AbstractID: 13298 Title: The effect of inter-fraction setup error on single fraction, cumulative, and biological effective doses in head-and-neck radiotherapy

Purpose:
To compare the effect of inter-fraction setup error in head-and-neck radiotherapy patients on a) dose from a single fraction, b) cumulative dose, and c) cumulative dose corrected for the biological effect of variable dose/fraction.

Method and Materials:
Intensity Modulated Radiation Therapy plans are copied and trials created by shifting the isocenter to simulate setup error. The dose from each shift is calculated in the Pinnacle treatment planning system (Philips, Cleveland, OH). Cumulative dose is found by summing the dose from each fraction. Cumulative biological effective dose (BED) at each point is found by summing the BED for each fraction. The BED-corrected cumulative dose is defined as the dose producing the same cumulative BED when delivered in constant fractions as the variable dose/fraction treatment.

Results:
A 33-fraction treatment was simulated assuming 6 fractions with a 5 mm patient shift in each of the left, anterior, and superior directions and 5 fractions with a 5 mm shift in each of the right, posterior, and inferior directions. This example represents large daily shifts but a small mean shift. The spinal cord, parotid, and CTV α/β ratios were set to 0.87, 3, and 10.5 Gy. The maximum single fraction spinal cord dose was 14% greater than the original. The cumulative and BED-corrected doses were 1.4% and 2.5% greater than original. The largest single fraction parotid mean dose was 37% greater than original. The cumulative and BED-corrected doses were respectively 1.5-3.5% and 2.5-4.8% greater. The CTV V100% was 98.7% in the original plan, 91.5% for the worst single fraction, and 98.7% for both the BED-corrected and cumulative doses.

Conclusion:
Cumulative doses to normal structures increase slightly if corrected by the BED due to inter-fraction motion. BED-corrected doses suggest that large daily shifts may be acceptable if mean shifts over time are small.