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Purpose: The aim of this work is to evaluate an emerging material called eXaSkin in a 6MeV electron beam to treat superficial lesions. This high density bolus could be placed on the skin to shield normal tissue areas. A treatment without low fusion point alloys is designed to shape the beam and to protect organs at risk (OAR), instead eXaSkin is used for the beam shaping.

Materials and Method: In the first place, a planning CT of an Euromechanics EMP 5001-424 phantom is performed. On the surface of this phantom a toroidal eXaSkin bolus is placed. Bolus dimensions are 3cm thickness and 3.3cm inner diameter.

In the second place, a treatment with a 6MeV electron beam is designed, being the prescription dose 5Gy at the point located in the toroid centre and on the phantom surface. The source-surface distance (SSD) is 100cm and the chosen accessory is the 6x6cm² applicator.

The treatment planning system (TPS) used is Eclipse version 13.7 with the algorithm Electron Monte Carlo (Version 13.7.20). A Varian TrueBeam linac is used to deliver the treatment. To verify the correct treatment delivery, Gafchromics filmsEBT3 are used. Films are analysed with IBA OmniPRO IMRT software.

Results: The obtained dose distribution can be seen in Figure 1.

Conclusions: Due to the high density of the bolus, with a few centimeters of the material a high shaping is achieved. The radiation beam is totally attenuated in the areas where protection is required. This procedure can be an alternative to the use of low fusion point alloys for shaping of electron beams when treating superficial lesions.

Keywords: electron, shielding, bolus, radiotherapy.

Fig. 1 (abstract P23). Dose distribution on treatment.

In the verification with films, the 93.28% of the points pass the gamma analysis 3%-3mm with 10% of maximum dose threshold and absolute dose differences. The dose was reduced to 10% from the prescription dose with 2.1cm of bolus.

Conclusions: Due to the high density of the bolus, with a few centimeters of the material a high shaping is achieved. The radiation beam is totally attenuated in the areas where protection is required. This procedure can be an alternative to the use of low fusion point alloys for shaping of electron beams when treating superficial lesions.

Keywords: electron, shielding, bolus, radiotherapy.

Purpose: Patient-specific quality assurance (PSQA) is the final and most important check prior to treatment to verify that the radiotherapeutic dose will be delivered as planned, especially for complex intensity or volumetric modulated techniques. The current practice of PSQA is based on statistical acceptance criteria, which under certain conditions might hide significant dosimetric discrepancies. The aim of this work is to present a novel method of analysis based on the difference of the plan's isodose surfaces and QA related tolerances, interpreting verification results in a clinically intuitive way. The ISD method was compared to the gamma index method on a H&N VMAT plan, in which errors of gradual importance have been introduced.

Materials and Method: The distance of dose points from the isocenter can be used as a function to produce a signature shape histogram of an isodose surface. Isodose surface difference (ISD) is defined as the normalised difference of reference and evaluated surface histograms, plotted against its corresponding isodose level. Acceptance tolerances are set individually for each plan, according to QA limitations and the verification results are presented in a clinically intuitive way. The ISD method was compared to the gamma index method on a H&N VMAT plan, in which errors of gradual importance have been introduced.

Results: The resulting discrepancies were plotted against the corresponding dose levels. The evaluation of the distribution was performed in two dose regions, high dose (PTV) and medium/lower dose levels (Normal Tissue). The novel method was sensitive to all introduced errors, regardless of magnitude. ISD revealed areas of the plan where errors cost PTV coverage or excess dose to normal tissue, although the gamma index passing rate was considered acceptable (>95 %). In some cases, these errors lead to unacceptable plans. For 2 mm posteriorly and 2 mm left-shifted distributions, the ISD method indicates “cooler” High-Risk PTV areas (coverage decreased up to 2 %) while gamma index passing rates were 96.1 % and 97.7 % respectively.

Conclusions: ISD is a novel dose distribution comparison method which uses individually defined QA related tolerances resulting to a clinically meaningful evaluation. This method can be used to interpret gamma index analysis results, or even as a standalone tool, avoiding reported verification pitfalls.

Keywords: radiotherapy, PSQA, plan verification, gamma index.

Purpose: Since its adoption, intensity-modulated radiation therapy (IMRT) has seen a continuous rise in its use, driven by the dosimetric benefits of IMRT over 3DCRT. However, IMRT treatments can be complex, placing great demands on the gantry and multi leaf collimator, and extensive patient-specific quality assurance is required. In our centre the proportion between IMRT (or volumetric...
arc therapy, VMAT) and 3DCRT is around 80%-20%, which generates a large burden for the Medical Physicist. With the COVID-19 pandemic, treatment schemes are shortened (leading to more frequent plans), access to the LINACs is reduced and the number of onsite physicists is less. In this work we investigated whether a plan complexity scoring system could be correlated to pre-treatment QA results and, if yes, whether a threshold could be defined so that not all plans would require pre-treatment QA.

**Materials and Method:** We retrospectively selected 100 plans at random, equally distributed from 10 common anatomical sites/treatments, all created on Monaco 5.1 (ELEKTA, Stockholm, Sweden). Using an in-house algorithm, modulation complexity scores (MCS) were calculated for each plan using the metric published by McNiven (2010), adapted for VMAT as described in Masi (2013). The metric incorporates the variation in segment shape and aperture area, weighted for each segment and beam. The scores were compared to pre-treatment QA results for each patient, which included: an assessment of the spatial distribution of absolute dose using ArcCHECK (SNC, FL); an in-air electronic portal imaging device absolute dose measurement analysed with PerFRACTION (SNC, FL); and an absolute point dose measurement using a pinpoint ionisation chamber.

**Results:** Our results show a clear variation in median MCS between different anatomical sites (Figure 1), with Prostate SBRT plans having the lowest median MCS (0.055 ± 0.028) and Brain plans having the highest median MCS (0.222 ± 0.055) (low MCS means a more complex plan). However, no correlation was found between the pre-treatment QA results and the MCS (data not shown here).

**Conclusions:** As expected, plans such as Breast, Head and Neck and Prostate SBRT, for which it is difficult to satisfy organ at risk constraints and/or there are many different dose levels, have lower MCS values. The results of patient specific QA could not be correlated to MCS. With further data it may be possible to define a threshold above which patient specific QA is not required (e.g. with MCS values more than 0.1).

**Keywords:** Plan Complexity, IMRT, VMAT, Quality Assurance.

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**P26**

**Scattered radiation loss in verification of long radiation fields with OCTAVIUS 4D**

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**Purpose:** OCTAVIUS 4D (PTW, Freiburg, Germany) allows to perform the verification of long radiation fields by virtually expanding the phantom. To do this, Verisoft (PTW) requires two measurements of the whole treatment: one with a longitudinal offset defined by the user, and a second one with same offset in opposite direction and the phantom turned 180º. We have used this method in our facilities for quality assurance of certain treatments, and we have realised certain dose loss especially in the central sections of the phantom. We theorize that this may be product of a lack of scattered radiation because, during the irradiation, part of the beam does not interact with the phantom, matching those central sections.

**Materials and Method:** We used an OCTAVIUS 4D phantom and OCTAVIUS 1500 detector (PTW, Freiburg, Germany) to perform the measurements. A rectangular field of 15 x 25 cm² was radiated in a Clinac IX (Varian Medical Systems, Palo Alto, USA). We produced several measurements with different offset values to evaluate the dose loss significance. The TPS used is Eclipse v.15.6 and the analyzer software Verisoft v.8.0.

**Results:** We noted a dose loss in the middle section of the phantom when studying the coronal slices of the DICOM files generated by Verisoft (Fig. 1). Dose profiles along longitudinal axis show an increment of this effect for increasing offset.