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Research-In-Progress

Eye-Tracking Surgical Headlamp for Improved Intra-Operative Visualization and Efficiency

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Introduction: Surgical headlamps are necessary for deep, narrow, and lateral surgical sites but must be manually adjusted at the start of the operation. Adjustments may also be necessary during surgery, requiring the surgeon to look away from their task. It takes the average person 23 minutes to fully regain concentration after a distraction such as this. Numerous distractions increase the risk of surgical errors, and poor lighting can lead to unintentional injury. Furthermore, if the sterile field is mistakenly broken, the patient becomes more susceptible to infection and an increased hospital stay. Therefore, there is a need for an automatic/self-adjusting headlamp that would decrease time spent on intra-operative adjustment, reduce distractions, and maintain focus.

Methods: Our concept is a headlamp with eye-tracking protective eyewear that is adjustable for glasses-wearers. Magnifying loupes can easily be attached/detached. A works-like prototype was developed using infrared technology and multiple servo motors arranged in 3-axes. The device was tested through exercises, such as moving the eye in various directions and measuring where the eye is focused.

Preliminary Results: Preliminary results from initial trials demonstrate the device's ability to accurately track eye movement and align a light with the general direction a user is looking. The prototype also recorded what the user looked at and pinpointed the focal point of their eyes. Those who participated in testing also commented on the device's ergonomic design.

Next Steps: Next step involve completing the motorized mechanism for the headlamp to auto-adjust the light source based on the surgeon's gaze. Rigorous testing of this integrated system will then be conducted to verify its accuracy, responsiveness, speed, and overall performance. By automatically following the surgeon's gaze, this device has the potential to optimize illumination precisely where needed, enhancing the surgeon's ability to focus on critical areas without the potential for distraction.