

GAMMA APPROVAL RATE OF PATIENT SPECIFIC IMRT QA VARIATION WITH THE CRITERIA USED

Prado, M.G.¹, Pavoni, J.F.².

¹Departamento de Física Médica, FFCLRP, Universidade de São Paulo, 14040-901 Ribeirao Preto, SP, Brazil

Introduction: Intensity Modulated Radiotherapy (IMRT) is an evolution of the Three-Dimensional Conformal Treatment (3DCRT) centered on the possibility of beam fluence variation within the treatment field. The planning technique used for treatments in IMRT is Inverse Planning. Once the planning phase is completed, it is necessary to verify if the planned doses are being delivered by the linear accelerator (LINAC), this verification is called patient specific QA [1]. Thus, a phantom irradiation occurs in the LINAC and the analysis of the similarity between the doses measured and those expected by the planning system is verified in a software using the Gamma function [2]. The gamma function compares the planned and the measured dose distributions based on an acceptance criteria which combines a point dose difference (DD) and a distance to agreement (DTA) tolerance and all the dose distribution distribution points are classified as passing or failing. In order for the whole distribution to pass the test, a certain percentage of successfully tested points should be reached and usually, this percentage is set to 90 or 95%.

The goal of this study was to evaluate the gamma function by evaluating the change in the approval percentages as a function of the modification of the criteria of DD and DTA used.

Material and method: The gamma analyses results of the 1087 patient-specific QAs were tabulated using the standard gamma analyses criterion of 3%/3mm (DD/DTA). The approval percentage, minimum γ , mean γ , and maximum γ were collected for each test. Next, gamma analyses were redone for all patients who treated the Head and Neck (HN) and Prostate region, changing the analysis criteria to 2%/2mm, 3%/2mm, 4%/4mm, 5%/3mm, and 5%/5mm. The same data mentioned above were collected.

Results: A worksheet with all the results listed was generated. Figure 1 illustrates the increase in the percentage of approval for the two sites studied when the gamma criterion is more relaxed. It is worth mentioning that for all analyzed QAs with 3%/3mm criterion

(n=1087), the average approval percentage was $99.9 \pm 20.7\%$ and that excluding HN and prostate data, this value goes to $94.4 \pm 20.7\%$ (n=718).

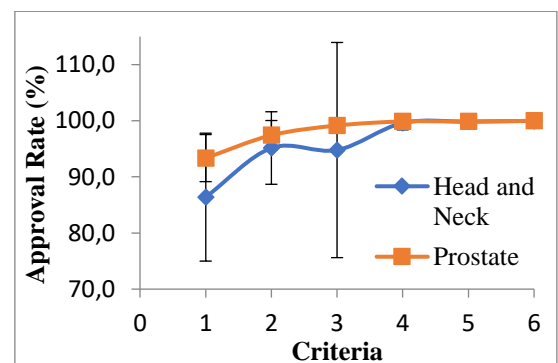


Figure 1: Mean value of the percentage of approval in the gamma QA analysis of HN and prostate treatments for criteria 1 to 6 that correspond respectively to 2%/2mm, 3%/2mm, 3%/3mm, 4%/4mm, 5%/3mm and 5%/5mm.

Conclusions: Through this study, we were able to understand the behavior of gamma function results when we changed the criteria used. It was evident that the results of the two regions analyzed (prostate and HN) tend to coincide with more relaxed gamma analysis criteria (4%/4mm, 5%/3mm, 5%/5mm), and differ more in restricted criteria of dose and distance variation (2%/2mm, 3%/2mm, 3%/3mm).

References

1. Miften, M et al. (2018), Tolerance limits and methodologies for IMRT measurement-based verification QA: Recommendations of AAPM Task Group No. 218. *Med. Phys.*, 45: e53-e83.
2. Low DA et al. (1998). A technique for the quantitative evaluation of dose distributions. *Med. Phys.*, 25: 656-661.