CORRESPONDENCE

Optimum brightness of a new light-emitting diode lightwand device in a cadaveric model – a pilot study

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To the Editor,

Lightwand devices have played an important role in management of the difficult airway.¹ The recent withdrawal of the TrachlightTM from the market has left many anesthesia providers without a suitable replacement for this well-validated device.¹ Despite its overall utility, the prior Trachlight was not without its limitations. It was known to have appreciable degradation in light output after repeated cleanings,² be associated with a risk for thermal burns from the incandescent bulb, and a fixed brightness of 2282 lux² that could not be adjusted to account for varying patients' neck sizes.³

We recently developed a new prototype lightwand device with red and white light-emitting diode (LED) light sources and adjustable brightness. In this pilot study, we assessed the optimum light intensity and LED bulb colour (white *vs* red) required for transtracheal illumination with this new device.

Our local institutional research ethics board granted approval (July 2012) for this study. Fourteen anesthesia staff members familiar with lightwand intubation consented to participate in the study. One was excluded from the study because of a technical problem during testing. One female and one male, minimally preserved,

clinical-grade cadavers (neck circumferences of 38 cm and 40 cm, respectively) were used for this pilot study. The brightness of the prototype device was controlled via a dimmer dial on a custom-built power supply. Two lightwand stylets were equipped with either a variable-brightness red (0–4500 lux) or white (0–8000 lux) LED bulb. The LED light output was calibrated using a previously described lightmeter and testing system.² Each lightwand was placed inside a 7-mm endotracheal tube (Mallinckrodt Hi-Lo cuffed tracheal tube, Covidien) so the LED bulb did not protrude beyond the tip of the tube. It was bent to form a “hockey stick” configuration.¹ The cadavers were intubated by one of the investigators with the endotracheal tube/lightwand tip placed in the glottis opening (confirmed by direct laryngoscopy). Testing was done with the room lighting darkened to < 3 lux. For each bulb colour, the participants adjusted the dial to the optimum transtracheal illumination to confirm tracheal placement. These data were recorded in two ways, both from the fully off position up to the optimum level and from the maximum brightness down to the optimum level.⁴ The order of the testing scenario was block randomized. After testing was complete, the participants were asked which bulb colour they preferred. The optimum brightness levels were compared using analysis of variance followed by post-hoc Holm-Sidak testing. Two-sided $P < 0.05$ (adjusted for multiple comparisons) was considered significant.

The optimum light intensity selected by the 13 staff participants for the different testing scenarios is shown in the [Figure](#). There were significant differences in the optimum light intensity for the female *vs* male cadavers ($P < 0.001$) and the red *vs* white LED bulb brightness ($P < 0.001$). There was no significant difference, however, in the

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Figure Mean (SD) optimum light levels for transtracheal illumination. The x-axis indicates the direction in which the light was adjusted by the staff anesthesiologists (i.e., gradually increasing from the “off” position or decreasing from the maximum brightness setting). Left: female cadaver. Right: male cadaver

optimum brightness selection by direction of dial adjustment ($P = 0.16$). The pattern of LED colour preference was variable, with 31% preferring the white LED light, 23% preferring the red LED, and 31% with no colour preference. The other 15% reported that their choice (either white or red) depended on the perceived neck thickness.

The optimum brightness required for transtracheal illumination was highly dependent on the anatomy of the cadaver tested, with a wide range of lux required for both LED bulb colours. The optimum brightness selected by the participants was up to three-fold higher for the white LED and up to 1.7-fold higher for the red LED in comparison to the brightness of the prior Trachlight device.²

This study was limited in that we tested only two cadavers. Although cadavers are more realistic than plastic manikins as an experimental airway model, they may not

fully represent the *in vivo* situation because the cadaver preservation process or lack of blood flow may influence light transmission properties in tissues.

The data from this study support use of the new lightwand device design with an adjustable light intensity and the option of red or white LED light sources. A user-adjusted brightness feature coupled with a brightness capability exceeding that of the prior Trachlight may allow usage in a broader range of neck girths and clinical situations. It awaits further study.

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Competing interests All three authors are the co-founders of Scotia MD Engineering Inc which holds the intellectual property rights for the device used in this study (patent pending).

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