Visual acuity during direct laryngoscopy at different illuminance levels


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Abstract

Background: Adequate light is essential for vision during direct laryngoscopy. The ISO 7376:2009 Standard specifies the minimum illuminance for laryngoscopes. No studies have objectively examined the relationship between laryngoscope illumination and visual acuity during laryngoscopy.

Methods: The near visual performance of 50 anaesthetists was measured during direct laryngoscopy using near vision charts located at the larynx of four manikins. A variable voltage supply adjusted the illuminance from the laryngoscope to 50, 200, 700 and 2000 lux. Participants also rated their experience regarding brightness of the laryngoscope, clarity of view, visual performance, suitability and adequacy of the light, before proceeding to the next manikin with a different light level. The distance visual performance of the participants was also measured using standard letter acuity wall charts at the same light levels.

Results: Visual acuity in manikins and on wall charts was associated with an increasing lux level (p<0.0001). Visual acuity was lower at 50 and 200 lux compared to 700 lux by significantly greater than the clinically discernible 0.1 logMAR. No statistically significant improvement in visual acuity occurred when illuminance was increased to 2000 lux. Visual acuity of participants was significantly better on the wall charts than the manikin charts (p<0.0001). The mean (standard deviation) logMAR scores at the four chosen lux levels on the manikin charts were: 50 lux 0.05 (0.13), 200 lux 0.06 (0.10), 700 lux -0.05 (0.11), 2000 lux -0.07 (0.11). This result was unaffected by age, seniority, sub-specialty, history of difficulty focusing, or use of lenses for laryngoscopy. Subjective rating of laryngoscope brightness favored 2000 lux for clarity of view, suitability of the light for laryngoscopy and visual performance. The average observation distance for direct laryngoscopy was 32 cm.

Discussion: This is the first study to objectively measure visual performance during direct laryngoscopy. The results may help improve the international standards for laryngoscope light and highlight the importance of appropriate light during near vision tasks such as direct laryngoscopy. A greater appreciation of how to optimize a view of the larynx could help decrease failed intubation and airway morbidity. The median near observation distance of 32 cm, found in our study, is less than the normal 40 cm near working distance expected for everyday tasks indicating that direct laryngoscopy is a very demanding near vision task. Corrective lenses could be needed at an earlier age for this closer distance and lenses specifically for laryngoscopy should be stronger than ordinary corrective lenses for reading.

Conclusions: Visual acuity improves as the laryngoscope illuminance increases up to 700 lux. No significant improvement was measured by increasing the illuminance up to 2000 lux. Subjectively, anaesthetists favor illuminance of 2000 lux for direct laryngoscopy.