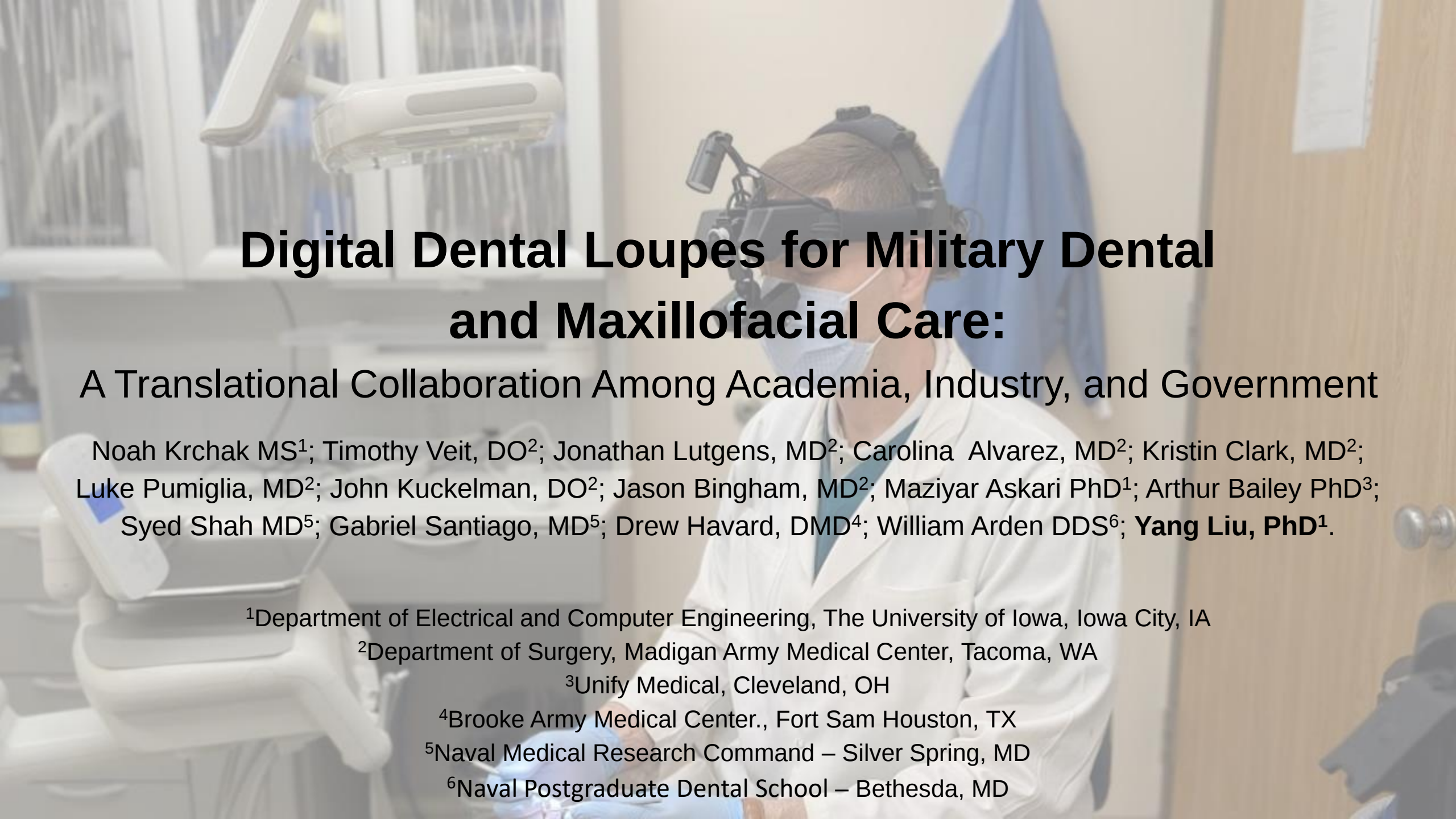


A dentist wearing digital dental loupes in a clinical setting.

Digital Dental Loupes for Military Dental and Maxillofacial Care:

A Translational Collaboration Among Academia, Industry, and Government

Noah Krchak MS¹; Timothy Veit, DO²; Jonathan Lutgens, MD²; Carolina Alvarez, MD²; Kristin Clark, MD²; Luke Pumiglia, MD²; John Kuckelman, DO²; Jason Bingham, MD²; Maziyar Askari PhD¹; Arthur Bailey PhD³; Syed Shah MD⁵; Gabriel Santiago, MD⁵; Drew Havard, DMD⁴; William Arden DDS⁶; **Yang Liu, PhD¹**.

¹Department of Electrical and Computer Engineering, The University of Iowa, Iowa City, IA

²Department of Surgery, Madigan Army Medical Center, Tacoma, WA

³Unify Medical, Cleveland, OH

⁴Brooke Army Medical Center., Fort Sam Houston, TX

⁵Naval Medical Research Command – Silver Spring, MD

⁶Naval Postgraduate Dental School – Bethesda, MD

Disclosure

- Y. Liu, A. Bailey and M. Askari are shareholders of Unify Medical, a company commercializing the digital dental loupes.

Introduction

- Military dental and maxillofacial providers operate in austere and far-forward environments.
- Conventional dental microscopes are not deployable in these settings.
- Capability gap in dental and surgical magnification and visualization.



Capability Description



Dental/Surgical Microscopes

- You “fit” into microscope
- Limited situational awareness
- Bulky and non-deployable

**Digitization &
Miniaturization**



Digital Dental Loupes

- The scope fit to you
- Improved situational awareness
- Small and portable

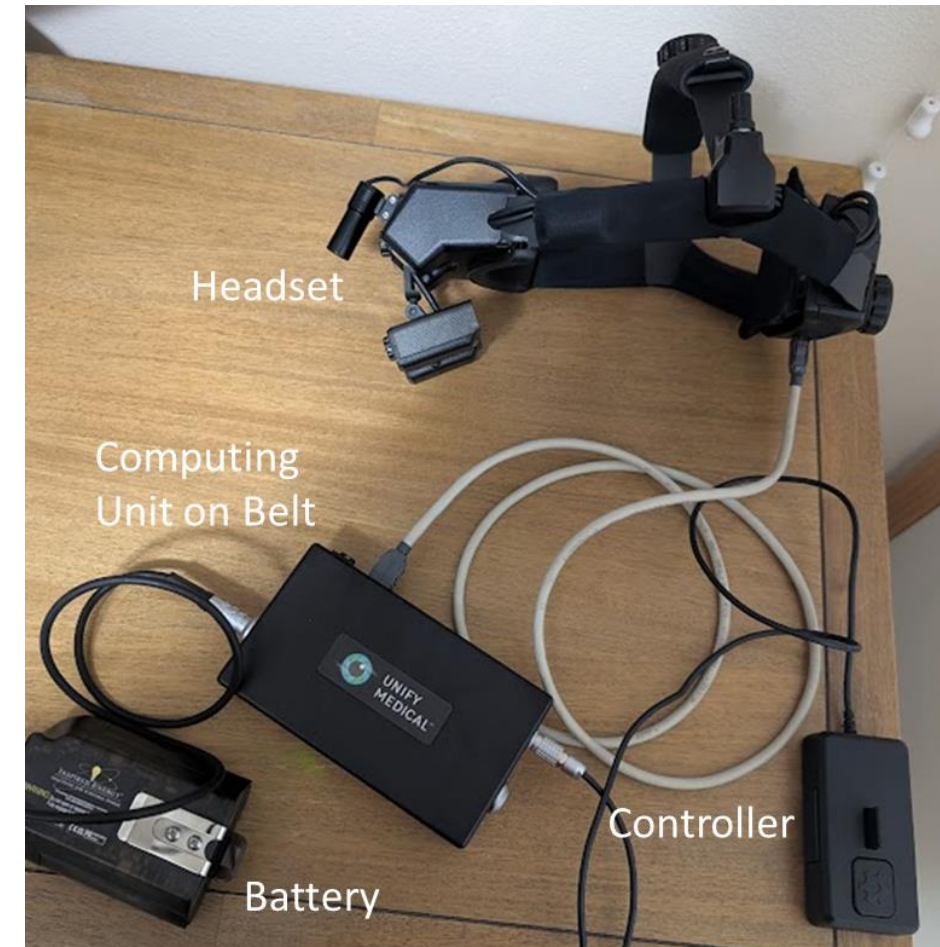
Capability Description

- Wearable, battery-powered visualization system.
- Real-time stereoscopic magnification, autofocus, integrated illumination, and near-eye 3D display.
- Self-contained, untethered, and designed for prolonged procedures while maintaining situational awareness.
- Supporting routine dental care, endodontic procedures, and maxillofacial surgical care in both fixed and austere settings.



Methods / Technical Approach

- The system integrates high-resolution Complementary Metal-Oxide-Semiconductor (CMOS) based stereoscopic imaging, binocular autofocus, light-emitting diode (LED) based illumination, Organic Light-Emitting Diode (OLED) microdisplays.
- Heterogeneous edge-computing architecture: Field-Programmable Gate Array (FPGA) + Central Processing Unit (CPU) + Graphics Processing Unit (GPU).
- Hand-held controller.
- Mechanical and ergonomic optimization minimized headset weight while offloading power to a belt-mounted subsystem.

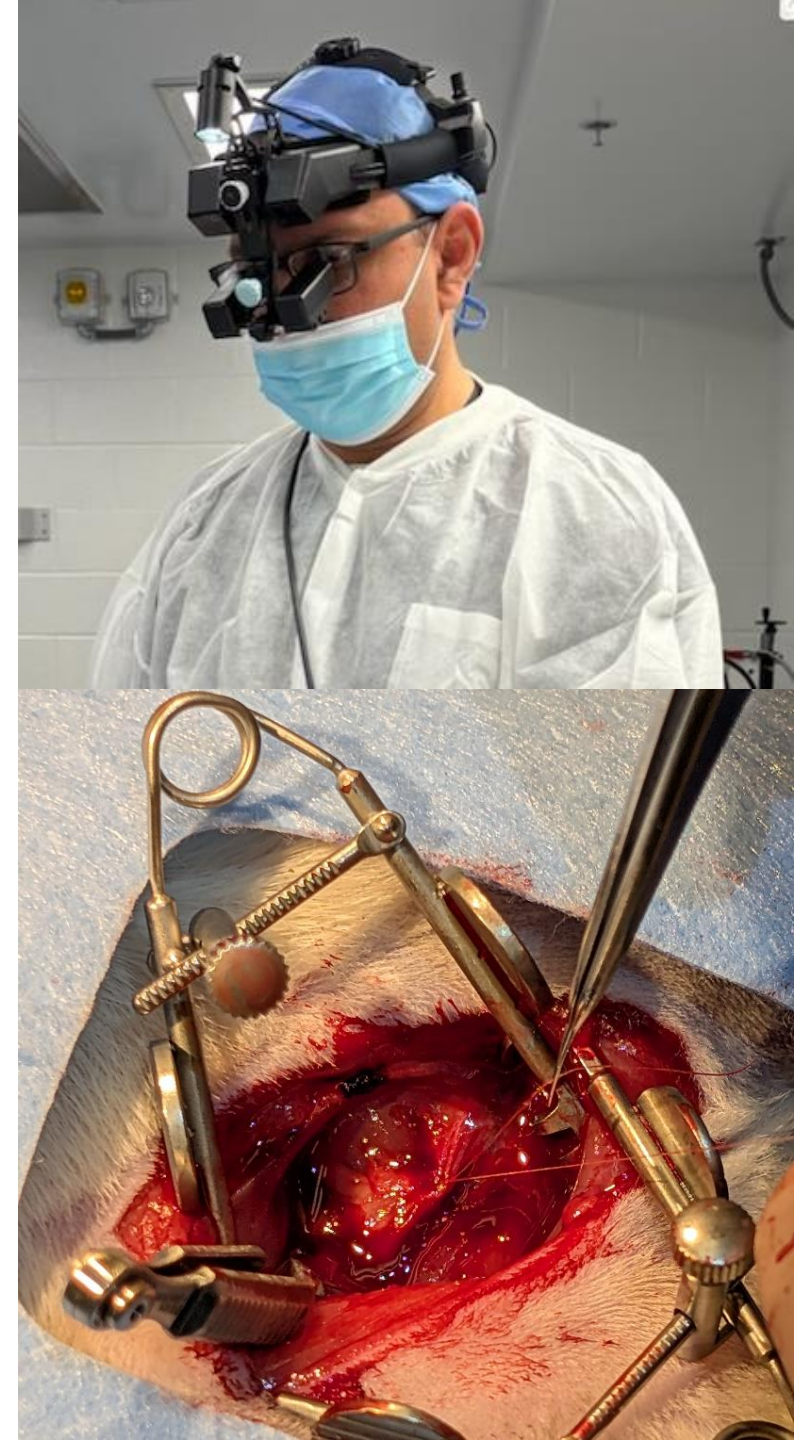


Results

- The Digital Dental Loupes offer stereoscopic magnification (2x–8x) with 3D depth of perception.
- Substantially wider magnification range than conventional optical dental loupes (2.5× or 3.5×).
- Binocular autofocus can be achieved with less than 1s.
- The autofocus capability represents a key advantage relative to optical loupes with fixed focal distances.
- The system offers a large depth of focus (>5 cm), enabling visualization across multiple tissue planes.

Results

- The device is intuitive has minimal learning curve.
- On average, it takes less than 10 minutes before new user start using the systems.
- Users reported higher useability than traditional dental/surgical microscopes.
- First-time users successfully performed microsurgical vascular procedures in mice. The diameter of artery was less than 0.4 mm.
- This FDA-listed product, used at a civilian ambulatory and surgical center, enables nerve and vascular repair (requiring 6–8× magnification) in patients that is not achievable with conventional surgical loupes.



Applicability to Medical Roles of Care

- The system supports dental, maxillofacial and surgical care across Roles 1–3.
- Enabling dentists, endodontists, maxillofacial surgeons, and non-dentist providers to perform precision procedures when conventional dental microscopes are unavailable.



Impact to the Warfighter / Significance

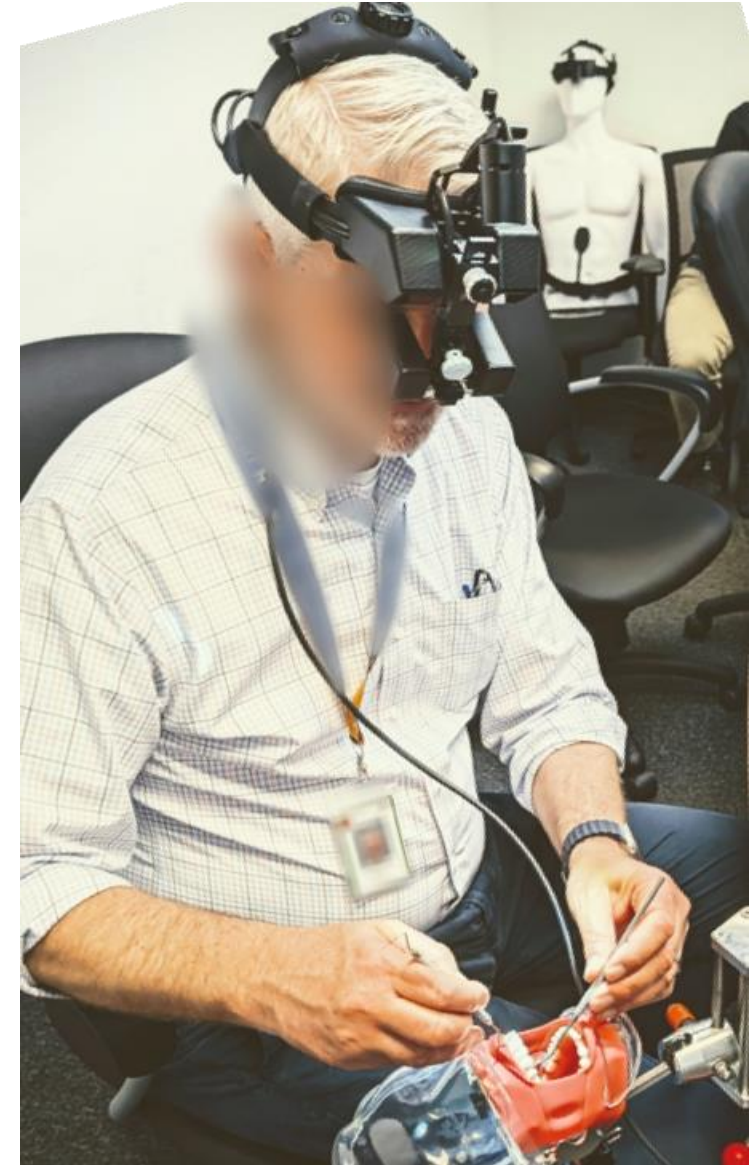
- Facilitate high-quality visualization in operational and austere environments.
- Minimize learning curve.
- Enhance procedural accuracy.
- Reduce provider fatigue.
- Expand the scope of dental, maxillofacial and surgical care deliverable in operational settings.
- Bring specialty and subspecialty care forward.
- Improving readiness and warfighter outcomes.

Developmental Status of the Technology

- The Digital Dental Loupes are listed with FDA as a Class I device.
- The technology is currently at TRL 7–8, with dental study and military evaluation underway.
- Future work will focus on development of additional functionality and capability, as well as iterative refinement of product.

Dual-Use Platform Technology

- Digital Dental Loupes can be applied to both military and civilian applications.
- Serving multiple dental and surgical subspecialties.
- Platform technology that can anchor additional capabilities.



Thank you for your attention!



Acknowledgement

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