Purpose:
A novel kV guidance method has been proposed in which the tumor position is continuously measured during IMRT and arc therapy by a single kV imager. Adding kV imaging during therapy adds radiation dose. We quantify the dose delivered and compare it to other imaging doses.

Methods:
The software PCXMC2.0 was used to calculate effective dose delivered to a mathematical human phantom. The Varian OBI system was simulated. The beam axis was set to intersect the geometric center of the prostate. Tube voltage and mAs settings were fixed. The imager angle, field size, height and mass (statistics from ten countries) of the phantom were varied.

For different treatment scenarios, the effective dose was averaged over all angles to obtain an average angular effective dose. The field size was fixed to the minimum area sufficient to cover all markers and the average effective dose was obtained by weighting all the countries by their populations. This average effective dose per projection was used to calculate the effective dose based on treatment technique, fractionation and imaging frequency. The dose was compared to the Navotek radioactive fiducial and CBCT.

Results:
Effective dose varied with imager angle. For a 6cm×6cm field, the highest average angular dose per projection is 1.2 microSv (India), while the lowest is 0.6 microSv (Germany). The average dose weighted by population is 0.9 microSv. The effective dose increases linearly with field size, imaging frequency and treatment duration but decreases with height or mass. A 15 minute single fraction IMRT treatment delivers 0.84 mSv at 1 Hz. For comparison, a pre-treatment CBCT pelvic scan delivers 4.3 mSv while the Navotek radioactive fiducial delivers 64 mSv of lifetime dose.

Conclusion:
Intrafraction kV guidance for tumor tracking gives less than 1mSv imaging dose with reasonable settings. This is lower than Navotek and CBCT.

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Conflict of interest:

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