

Comparison of the Epson Expression 1680 flatbed and the Vidar VXR-16 Dosimetry PRO™ film scanners for use in IMRT dosimetry using Gafchromic and radiographic film.

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Purpose:

IMRT treatment plan verification is often done using Kodak EDR2 film and a Vidar Dosimetry PRO™ film digitizer. However, since many hospitals are moving towards a filmless environment, access to a film processor may not be available. Therefore, we have investigated a newly available Gafchromic® EBT film for IMRT dosimetry. Planar IMRT dose distributions are delivered to both EBT and EDR2 film and scanned with the Vidar VXR-16 as well as an Epson Expression 1680 flatbed scanner. The measured dose distributions are then compared to those calculated with a Pinnacle treatment planning system.

Materials and Methods:

IMRT plans consisting of seven to nine 6 MV beams for treatment of prostate, head and neck, and a few other sites were calculated using a Philips Pinnacle treatment planning system. The specific patient beam arrangement was re-calculated in a solid water slab phantom and a planar dose distribution was obtained at 10 cm depth in the phantom. This dose distribution was delivered to the phantom using both EDR2 and EBT film with maximum dose in the range of 125 to 225 cGy, which was typical for one fraction of the treatment. The films were scanned with both the Vidar and the Epson scanner and analyzed using FilmQA™ (3cognition LLC) software. Comparisons between measured and calculated dose distributions are reported as dose difference (pixels within $\pm 5\%$), distance to agreement (3 mm), as well as gamma values (dose = $\pm 3\%$, dist.=2 mm).

Results:

Using EDR2 with the Vidar scanner is an established technique and gives good results. However, scans of the EBT film with the Vidar scanner were not as good. This is attributed to the way the film is transported through the scanner. Vidar scanners have a long diffuse fluorescent white light source. As the film moves past the measurement slit it changes direction and hence light strikes the film at a slightly different angle and the proportion of incident light reflected from the film surface changes. This causes artifacts in the EBT film scan but does not seem to affect the EDR2 film. In the Epson scanner both films are rigidly immobilized and the light source scans over the film. It was found that the Epson scanner performed equally well with both types of film.

Conclusions:

While it is possible to use EBT film with the Vidar scanner, much better resolution and agreement with calculation can be obtained using a flatbed scanner. For EDR2 film both scanners gave equally good results. Tissue equivalence, high spatial resolution, energy independence, and self developing properties make the choice of EBT film for IMRT more desirable than silver based radiographic film, however, a flatbed scanner in transmission mode is recommended to give optimal results with this type of film.