



Potential of eye tracking technology for assessment of performance and medical education in the field of anesthesia

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Eye tracking refers to the process of measuring either the gaze point or eye movement while an individual performs a task [1]. These measurements are performed by a device or computer equipped with an eye tracker, which consists of cameras, and projectors and utilizes image processing algorithms. In conjunction with ongoing advances in eye tracking methods and equipment, eye tracking technology has been applied in a growing number of diverse fields including psychology, neuroscience, marketing, product design, automotive research, and medicine [2]. In all of these fields, eye tracking technology is utilized on the basis of a relationship between what a subject is looking at and what he or she is paying attention to or thinking about at that point in time.

In the medical field, eye tracking has long been used as a useful tool in medical diagnosis, especially mental diseases such as schizophrenia [3], bipolar disorder [4], attention deficit hyperactivity disorder (ADHD) [5], autism [6] and Alzheimer's disease [7]. Various eye tracking techniques have been used for diagnostic purposes, ranging from simple methods such as pro-saccadic tasks, anti-saccadic tasks, and smooth pursuit tasks to more complicated methods such as visual search tasks and free observation [8].

While numerous studies have investigated the use of eye tracking to diagnose various diseases [3–7,9,10], its role in medical therapy and treatment has not been well established due to

a relative lack of evidence. Patients with locked-in state amyotrophic lateral sclerosis (ALS) can use an eye tracking assistive device to communicate with their caregivers. This can improve quality of life in ALS patients, and reduce the burden on caregivers [11]. An eye tracker can reportedly help patients with eye cancer during radiotherapy by reducing the target volume size and concentrating the radiation beam on the lesion [12]. A recent clinical trial investigated the feasibility of early attention skill training via novel eye tracking technology and gaze-contingent training paradigms in infants at familial risk of ADHD [13].

Eye tracking technology can also reportedly yield information that is used for differentiating novices from experts by analyzing their visual patterns [14–17]. One systematic review suggests that eye tracking technology may be a reliable tool for the assessment of surgeon skill [14]. In another study investigating chest X-ray interpretation for pneumothorax, it was found that the diagnostic accuracy of pneumothorax increased with experience, and that parameters derived from eye tracking were also significantly associated with diagnostic accuracy [15]. In the field of anesthesia, analysis of visual attention via eye tracking technology may be useful for the assessment of performance in ultrasound-guided regional anesthesia (UGRA). Harrison et al. [16] examined gaze-fixation heat map for comparing procedural expertise while performing simulated UGRA. In another study, Borg et al. [17] investigated the area of interest of anesthesiologists who were asked a standardized anatomy-based question related to ultrasound image that may be commonly encountered during UGRA. These studies presented that experts spent less unfocused time away from a target compared to novices. Similarly, Schulz et al. [18] investigated the impact of experience on performance, physiological workload indicators, and distribution of visual attention during simulated critical incidents.

In this issue, King et al. [19] utilized eye tracking technology in a comparative evaluation of five malignant hyperthermia

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cognitive aids. This method may provide useful data for the development of new cognitive aids that could be helpful for patient care during critical events. In addition, a better understanding of the relationship between visual attention, situational awareness, and performance may result in improved monitoring interfaces

and enhanced usability of anesthesia machines in the workplace [20,21]. In the field of anesthesia, the currently available evidence suggests that eye tracking is a promising area of research in terms of performance assessment and improvement of health-care provider training.

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