Dermatol Sci. (in press) |
| 論文審査担当者 | 主査：　山崎 小百合<br>副査：　芝本 雄太，森田 明理 |

**Abstract**

Photosensitizers used for photodynamic therapy (PDT) to treat dermatologic disease are metabolized into mainly protoporphyrin IX (PpIX), which has five absorption wavelength peaks: 410 nm, 510 nm, 545 nm, 580 nm, and 630 nm. Although only red light around 635 nm and blue light around 400 nm are used as light sources for PDT, the efficiency of PDT might be improved by using multiple wavelengths, including those that correspond to the other absorption peaks of PpIX. Furthermore, because the target disease often occurs on the face, a flexible-type light-source unit that can be fitted to the lesion without unnecessarily exposing the mucous membranes, e.g., the eyes, nostrils, and mouth, is preferred. We investigated the efficacy of a flexible light-emitting diode (LED) unit that emits multiple wavelengths to improve PDT effects. HaCaT cells were incubated with 5-ALA and subsequently irradiated with either a single wavelength or sequentially with two wavelengths. Cell viability and reactive oxygen species were analyzed. Nude mice were implanted with COLO679 cells by subcutaneous injection into the flank. 5-ALA was subcutaneously injected into the tumor. The tumor was irradiated with 50 J/cm$^2$ (day 0) and assessed daily until day 21. The synergistic PDT effects of dual-wavelength irradiation and reactive oxygen species production were highest with the 405-nm and 505-nm wavelength combination. This dual wavelength combination was also the most effective in vivo. We could therefore conclude that dual-wavelength PDT is an efficient strategy for improving the therapeutic effects of PDT. Using a flexible LED unit is expected to achieve more uniform irradiation of uneven areas.