

Purpose:To quantify intrafraction prostate motion between patient groups treated with and without daily endorectal balloon (ERB) employed during prostate radiotherapy and establish the effectiveness of the ERB.

Methods:Real time intrafraction prostate motion from 29 non-ERB (1061 sessions) and 30 ERB (1008 sessions) patients was evaluated based on three-dimensional (3D), left, right, cranial, caudal, anterior and posterior displacements. The average percentage of time with 3D and unidirectional prostate displacements > 2, 3, 4, 5, 6, 7, 8, 9, and 10mm in 1 minute intervals was calculated for up to 6 minutes of treatment time. The Kolmogorov-Smirnov method was used to evaluate the intrafraction prostate motion pattern between both groups.

Results:3D motion ≥ 1 cm was observed for the non-ERB group only. The motion increased as a function of elapsed time for displacements > 2 to 8mm for the non-ERB group and > 2 to 4 mm for the ERB group ($p < 0.05$). The percentage time distributions between the two groups were significantly different for motion > 5mm ($p < 0.05$). The 3D internal margin (IM) covering 95% treatment time can be reduced from 5 to 3mm (40% reduction) while the asymmetrical IM can be reduced from 3 to 2 mm (33% reduction) in cranial, caudal, anterior, and posterior for 6 minutes treatment, when ERB is employed. Beyond 6 minutes, the 3D and cranial, caudal, anterior, and posterior IMs can be reduced from 9, 4, 7, 7, and 8 to 5, 2, 5, 3, and 4 mm, respectively (up to 57% reduction). The calculated IMs apply to the worst case scenario patient as well.

Conclusions:The ERB effectively reduces prostate motion and allows for smaller IMs. Therefore, daily ERB has the potential to further improve toxicity profiles in prostate radiotherapy.