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Name	Yalvac
First Name	Burak
Institution Name	Universiteit Hasselt
Institution Address	Agoralaan - gebouw H, 3590 Diepenbeek
E-mail Address	burak.yalvac@uhasselt.be

II. Abstract information

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Please list up to five keywords

Beldart, SRS, SBRT, VMAT, dose verification, EPR dosimetry, film dosimetry

Eligible for young physicist award (less than 28 years old or less than 5 years' experience)	Y

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I. BELdART-3 a national mailed audit program for Stereotaxy

B. Yalvac, W. Schroeyers, N. Reulens, S. Schreurs, B. Reniers.
Universiteit Hasselt, CMK, NuTeC, Diepenbeek, Belgium.

II. Introduction and purpose

BEL*d*ART-3, in continuation of BEL*d*ART-2, is now focusing on intracranial stereotactic radiosurgery (SRS) and extracranial Stereotactic Body Radiation Therapy (SBRT). The project is supported by the College of Medicine-radiotherapy and the FOD Healthcare.

III. Material and methods

The radiation dose is measured using a combination of L-α-alanine-EMR dosimetry and Gafchromic® EBT3 films. The films were read using the triple channel dosimetry in the FilmQA Pro software developed by Ashland (Covington, Kentucky, USA) [1] and the "One-scan" procedure [2]. As for BEL*d*ART-2, we used alanine cylindrical pellets with height 2.8 mm and a diameter of 5 mm (Harwell Dosimeters LTD, Oxfordshire, UK). Some basic dosimetry is again done in water using the 3D printed support.

Prior to the use of the anthropomorphic phantoms, the use of commercial alanine pellets was tested for small field dosimetry. Therefore, alanine pellets have been irradiated in combination with films in fields of 5x5 cm^2 to 1x1 cm^2 and the experiment has also been modelled in the EGSnrc Monte Carlo code. Once the limitations for the commercial alanine were known, they were included in the protocol for SRS delivery using the Stereotactic End-to-End Verification (STEEV) phantom (CIRS Inc, Norfolk, Virginia, USA) prepared with alanine and film. Furthermore, a custom support system for the phantom was developed to reduce positioning time and errors. The films were evaluated with gamma analysis [3] using the 5 %/1 mm tolerance levels with a lower dose threshold of 50 %.

IV.Results and discussion

The correction factors for alanine in small fields were first estimated by Monte Carlo calculations, showing an over-response of the alanine > 2% for field sizes < 2 cm. This result was confirmed by measurements. Consequently, a target larger than 2 cm diameter is drawn for the combination film/alanine. The same sheet of EBT3 film is also used for a smaller target placed on another slice without alanine. The first tests show a ratio between the calculated dose and the alanine of 0.98 +/- 0.01. The film passing rate is 98 % for the large lesion in the STEEV phantom. The system of positioning has also improved both the accuracy and the speed of the positioning. The full procedure is still under testing.

V. Conclusions

The combination of L-α-alanine-EMR dosimetry and film dosimetry show promising results for SRS audits. However, the field size must be larger than 2x2 cm^2 for accurate results of the alanine. The development of a similar protocol for SBRT is in progress.

Acknowledgements and potential conflicts of interest

We would like to thank the physicists from the Jessa hospital and the Cliniques Universitaires Saint-Luc for their time helping us to develop the protocol and the Cancer Plan, FOD Healthcare and the College of Medicine for the financial and scientific support. In addition, we would like to thank the members from the steering committee for their support and scientific contribution.

No conflict of interest.

References

[1] Micke, Lewis, and Yu, Multichannel film dosimetry with nonuniformity correction, Med. Phys. 38(5), May 2011.

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[3] Low, William, Harms, Mutic and Purdy, A technique for the quantitative evaluation of dose distributions, Med. Phys. 25(5), March 1998.

A **B**

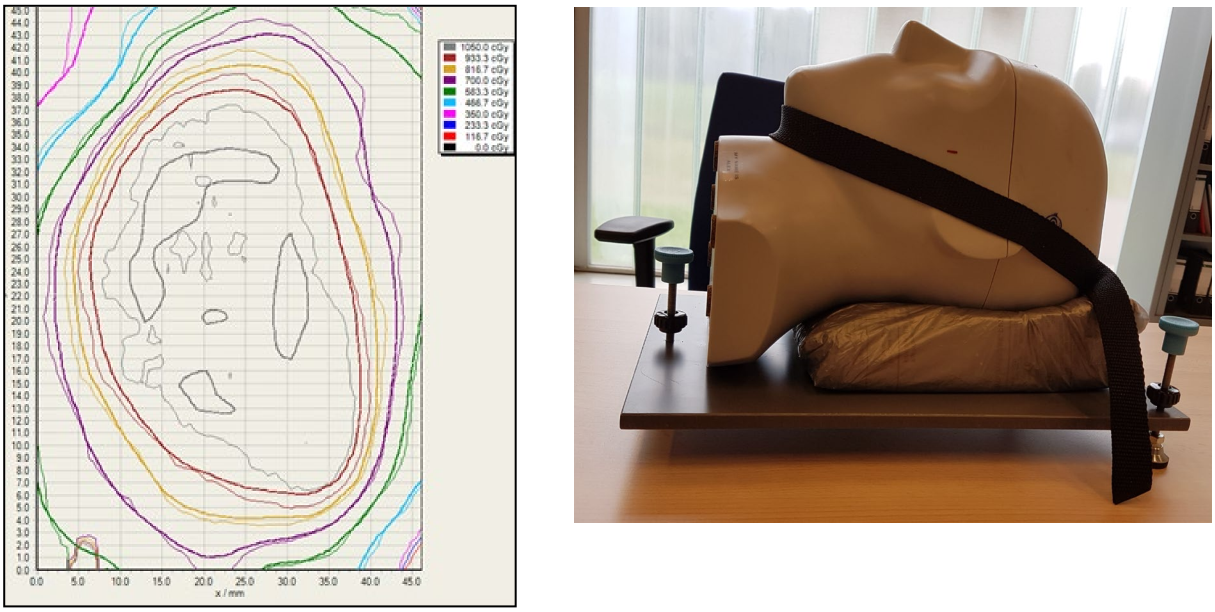

Figure 1 : (A) Isolines comparison map (treatment plan vs irradiated film) for the large lesion. The passing rate is 98% for constraints of 5 %/1 mm. (B) Custom support system (levelling plate and cushion) for the STEEV phantom.