A high-resolution detector array versus film/point dose for stereotactic radiotherapy quality assurance

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Introduction

Historically, film and point dose has been the gold standard in radiotherapy patient-specific dosimetry due to its sub-millimeter spatial resolution and high dosimetric accuracy. However, maintaining a film program has always been cumbersome, lacking real-time analysis. IBA's MyQA SRS detector array, utilizing advanced CMOS technology, claims film-level spatial resolution with superior dosimetric accuracy and no processing delays. This retroactive study aims to validate this claim.

Materials

An IBA MyQA SRS system was utilized to measure anonymized actual patient plans treated at our facility. Measurements were also acquired using radiochromic EBT3 film and A16 ion chamber point dose and compared to the results using the MyQA SRS. Gamma analysis was conducted using the MyQA and radiochromic.com software platforms. Qualitative analysis was also conducted using beam profile overlays.

Methods

Various stereotactic patient plans were calculated on a MyQA SRS phantom image in Varian's Eclipse treatment planning system (TPS), and an expected dose plane was exported. Patient plans were measured using the MyQA SRS, and gamma analysis was performed in the MyQA software against the expected doses from the TPS. Gamma analysis was also conducted for film plans against the expected doses from the TPS and compared with the results obtained with the MyQA SRS.

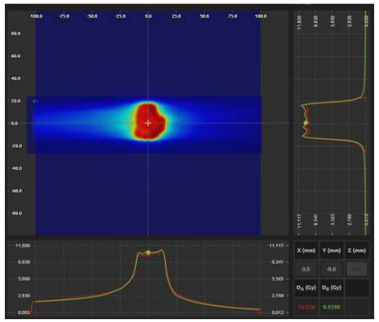

Figure 2: MyQA gamma analysis result showing expected TPS dose versus measured myQASRS result.

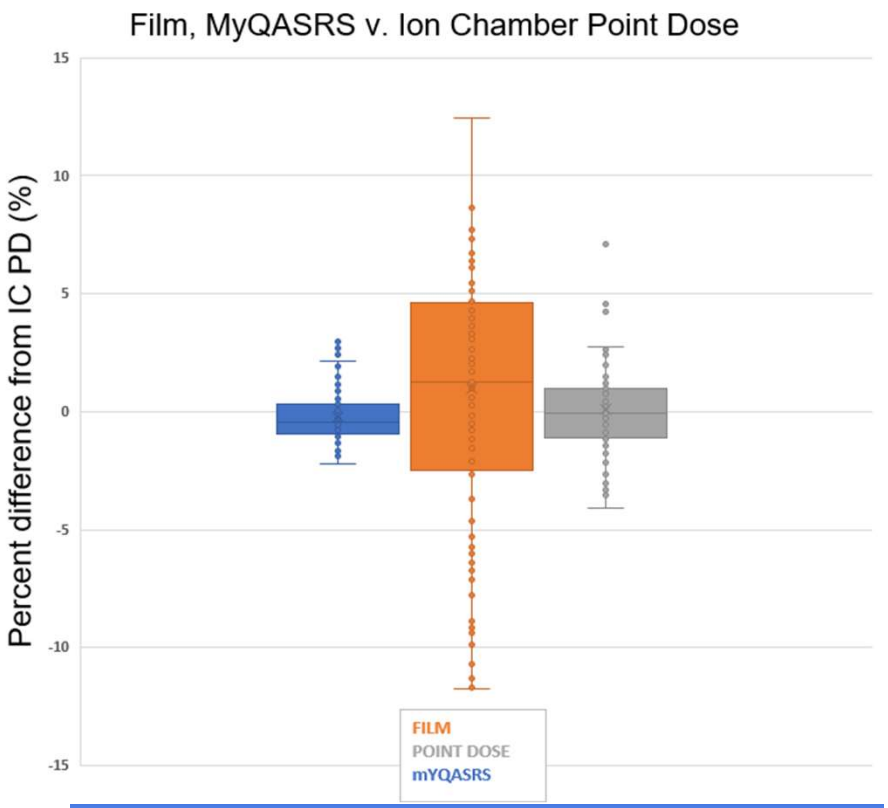

Figure 1: Results for 108 patient stereotactic plans. Gray results show point dose percent difference from expected treatment planning system values. Orange results show film percent difference from expected treatment planning system values. Blue results show MyQASRS percent difference from expected treatment planning system values. MyQASRS results were consistently closer to point dose results than film results.

Figure 4: MyQA SRS setup in room under gantry head. MyQASRS device fits inside cylindrical phantom for measurements.

Results

The comparison between MyQA SRS and TPS gamma results for 108 stereotactic plans showed exceptionally high passing rates (>99%) for both cohorts. Full-field qualitative analysis for film and MyQA SRS planar measurements demonstrated similar response between the two QA modalities (i.e., high spots are high, low spots are low). Both modalities showed excellent agreement with the TPS, particularly in high-gradient regions. It was concluded that the MyQA SRS is a comparable alternative to film/point dose, with the added advantages of real-time analysis and repeatability.

Discussion

MyQASRS percent difference from point dose measurements results were almost always closer to treatment planning system expected values than for film results. This indicates that myQASRS has a significantly better absolute dosimetry than film.

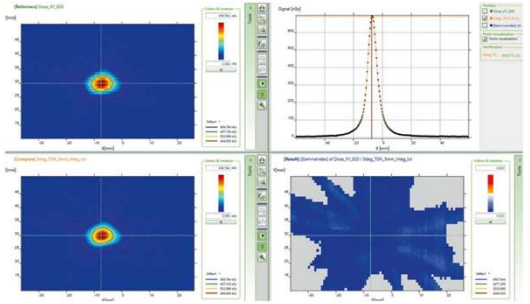

Figure 3: MyQA gamma analysis result showing expected TPS dose versus measured myQASRS result.

References

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