

# Leveraging 3D Printing for a Low-Cost Loupe-Mounted Camera in Surgical Education

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## ABSTRACT

**Background:** Cleft palate surgery presents unique challenges, as it requires intricate work within confined spaces. These spaces are often obscured from the view of students and observers, limiting effective intraoperative education. The use of a camera to capture the surgeon's perspective can significantly enhance both intraoperative and post-operative teaching by providing a clear and direct view of the surgical field. However, existing solutions pose several challenges. Non-specialized action cameras are cumbersome to mount and operate. While commercially available surgical loupe cameras are expensive, thus limiting accessibility.

**Methods:** The proposed solution employs an off the shelf, 4K 30fps, M12 mount camera, secured to the headlight mount of surgical loupes using a custom-designed, 3D-printed adjustable bracket. This ensures precise alignment with the surgeon's line of sight and compatibility with various loupe manufacturers and configurations. An additional Bluetooth foot pedal enables sterile hands-free operation, while a wireless video transceiver streams real-time video to external displays.

**Results:** The camera was tested by two plastic surgeons and delivered satisfactory results. The camera costs \$84 CAD in parts and materials, weighs 28 grams, and provides 8.4 hours of battery life if streaming wirelessly in 4K at 30 fps.

**Conclusion:** This case highlights the potential of 3D printing to create highly customizable, low-cost solutions for addressing challenges in clinical medicine. With further promotion and awareness of 3D printing as a transformative technology, clinicians can be empowered to identify key areas for innovation and foster collaboration with engineers, driving the development of novel and effective tools for medical practice.

*Keywords:* Examples: 3D printing, Intraoperative Video, Surgical Education, Cost-Effective Solutions

*Conflict of Interest:* The authors declare that they have no conflict of interest.