Purpose: In this study, we retrospectively analyzed patient treatments utilizing a prototype of the Varian Eclipse™ treatment planning system integrated with their new DART™ technology. Structure volume changes, structure displacements, and dose deviations were analyzed to assess the need for more adaptive treatment planning.

Methods: Ten patients with head and neck cancer who received daily cone-beam imaging CTs, as part of their radiation therapy, were chosen from the University of California San Diego Moores Cancer Center database. With the aid of DART™, we were able to retrospectively calculate the accumulated dose to both the tumor and healthy tissue over the entire course of treatment. This process was accomplished through rigid and deformable registrations of their daily cone-beam CT scans and cumulative dose measurements. Volumetric changes were compared to their original planning CT image.

Results: Our results showed notable changes to the parotid glands in all patients, in both structure shrinkage and dose escalation, which were often correlated with a medial displacement of the glands towards the high-dose region. Our study estimated that the mean rate of parotid volume reduction was 0.18 cm³/treatment day with a range of 0.08 - 0.31 cm³/treatment day. GTV, CTV, and PTV regions also showed significant volume reductions which was shown to be more pronounced during the first half of treatment. In 6 out of 9 patients with contoured parotids, the absorbed dose increase to these glands was >3%. The GTV, CTV, and PTV showed smaller variations, and in only 1 out of the 10 patients studied did the dose accumulation increase >3%.

Conclusions: While the program used was just a prototype, it is our hope for the future that this project could be integrated clinically to develop more adaptive treatment plans allowing for better treatment accuracy and patient care.