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HPV+ oropharyngeal cancer is one of the few malignancies that is increasing in incidence, both in the United States and world-wide. At Moffitt Cancer Center, much like other major centers, treatment of early stage HPV+ oropharyngeal cancer consists of radiotherapy alone or in combination with chemotherapy. As outcomes with standard dosing of radiotherapy are excellent, we hypothesize that HPV+ oropharyngeal cancer represents the ideal opportunity to establish a paradigm of individualized radiotherapy based on mathematical models. We have developed a variety of mathematical models to help analyze patient specific tumor growth dynamics and responses to therapy. These models are now deployed to predict which patients will be controlled with the given approach, and who will not. Based on these models, calibrated and validated with historic data of individual patients, we propose the first mathematical modeling biomarker to intensify therapy when needed, and de-escalate therapy without compromising outcomes when possible. (Received August 24, 2020)