Purpose: In this abstract, we discuss a biomechanical head and neck model that will be able to represent patient setup variations as well as physiologic changes and subsequently enable dose calculations on the deformed anatomy.

Methods: We selected Multi Pose MRI as the imaging modality to aid in model development and validation. The MRI data allowed us to build a biomechanically predictive model that will enable accurate estimation of tumor position when seeded with CT data alone. The soft tissue contrast and lack of ionizing radiation when using MRI enabled us to acquire extensive imaging datasets with a suitable variety of head pose variations. These poses were selected to encompass the clinical positioning variations so that the resulting model will accurately reflect internal organ motion and deformation. All images were acquired using an 8-channel, 1.5T research MRI system in radiology. The imaging volume extended from about T3 (upper thoracic vertebrae) to the top of the head, thereby covering the entire head and neck. Model components included: muscles, skeletal bones, lymph nodes, fat tissues, and organs such as salivary glands, tendons, and ligaments. At first, one MRI image dataset was selected as the reference image. The biometric properties (length, volume, mass, shape), hinge constraints of the bones, and the biomechanical properties of each of the anatomies were estimated using MRIs acquired at different head and neck poses.

Results: The model’s ability to represent different head and neck postures can be illustrated by observing the internal tissue deformations and the model’s ability to represent different postures.

Conclusions: Results show that the biomechanical model was able to simulate different poses that may be exhibited during interfraction patient setup variations and intrafraction patient motion. Future work would focus on integrating dose calculations on the deforming model and validating the model deformations.