IMAGE-GUIDED FLUORESCENCE TOMOGRAPHY IN HEAD & NECK SURGICAL MODELS

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Clinical indications for fluorescence-guided surgery continue to expand, and are being spurred by the rapid development of new agents that improve biological targeting.[1] There is a corresponding need to develop imaging systems that quantify fluorescence – not only at the tissue surface, but at depth. We have recently described an image-guided fluorescence tomography system that leverages geometric data from intraoperative cone-beam CT and surgical navigation,[2] and builds on finite-element method software (NIRFAST) for diffuse optical tomography (DOT).[3] DOT systems have most commonly been used for sub-surface inclusions buried within tissue (e.g., breast and neurological tumors). Here, we focus on inclusion models relevant to tumors infiltrating from the mucosal surface (an "iceberg" model), as is most often the case in head and neck cancer, where over 85% of tumors are squamous cell carcinoma.[4] This work presents results from simulations, tissue-simulating anatomical phantoms, and animal studies involving infiltrative tumor models. The objective is to characterize system performance across a range of inclusion diameters, depths, and optical properties. For example, Fig. 1 shows a fluorescence reconstruction of a simulated tonsil tumor in an oral cavity phantom. Future clinical studies are necessary to assess *in vivo* performance and intraoperative workflow.

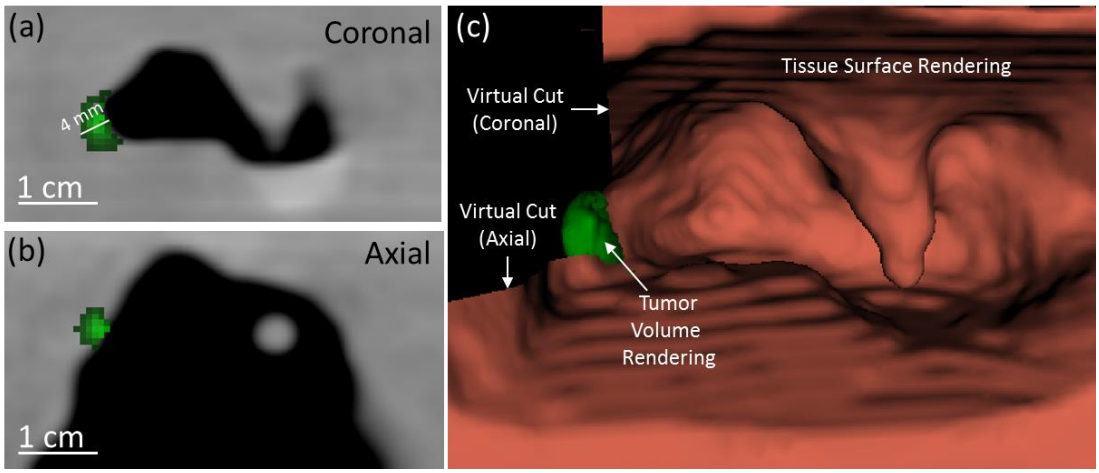

Figure 1 – Fluorescence reconstruction in a trans-oral surgery lab model. Cone-beam CT slices for (a) coronal and (b) axial views with fluorescence overlay showing estimated depth of tumor invasion (~4 mm). (c) Virtual clipping planes reveal fluorescence volume infiltrating below tissue surface.

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