

Abstract

Clinical innovation: Enhancing patient experience and image quality in respiratory examinations

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Patients with breathing difficulties may have dysfunctional airways in which the vocal cords contract during exercise, a condition called Exercise-Induced Laryngeal Obstruction (EILO) [1]. To diagnose this condition, Continuous Laryngoscopy During Exercise (CLE) tests can be performed. In CLE tests, a laryngoscope is mounted onto a head-mounted fixture and inserted through the nose into the throat to visualize the vocal cords. The patient is then placed on a treadmill which is ramped up in both speed and elevation to severely challenge the patients physically to induce an EILO episode.

At the Center for Respiratory Diseases at Aarhus University Hospital, CLE tests have been performed using a stainless-steel fixture (figure 1) to hold the laryngoscope in place during the test. The fixture is difficult to mount on the patients, often requiring the examination to be interrupted to adjust the fixture during the test. Even after repeated adjustments, positioning of the laryngoscope to achieve satisfactory image quality can be problematic.

The fixture was redesigned and manufactured using 3D printing with FDM technology (figure 2). Through an iterative process involving frequent user feedback, the new fixture was designed with a less clinical appearance and with a tightening mechanism familiar to patients and clinical personnel from everyday life (figure 3). This approach significantly reduced the time required for the examination while also substantially improving the quality of the image material by fixing the laryngoscope much more rigidly.

The iterative process allowed for continuous improvements, resulting in a fixture that was easier to mount and ensured a more reliable and consistent positioning of the laryngoscope during the examination. Our experiences point to vast potential for using the rapid nature of additive manufacturing for conducting multiple feedback loops for user-centered design and optimizing the final product.

AUTHOR'S STATEMENT

Authors state no conflict of interest. Informed consent: Informed consent has been obtained from all individuals included in this study.

REFERENCES

[1] E. S. Walsted et al. Characteristics and impact of exercise-induced laryngeal obstruction: an international perspective, ERJ Open Research, 7: 00195, 2021. <https://doi.org/10.1183/23120541.00195-2021>



Figure 1: Original CLE helmet

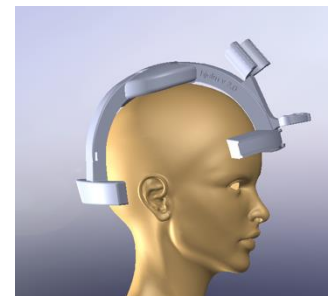


Figure 2: Interim design



Figure 3: Final CLE helmet