

The Impact of Standardization of Gamma Criteria on Imaging Radiation Oncology Core Phantoms Analysis

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INTRODUCTION

Establishing a global standard between clinical trial groups is a core goal of the Global Harmonization Group (GHG), which will require extensive efforts on the evaluation of gamma and its sensitivity within the different QA networks. The impact of gamma criteria and framework, on the average percent of pixels passing gamma and the average gamma values, highlights major concerns regarding the current inter-comparisons between clinical trial QA groups.

AIM

This work seeks to evaluate the impact of different gamma criteria for two frameworks relevant to clinical trial QA.

METHOD

Data

Twelve head and neck phantoms, each containing films in axial and sagittal orientations, were irradiated following clinical protocols. Gamma analysis was conducted on each plane using film analysis Tool, CERR.

Framework Comparison

The analysis was performed utilizing protocols from two different frameworks: Imaging Radiation Oncology Core (IROC) and GHG standards. The IROC method uses a normalization dose of 6.6 Gy and a 0% threshold, while the common ground method, proposed by GHG, requires plans to be normalized to the maximum dose in the measured dose distribution with a low dose threshold of 20%.

Evaluation

Within each framework, the percent of pixels passing and mean gamma were evaluated at 7%/ 4mm, 5%/5mm, 3%/3mm, 3%/2mm, and 2%/2mm.

RESULTS

The percent difference between the average percent of pixels passing for the IROC and GHG protocols ranged from 2-4%; the p-values were significant for all the criteria except for 2%/2mm. The percent difference between the average mean gamma values for the IROC and GHG methods ranged from 1-6%; the p-values were significant for all criteria except for 3%/3mm and 2%/2mm.

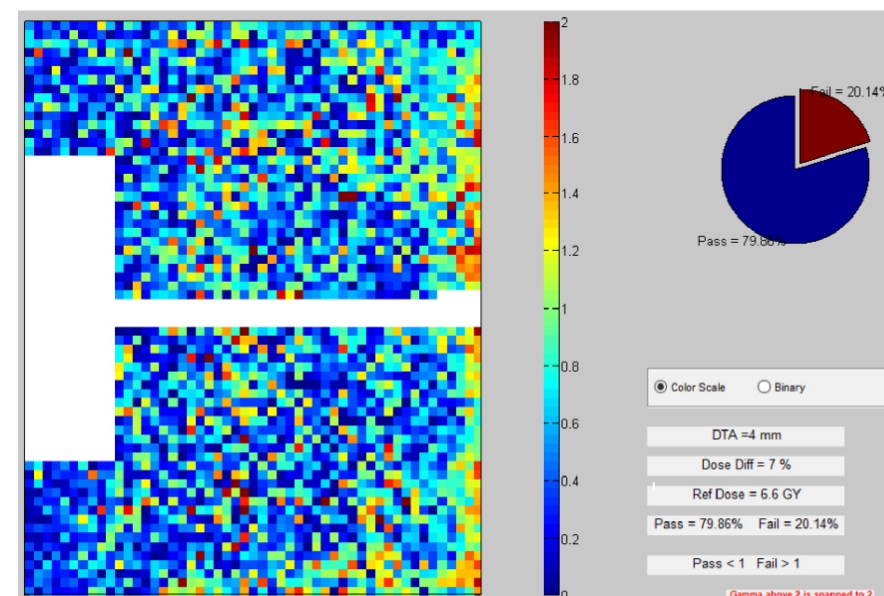
Table 1: Comparison of average percent of pixels passing (%P.P) between the IROC and GHG frameworks.

Evaluation Parameters	IROC: Average %P.P. & STDV		GHG: Average %P.P. & STDV		Difference (GHG –IROC) & % Difference		P Value
7%/4mm	87.66	9.05	90.45	7.15	2.79	3.13%	0.0013
5%/5mm	83.12	11.01	85.63	9.29	2.51	2.97%	0.0016
3%/3mm	63.37	15.51	65.31	13.16	1.94	3.01%	0.020
3%/3mm	52.92	15.81	55.18	13.26	2.26	4.18%	0.032
2%/2mm	45.76	16.48	46.75	14.05	0.99	2.14%	0.30

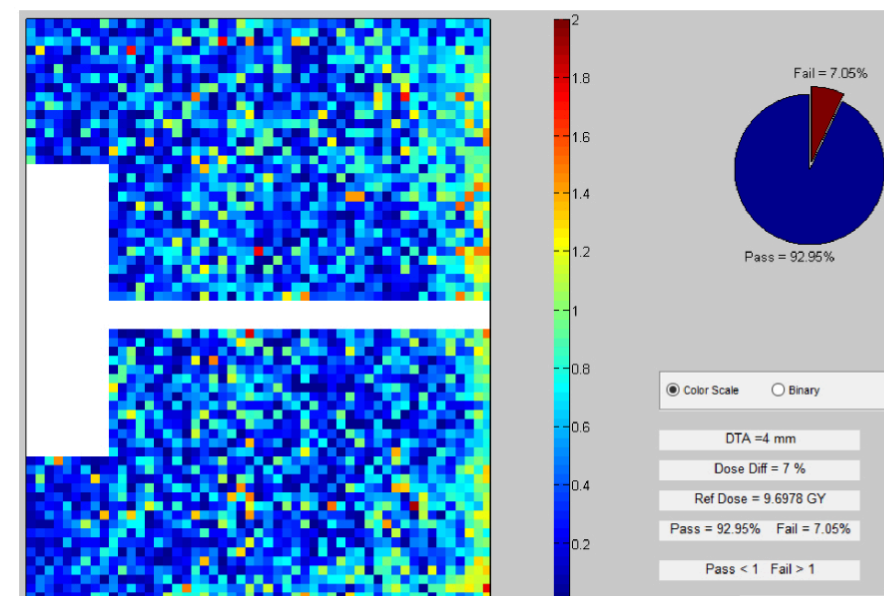
Table 2: Comparison of average mean gamma value between the IROC and GHG frameworks.

Evaluation Parameters	IROC: Mean Gamma & STDV		GHG: Mean Gamma & STDV		Difference (GHG –IROC) & % Difference		P Value
7%/4mm	0.52	0.15	0.49	0.12	0.03	5.94%	0.021
5%/5mm	0.58	0.17	0.55	0.14	0.03	5.94%	0.019
3%/3mm	0.85	0.22	0.82	0.19	0.03	3.59%	0.029
3%/3mm	1.00	0.25	0.97	0.20	0.03	3.05%	0.15
2%/2mm	1.12	0.27	1.11	0.22	0.01	0.90%	0.71

IROC: 79.86% Pixels Passing



GHG: 92.95% Pixels Passing



CONCLUSIONS

An evaluation of the results provides quantification of the effects of gamma criteria and framework on the average percent of pixels passing gamma and the average gamma values. Differences in criteria and input parameters resulted in four pass/fail status changes for both 7%/4mm and 5%/5mm criteria.

Careful attention should be given to acceptance criteria when comparing results between global clinical trial groups.

ACKNOWLEDGEMENTS

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REFERENCES

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