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ASSESSMENT OF THE USE OF COMMERCIAL DICOM VIEWERS TO OBTAIN SIGNAL INTENSITY IN POLYMER GEL DOSIMETRY

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Introduction: Researchers interested in working with polymer gel dosimetry should be familiar with the theory of radiation interaction with matter and more knowledge of chemistry, programming and image processing. The aim of this work is to assess the possible uncertainties in the choice of freely available programs for DICOM image processing to obtain the pixel intensity of each eco image of the irradiated polymer gel to calculate the relaxation time.

Material and method: To perform this work, we used to validate previous images[1] of the calibration tubes of the polymer gel MAGIC-f, irradiated with a Co-60 source and MRI images obtained using a 3T scanner with a sequence of 16 echos, TE of 15 ms and TR of 5000 ms.

The images were downloaded to commercial DICOM viewing programs that did not require prior registration and provided a square or circular ROI. Dicom Library, on-line version, Horos 3.0, RadiAnt 2020.2 and Onis 2.5 software were used. Their results have been compared with the results obtained by using a homemade code developed in MatLab. Measurements were normalized to an ROI of about 0.2 cm^2, and all selections were made manually.

The results obtained were recorded in an excel table to be processed equally in order to obtain the value of R2 for the tubes with doses of 0 Gy, 0.5 Gy, 1 Gy, 1.5 Gy and 5 Gy. The possibility to compare results at every step of the process, identifying uncertainties and potential difficulties.

Results: Figure 1 illustrates the behavior of signal intensity variation for irradiated polymer gel MAGIC-f with an absorbed dose of 5 Gy. The maximum variation observed in the signal intensity in relation to the value obtained using the code developed in MalLab, was 12% in the relationship between MatLab and Dicom Library for the last echo in the 1 Gy tube.

The greatest variation in the ROI area used was 3%, the average value observed, even though it was performed manually in each echo, was about 1%. Enabling high reliability in the comparison of intensity values obtained.

No significant difference was also observed in the use of square ROI or circle ROI, the comparison values using the same software to compare demonstrated variation less than 2%. The same behavior is observed in the comparison of values of T2 and R2 calculated using the same computational tool to perform the fitting.

Conclusions: The present work demonstrates that it is possible to use DICOM viewers available free of charge to obtain the intensity pixel value of each echo of the polymer gel relaxometry sequence with high confidence in its results, thus not requiring the researcher to develop his own computer code to process the MRI images of the irradiated polymer gel.

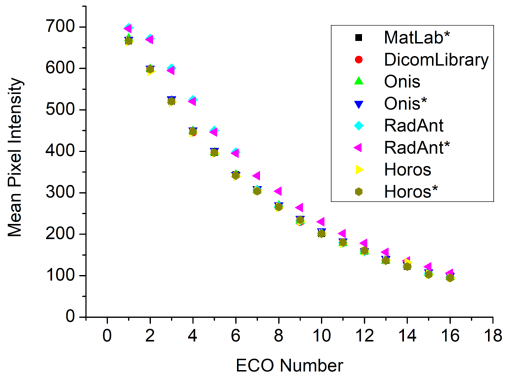

Figure 1: Signal intensity variation for MAGIC-f gel irradiated with 5 Gy, the softwares indicated represents the use of square ROI.

References:

1. M. M. B. Schwarcke, Ph.D. Thesis, Ribeirão Preto:USP-FFCLRP, 2013.