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Editors

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2 Airway Imaging and Vocal Fold Dynamics II
Justus F. Ilgner, Uniklinik RWTH Aachen (Germany)

Introduction

The 10th Scientific Meeting of the Head and Neck Optical Diagnostics Society was held in conjunction with the annual SPIE Photonics West BiOS Conference in San Francisco, 27–28 January 2018. The scientific meeting, which was titled "Optical Imaging, Therapeutics, and Advanced Technology in Head and Neck Surgery and Otolaryngology 2018," covered a broad range of topics regarding non- to minimally invasive imaging modalities to assess airway and vocal fold dynamics, optically guided cancer surgery, and auditory diseases; and the development of new technologies and therapeutics. Presentations covered imaging techniques such as: optical coherence tomography (OCT), narrow band imaging (NBI), diffuse reflectance spectroscopy (DRS), fluorescence lifetime imaging (FLIM), and Raman spectroscopy; and their applications in Otolaryngology-Head and Neck Surgery.

The first two sessions titled "Airway Imaging and Vocal Fold Dynamics" discussed optical coherence tomography for phono-microsurgery, machine learning algorithms for high speed laryngeal imaging and near-infrared spectroscopy, and the comparison of various newly developed OCT systems for laryngeal imaging. As the vocal cords are a sensitive functional structure, it is pertinent to explore means of screening technologies as an adjunct to biopsy to guide surgical intervention to only remove diseased tissue. Similarly, machine learning algorithms coupled with high speed laryngeal imaging were presented as an adjunct to vocal fold assessment. With the emerging new trends accessibility in large data, machine learning algorithms and their respective structures have gained immense interest.

The sessions titled "Optically Guided Cancer Surgery" discussed the use of various imaging modalities to intraoperatively screen and delineate tumor margins of oral neoplasia and squamous cell carcinoma. These optical imaging modalities including FLIM, widefield imaging using fluorescently labeled antibodies, confocal imaging, hyperspectral imaging, and diffuse reflectance spectroscopy, incorporate radiology, pathology, and surgery for real time or almost real time analysis. Research in this area has rapidly advanced and many of these technologies have been studied intraoperatively. However, many challenges were also discussed, such as accurate correlation to pathology and the need to focus imaging goals on the deep margins that lead to the most disease recurrence.

In the next session, titled "Hearing and Diseases of the Ear," minimally invasive optical approaches to screen and diagnose changes in auditory anatomy and functionality, including the tympanic membrane and cochlea, were explored. Spectroscopic and intensity based structural techniques to differentially diagnose otitis media were presented. The combination of electrical and infrared neural stimulation to reduce the threshold required for cochlea implants and reduce

thermal damage was discussed to close the session. Despite the challenges of the invasiveness of optical imaging in the ear, these technologies allow for development of more precise individualized medical therapies and accurate assessment of therapeutic efficacy.

The sessions titled "NBI and Optical Biopsy" included presentations that discussed the use of NBI and other various imaging modalities to non-invasively or minimally-invasively differentiate pathologies in the head and neck. Hyperspectral imaging in conjunction with neural networks were discussed as a means of optical biopsy for head and neck cancers. Narrow band imaging and autofluorescence lifetime endoscopy were presented as imaging modalities used to reduce local recurrence and detect early stage oral cancer and dysplasia respectively. Lastly, near-infrared autofluorescence was shown to guide parathyroid gland mapping in thyroidectomies and related procedures.

The final session, "Novel Therapeutics, Photodynamic Therapy, and Robotics," concluded the scientific meeting. It is well understood that surgeons have a limited capability in accessing the complicated anatomical structures in the head and neck. Due to the ability of robotics to access these areas, the use of robotic surgery has greatly increased in the recent years. With the emerging combination of optics in robotic surgery, head and neck surgeons are now able to assess tissue micro-pathology non-invasively when tactile feedback is not provided by the robot. Particularly, fluorescence lifetime imaging was discussed as a powerful optical tool for transoral robotic surgery. The development and improvement of new therapies and surgical tools were also discussed. New devices, such as a cranial implant comprised of nanocrystalline yttria-stabilized zirconia to optically access the brain, were presented with modifications for appropriate clinical use. In addition, advancements in interstitial photodynamic therapy (PDT) treatment and PDT with Cetuximan-IR700DX was explored.

Various tomographic and spectroscopic non- to minimally invasive imaging modalities were presented to assess changes in healthy and abnormal otolaryngology-head and neck tissues. It is evident that the focus of imaging work is on highly sensitive organs which should be adequately preserved, which includes but is not limited to the vocal folds, oral cavity, and cochlea. The future of imaging technologies in otolaryngology can provide avenues for drug discovery and further understanding of disease pathology. System developments and improvements in analytical models of these imaging technologies inch them closer to clinical application. Improving the quantifiable measures towards tissue classification provides detailed information that is otherwise limited by traditional methods. The papers collected in this special proceedings issue can be expected to deepen our understanding of the uses of such technologies and their future implications.

The conference was led by chairs Brian J. F. Wong M.D. Ph.D. (Beckman Laser Institute and Medical Clinic, United States), Justus F. Ilgner Prof. Dr. med. (Uniklinik RWTH Aachen, Germany), and Max J. Witjes M.D. D.D.S. Ph.D. (University Medical

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