



Evaluation of a Noninvasive Widefield en-face Probe for Detection of Oral Dysplasia and Invasive Carcinoma

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Introduction / Background

- Autofluorescence of endogenous tissue fluorophores has shown promise for early detection of oral squamous cell carcinoma (OSCC). Using blue (405nm) excitation light, dysplastic tissue have a loss of green fluorescence allowing early visualization of potentially cancerous lesions.

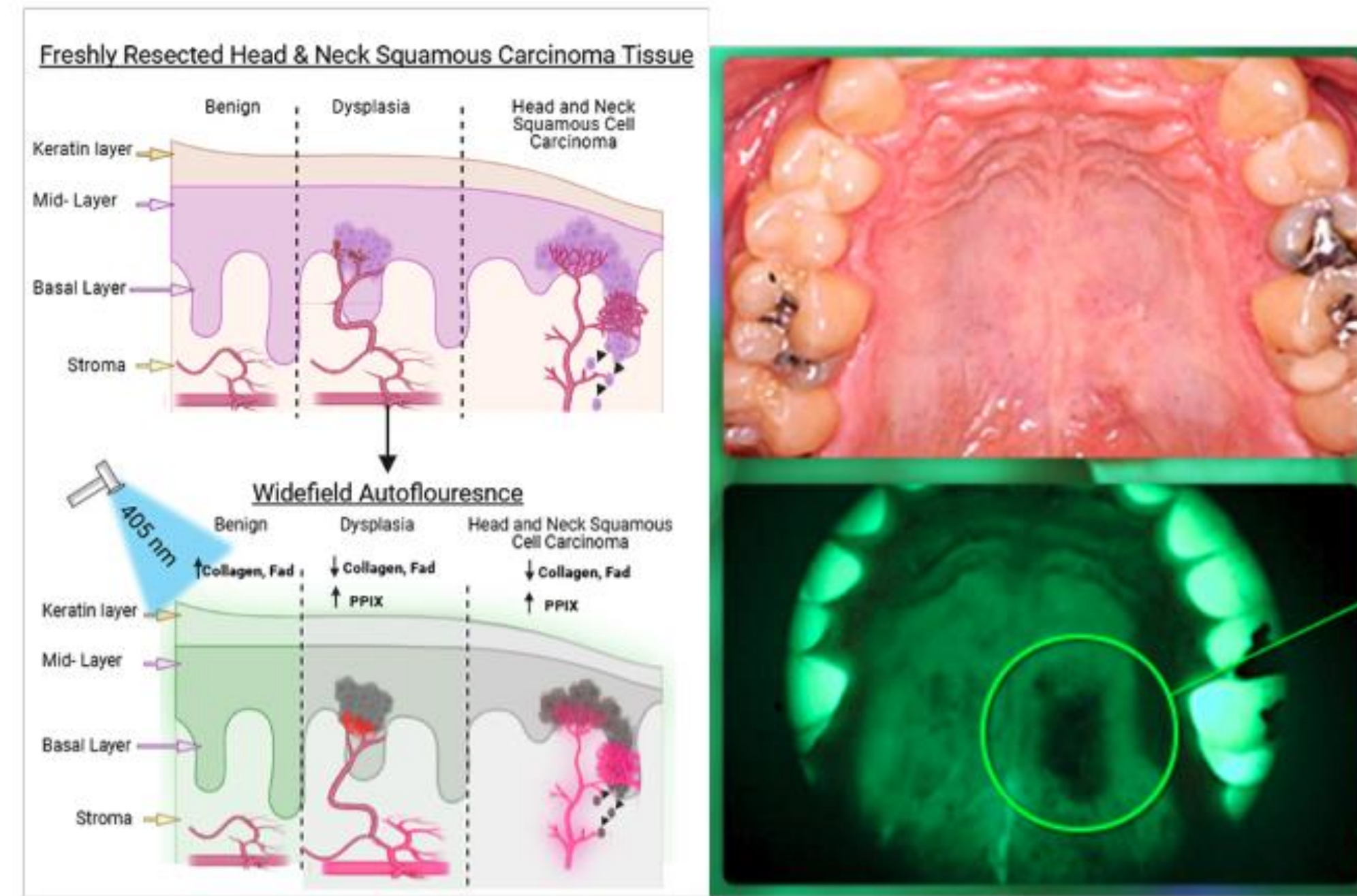


Figure 1. Diagram showing the basics of autofluorescence in oral cancer,.

Methods

- We evaluated a 1.5mm 120° CMOS microsensor's (Omnivision) ability to detect red and green autofluorescence in clinical oral cancer tumor samples.

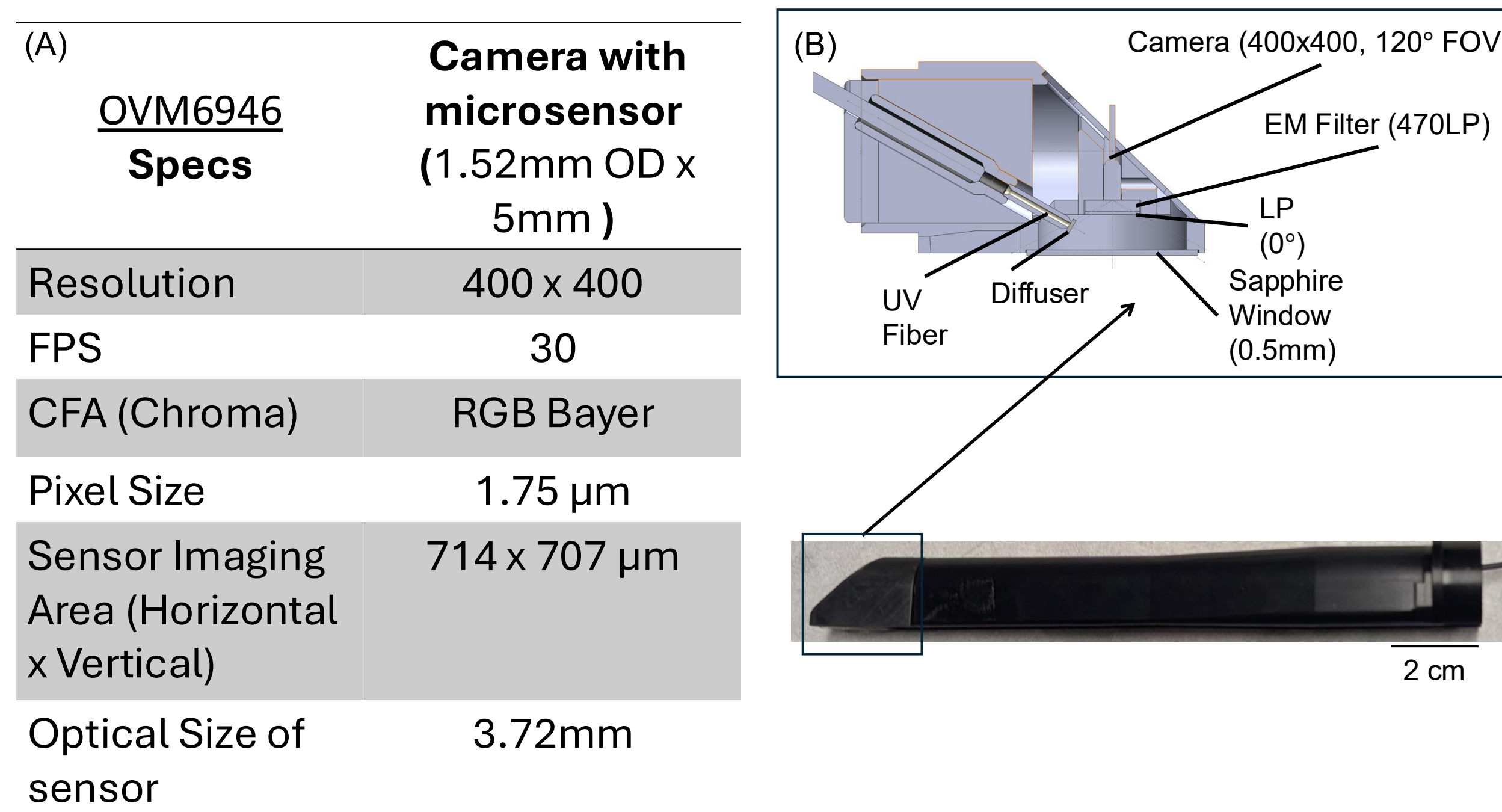
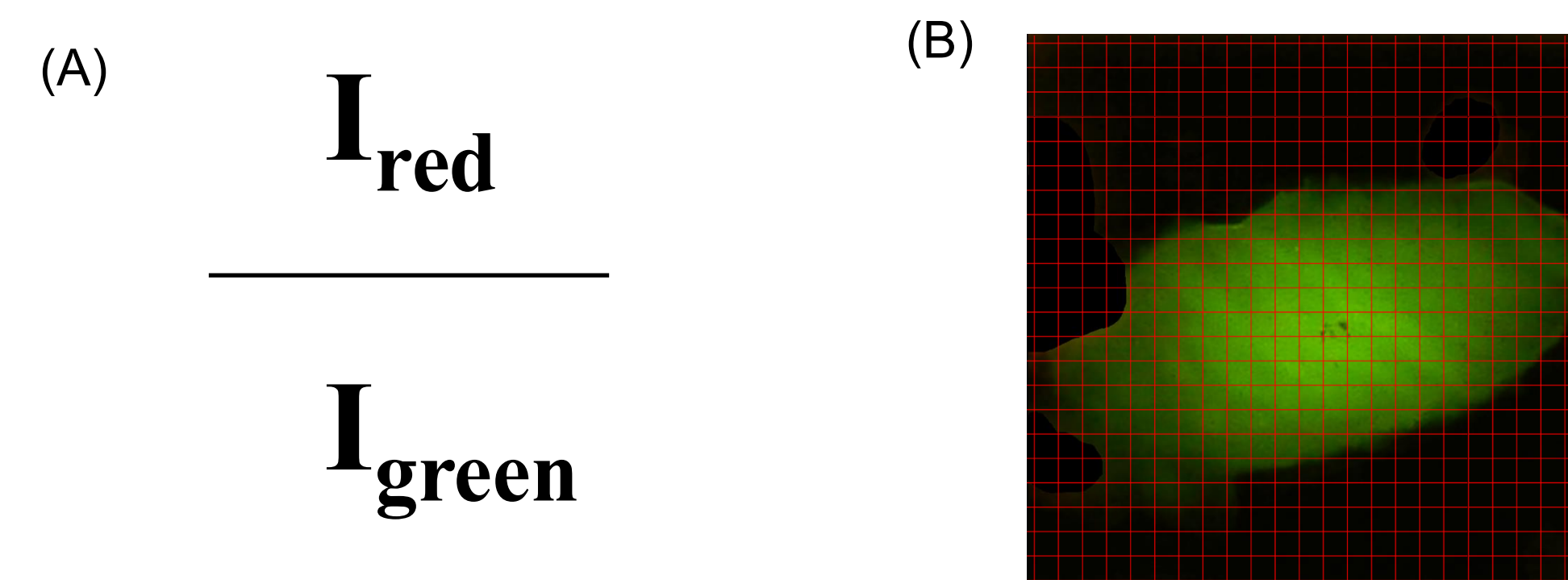


Figure 2. Table showing specs and dimensions of Omnivision microsensor (A). CAD diagram of enlarged probe head design with elements labeled (B).

- Intensity analysis of red and green channels was acquired at sites grossly evaluated as either tumor, normal, or transition.
- Red/green (R/G) autofluorescence intensity ratios were calculated in whole tissue using a red/green ratio (A) and from each pixel (PBP) in the collected images (B).



Results

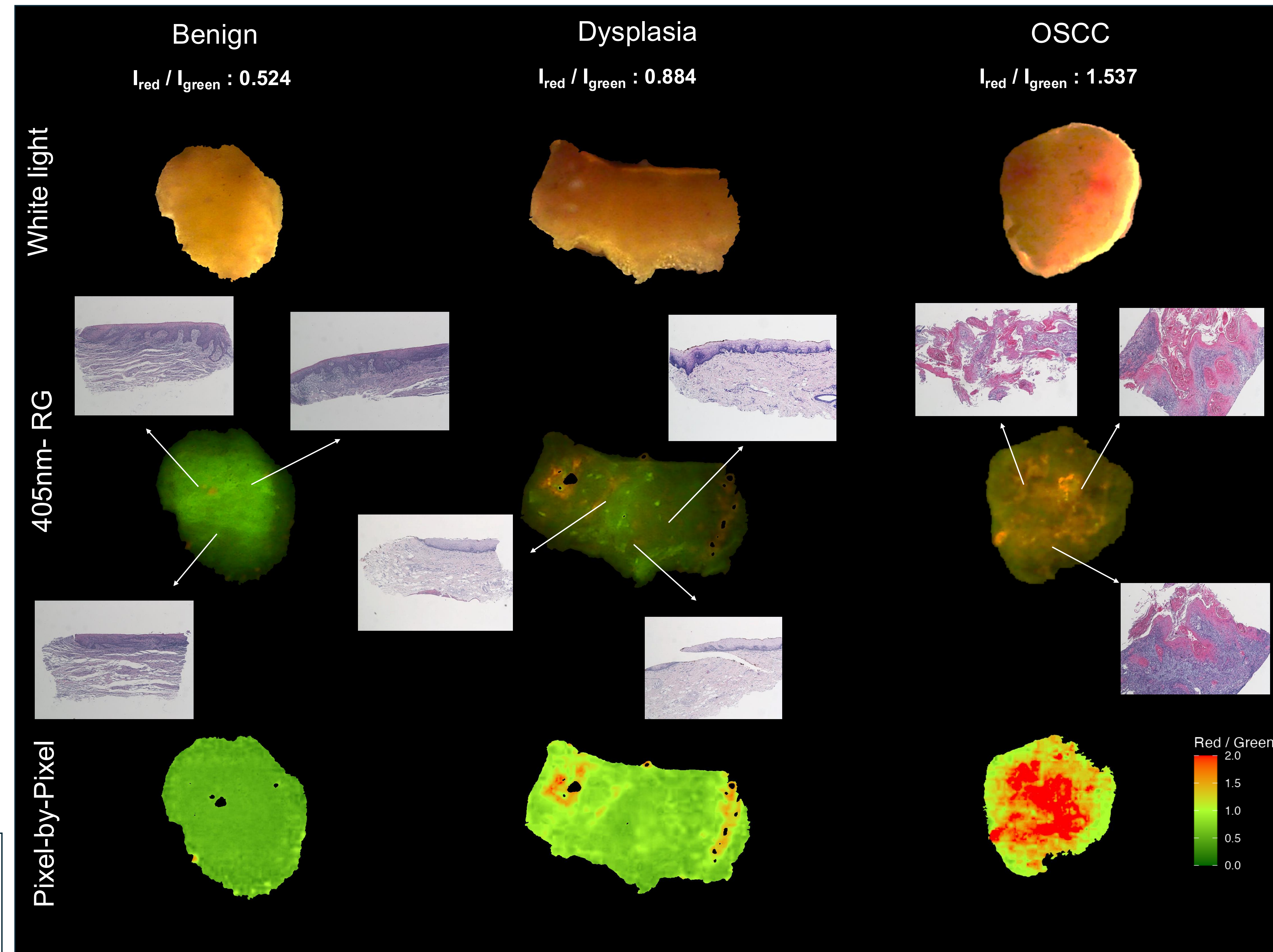


Figure 3. Images of resected tissue from left to right, benign, transition and tumor. White light, 405nm red/green, and pixel-by-pixel analysis shown. Corresponding histology also visible.

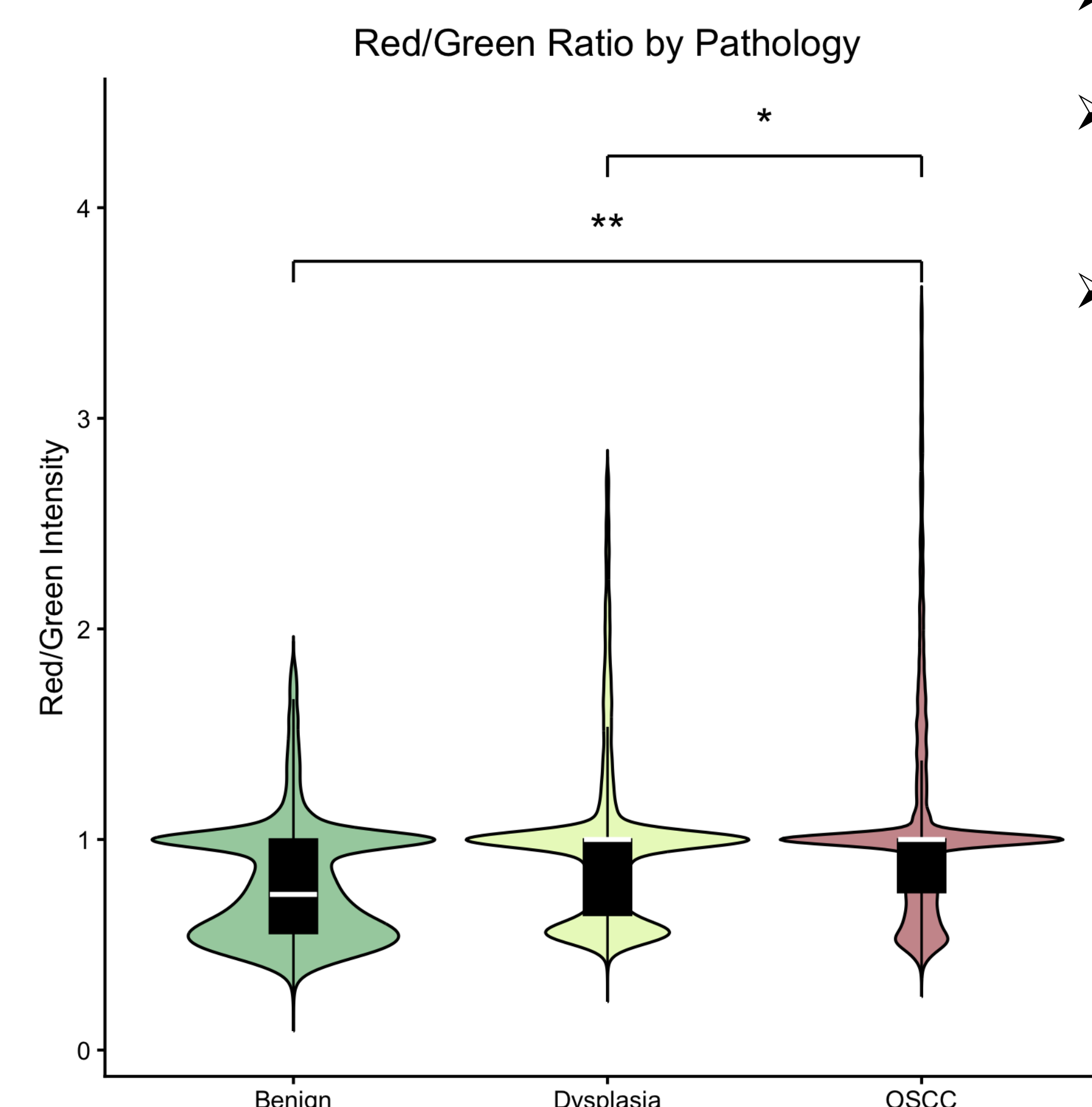


Figure 4. Graph of Red/Green Ratio for benign, dysplastic, and OSCC groups. Significant differences between Benign vs. OSCC, and dysplasia vs. OSCC.

- 25 resected samples from varied anatomical regions were collected.
- Results show normalized R/G ratios increase from benign to OSCC, indicating that the microsensor is sensitive to detection of autofluorescence.
- PBP analysis was useful in creating spatial mapping of the areas of concern.

Gross description	Anatomical area and sample size
Normal	Larynx (4), FOM (3), Lip (1), Tongue (2)
Transition	Larynx (2), FOM (1), Tongue (1)
Tumor	Larynx (4), FOM (3), Lip (1), Tongue (3)

Figure 5. Table with sample description, anatomical area, and sample size.

Conclusion

- This study establishes groundwork for clinically translating compact imaging sensors for label-free oral cancer detection.
- Pixel by pixel analysis enables better evaluation of spatial variations within regions of interest to identify areas exhibiting distinct autofluorescence characteristics relative to neighboring sites.
- Red/green autofluorescence ratios increased across benign, dysplastic, and OSCC tissue, supporting the probe's ability to distinguish malignant tissue and localize areas of concern.
- These findings support further clinical evaluation of the probe as a compact, noninvasive tool for earlier detection of suspicious oral lesions.

Future Directions

- We are currently conducting a clinical trial using our probe within the UTMB Otolaryngology Head and Neck department.
- Our goals:
 - Survey clinicians to establish maneuverability, feasibility, and handling of the probe in a clinic setting.
 - Gather preliminary imaging on patients with OSCC in clinic and post-operatively.



Image 1. En-face probe in compact carrying case (left). Probe in use during run through of clinical trial in ENT clinics (right).

References



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