Response of EBT2 Gafchromic film to possible stresses associated with in-vivo measurements.

EBT2 gafchromic film is largely replacing radiographic film in many departments for IMRT QA purposes. However, use of the film additionally as an in-vivo dosimeter for therapy patients is attractive since the film can conveniently render 2-D information of dose with high resolution. However, the film often will need to be cut to a smaller size in order to place the film in a small area. In the figure below the film is cut into a strip 5 mm wide and placed beneath a wax bolus for the treatment of a skin lesion on the tip of a patient’s nose, where a 6 MeV en-face electron field was used. The strip of film was also bent in order to conform to the nose, as shown. In the adjacent figure, skin dose was assessed by placing the film underneath a patient undergoing pelvic treatment, where the film was subject to compression by the weight of the patient.

The effect of generally bending the film was investigated by rolling the film into cylinders of various radii and exposing the film while it is rolled. Each roll of film consisted of a rectangular cut piece that was 5cm high and at least 8cm long. The film was submerged in water and exposed to 200cGy from a lateral beam of 15 MV X-rays. The rolls of film were rotated in the beam in order to generate a homogeneous dose to the film. An unbent piece of film was placed with the roll in order to act as a control. The film remained submerged in water for less than 5 minutes, and was immediately dried and unfurled after exposure. Results indicate, for a 1cm radius of curvature, the bending stress can influence the response of the film by over 5%.

The influence of compression was investigated by exposing square pieces, 64 cm^2, of the film to extreme compression. The film was sandwiched at Dmax depth in a 30x30 cm solid water stack, where a 64 cm^2 square of acrylic, 5mm thick, was placed directly over the film in order to concentrate all weight on the film. The film was then subject to higher compressive weight during exposure by placing lead weights on top of the solid water, where the weights were well out of the beam. Results indicate, for a compression corresponding to 0.6 kg/cm^2, the response of the film is influenced by <2%.

The effect of cutting the film was investigated by exposing the film to a uniform dose and investigating any subsequent artifacts. The image below indicates artifacts are usually confined to within 2mm of the cut, but can also occur further away. Results indicate cutting with scissors will often produce rough edges conducive to “light piping” during scanning.

The results of this investigation indicate, when simple precautions are made, the effects of cutting and “stressing” EBT2 film can be relatively small, thus usually enabling in-vivo measures with a high degree of accuracy.