predict dose for head and neck proton and photon therapy for Oropharyngeal tumors using machine learning.

**Materials/Methods**: 35 patients with head and neck cancer who received postoperative proton radiation therapy were retrospectively identified. Each patient also had an available, corresponding photon-based intensity-modulated (IMRT) plan. DICOM-RT datasets for both proton and photon plans were processed to extract a comprehensive feature-set, including relationships between the PTVs and Organs at Risk (OARs), parameters characterizing the radiation modality, and clinical parameters. Prediction models were developed using patient-matching software to estimate the dose utilizing cross-validation techniques on the feature-set. Specifically, models were created for the PTVs (primary and nodal) and OARs designated to be of high significance in planning (Spinal Cord, Brainstem, Mandible, Oral Cavity, Parotid and Submandibular glands, Larynx). Root mean square out-of-sample error was calculated for these structures for proton and photon plans.

**Results**: We were able to effectively predict dose distributions within the OARs and PTVs for both photon and proton treatments prior to plan development. For photon plans, root mean squared error between predicted and planned dose was within 1.5 Gy for all structures. For proton plans, the error between predicted and planned dose to critical structures was within 2.3 Gy.

**Conclusion**: We have demonstrated the ability to predict photon and proton-specific dosimetric indices for head and neck patients prior to treatment planning. These results may have profound clinical implications that extend from decision making to planning workflow improvement.

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### 3557

**Combined Proton-Photon Technique for Regional Nodal Irradiation in Breast Cancer**

J.A. Bradley,1 M.W. Ho,1 R. Dagan,1 M.S. Rutenberg,1 Z. Li,1 and N.P. Mendenhall1

1University of Florida, Jacksonville, FL

1University of Florida Health Proton Therapy Institute, Jacksonville, FL

**Purpose/Objective(s)**: The optimal radiation therapy (RT) technique for breast cancer depends on an individual patient’s anatomy. Women with pendulous breasts or tissue expanders are two groups in which optimal target coverage and organ-at-risk (OAR) sparing can be difficult to simultaneously achieve with any single modality. The purpose of this study is to describe a combined proton-photon technique for breast cancer patients requiring regional nodal irradiation.

**Materials/Methods**: A matched proton-photon technique was developed in which proton therapy was used to treat the supraclavicular nodes, the high axillary nodes, and the internal mammary nodes (IMN). Narrow parallel-opposed photon tangents were used to treat the breast tissue or the chest