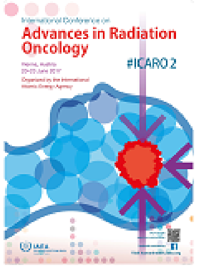

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The use of MAGIC-f gel to perform RTP clinical checks, a first approach

Thursday, June 22, 2017 3:50 PM (5 minutes)

Introduction:
When we receive a breast patient after mastectomy with an expandable prosthesis containing a valve with a rare-earth metal magnet a special protocol has to be designed. The magnet is used to guide the surgeon by means of a gimbal to the right spot where to inject small quantities of saline solution to create a cavity that further on will be filled with a permanent breast prosthesis in a restorative surgery. The problem is that during this period, the patient has also to undergo a radiotherapy treatment and the presence of metal is a complicating factor. Several groups since 2004 has being discussing this problem, by means of dosimetry with Diodes, TLD, radiological films, Monte Carlo simulations, and Gafchromic films. Up to now the results are not conclusive. Thus, we want to implement the use of gel dosimetry as a possible application to help the understanding of this interface problem.
Methodology:
Glass, Boron-Silicate phantoms were produced at the SP-Ribeirao Preto campus glass workshop according to a design proposed. They were made by glass balloons of two-liter capacity. At the bottom, of the balloons, a dome was created to insert the SILIMED/470 prosthesis. The final volume of the glass flask phantoms was 1.1 L and 0.89 L , both filled with Magic-f gel. Because of the dome was created using a manual procedure it is difficult to produce both flasks with equal volumes.
The preparation of Magic-f starts dissolving the gelatin in water, during at least half-an-hour, separately the other reagents are added, the addition of reagents are performed at 35- 40 degrees Celsius. Finally, the phantoms are filled with the gel and left at 5 degrees Celsius for at least 12 hours before the irradiation.
The phantoms were taken to a CT-scanner Brilliance Big Bore,(Philips Medical Systems, Cleveland) of the Hospital and Clinics of the Faculty of Medicine, University of S. Paulo, RP-SP-Brazil, hereafter (HC-FMUSP-RP). The CT scan was sent to XIO−CMS RTP system. A treatment plan using a two opposed tangential asymmetric beams with field size of 19 x 20 square centimeter, at gantry angles of 90/270 degrees; using wedges of 15 deg, at isocenter, for 15 MV and 6 MV. Where a 2 Gy/fraction daily dose was calculated. Contouring was performed in a Varian's Eclipse workstation and then calculated by XIO superposition algorithm taking into account inhomogeneity. The results were then transferred to the Siemens Oncor medical linear accelerator by means of Lantis.
The phantoms were irradiated in the following sequence the 1.1 L by a 15 MV x-rays, and the 0.89 L by the 6 MV x-rays respectively, with a 2 Gy absorbed dose normalized to the isodose of 97.5% and 95% respectively. Magnetic resonance images (MRI) of the two phantoms were acquired 1 day after irradiation using a 3T scanner (Phillips, Achieva). These images were centered in the head coil (where the phantoms were positioned) using a 3D multi spin echo sequence with 8 echo times multiples of 35 ms, repetition time of 560 ms and voxel size of (2 x 2 x 2) mm3. The calibration vials were scanned using the same sequence, but with a slice thickness of 5mm. The R2 maps were calculated in a program developed in MatLab®.

Results and Discussion
The relaxation rate or relaxivity (R2=1/T2) maps that are proportional to the dose. In the figures each pixel was normalized by the intensity of the isocenter, thus what is being shown is the relative R2 value.(In Figure X4. R2-Relaxation maps obtained by MRI imaging of the phantom after irradiation with a 15 MV beam) It is easier to visualize any changes from the planed dose. As it can be seen there are no change from the planed dose to the delivered dose. Only at the "neck" of the phantom we can see some changes that are probably due to oxygen diffusion in the phantom. The magnet is close to the lower surface of the phantom and possible changes of the dose would be reflected in the relaxation rates near this interface. In summary, these first

experiments show that there is not a detectable change in dose due to the presence of the magnet. The results are consistent with the Ann Arbor-UMMC studies.

Figure X4. R2-Relaxation maps obtained by MRI imaging of the phantom after irradiation with a 15 MV beam. (included as a file)

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