Abstract - ID: 21

Author(s):	Alexander Osman **(Presenter)**, American University of Beirut Medical Center Nabil Maalej, King Fahd University of Petroleum and Minerals Kunnanchath Jayesh, American Hospital Dubai

Title:	Accurate Prediction of the MLC Positional Errors During IMRT Delivery Using Artificial Intelligence Neural Network

Abstract:

Purposes: We describe a state-of-the-art machine learning approach to predict the multi-leaf collimators (MLCs) positional errors before the delivery of IMRT treatment.

Methods: A total of 18 predictive parameters were extracted from the IMRT treatment plan data transferred to log file of a Varian machine equipped with 120 HD MLC millennium system. Actual leaves position data extracted from log files of IMRT plan delivery was used as a target response for training of the neural network (NN). We developed a NN artificial intelligence architecture with 120 units for predicting the MLCs position errors. The model was evaluated for its prediction accuracy using mean square error (MSE).

Results: The predicted leaves positions closely matched the executed leaves positions during plan delivery. A MSE of 0.00001 mm^2 was achieved in predicting the MLCs position errors on 902 data points for each leaf. The correlation coefficient, R, measures of the goodness of fit, was perfect (R =1) in all plots indicating an excellent agreement between the predicted and actual MLC positions for the training, validation and test data.

Conclusions: Our NN model is capable of predicting the executed MLCs position during treatment delivery with a very high degree of accuracy. Including the leaves predicted positions into the TPS would provide very important feedback to determine the agreement between planned and would be executed plans. It can be easily implemented for all treatment plans and hence reduce the need for patient-specific QA for complex plans such as IMRT/VMAT.

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Abstract - ID: 395

Author(s):	Ali Ali **(Presenter)**, AlNeelain University
Are you an invited speaker/presenter to ICRM2018?:	No
Title:	EPID based MLC in-vivo verification method for prostate VMAT plans

Abstract:

Introduction: For advanced Radiotherapy Techniques (e.g. VMAT) additional quality control to the routine linac quality control is required. MLC position verification is one of the essential issues to be addressed in this regard.

Material/Methods: MLC position from the RTP file (MLC rtp-based) was compared to the MLC position based on EPID image using the cine mode (MLC image-based); For the MLC rtp-based, the data from TCSA has been synchronized with the data from TNT based on the acquisition time. For the MLC image-based, per line of the image the two peaks have been detected to represent the MLC position for the two banks.

Results: For the static beams the average overall beams was 0.27±0.19 mm, 0.22±0.12 mm, and 0.29±0.18 mm for the left absolute average leaf deviation, right absolute average deviation, and gap deviation respectively. For the in vivo patients' results, the average of the absolute left leaf deviation was 1.02±1.12 mm, and the average absolute right leaf deviation was 1.00±1.13 mm,

while the average absolute gap deviation was 1.06±1.17 mm. As a benchmark, static beams for different filed sizes and MUs have been delivered to test the method, then for 20 patients the first 3-4 fractions have been acquired and analyzed during the treatment

Conclusion: A simple method was developed for the verification of the MLC during the treatment for a group of prostate cancer patients, the difference in the accuracy between the static beam and the VMAT plans could be due to the complication of the plan.

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Abstract - ID: 396

Author(s): Khalid Rabaeh **(Presenter)**, Hashemite University
Belal Moftah, KFSH&RC
Ahmed Basfer, KAST
Akram Al Moussa, KFSHRC

Are you an invited speaker/presenter to ICRM2018?: Yes

Title: Dosimetry validation of N-(Hydroxymethyl)acrylamide (NHMAGAT) polymer gel dosimeter using MRI

Abstract:

Normoxic 3D N-(Hydroxymethyl)acrylamide (NHMAGAT) polymer gel dosimeters in conjunction with MRI scanning are introduced for radiotherapy treatment planning system (TPS). NHMAGAT gels were fabricated under a fume hood in normal atmospheric conditions. The dosimeters were irradiated withVarian RapidArc linear systems at different absorbed doses. Magnetic resonance imaging (MRI) scanning was used to calculate transverse relaxation rate R_2, The change in R_2 corresponding to the amount of polymer formation in polymer gel dosimeters increases gradually with absorbed dose. The results show the percent depth dose as well as 3D dose distribution of NHMAGAT polymer gel dosimeters are in a good agreement with the ionization chamber measurements and CT planned dose distribution, respectively.

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Please provide details: form Patent entitled (Method of using the novel polymer gel for magnetic resonance imaging (MRI) validation)

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Abstract - ID: 408

Author(s):	Mohammed Al Towairqi **(Presenter)**, University of Wollongong (UOW) Dean Cutajar, Centre for Medical Radiation Physics, University of Wollongong, Australia Terry Braddock, Centre for Medical Radiation Physics, University of Wollongong, Australia Enbang Li, Centre for Medical Radiation Physics, University of Wollongong, Australia Shadei Alanazi, shadeialanazi.86@gmail.com Shada Wadi Alramahi, KFSHRC Belal Moftah, KFSH&RC Anatoly Rosenfeld, Center for Medical Radiation Physics, University of Wollongong, Australia
Are you an invited speaker/presenter to ICRM2018?:	Yes

Title: Optimization and pre-Clinical Characterization of an Innovative Fibre Optic Dosimetry System as Quality Assurance Tool and Source Tracking During HDR Brachytherapy

Abstract:

Introduction

Brachytherapy is a complex treatment procedure with high dose gradient that requires accurate quality assurance (QA) tools to assure the safe delivery of prescribed dose to patients. Due to the unique properties of scintillation plastic fibers, this study was aimed to introduce and characterize an innovative fiber optic dosimetry system for source tracking during HDR Brachytherapy

Materials & Methods

Scintillating plastic fibers (BCF-60, Saint-Gobain Crystals USA) with different scintillation

lengths were finely cut, polished, paint coated, and then optically coupled to a 1m long clear plastic fibers (BCF-98, Saint-Gobain Crystals USA). Trans-impedance photodiode amplifier was used to detect positional sensitivities of different fiber probes placed within a solid-water phantom at varying distances above an ^{192}Ir brachytherapy source located within the catheter, with dwell positions varied every 2.5mm

Results

A pre-clinical investigation has validated the expected response of the scintillating plastic fibers for multiple dwell positions with demonstrating the variance of detector response with source location. It showed the ability of shorter scintillating fiber lengths (3cm and less) to distinguish between varying source locations once SNR maintained high. However, fully scintillating plastic fiber showed flat response for most dwell positions. Polishing and coating of fiber end effectively increased the efficiency of signals acquired

Conclusion

The proposed system was characterised and optimised in terms of coating, selecting optimal fibre length and SDDs. It shows to be appropriate for further clinical investigations, such as simultaneous dose measurement and source localisation. It has shown its capability for providing 3D position reconstruction through in-vivo source tracking

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Abstract - ID: 437

Author(s):	assya boughalia **(Presenter)**, Nuclear Research of Algiers serge marcie, Antoine-Lacassagne Centre Physics department Mohamed Fellah, Houari Boumedienne University Karine Benezry, 36 voie Romaine Nice
Are you an invited speaker/presenter to ICRM2018?:	No

Title:	A dosimetric and radiobiological assessment of three intensity-modulated radiation therapy for the treatment of oropharyngeal cancer

Abstract:

Purpose: The aim of this study was to assess and quantify the dosimetric plan quality and radiobiological impact between intensity-modulated radiation therapy (IMRT), volumetric-modulated arc therapy (RA) and helical tomotherapy (HT) for oropharyngeal carcinoma.

Patients and Methods: three cohorts of patients were treated with IMRT, RA and HT respectively. All of them were surveyed through the analysis and the assessment of their treatment plans. At first, dosimetric analysis was carried out including the coverage dose of the target, the homogeneity and the sparing of organs-at-risk (OARs). At the second phase, in-house software was used to calculate EUD for tumor. NTCP and ID for each OARs were also calculated to assess whether IMRT, RA or HT was the more beneficial.

Results: Similar target coverage was observed between the three IMRT treatments but better target's homogeneity was obtained in the case of RA. The hot spot in HT was the lowest where Dmax The integral dose varies from one modality to another. The spinal cord and the Lt-parotid gland were well protected with HT compared to IMRT and RA respectively, brainstem and Rt-parotid gland were better protected with IMRT and RA respectively. In case of larynx the IMRT was more protective. **Con*clusion:*** HT provides the most uniform doses and better protection of OARs.

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Abstract - ID: 500

Author(s):	badreldeen Ahmed **(Presenter)**, Sudan University for Technology and Science
Are you an invited speaker/presenter to ICRM2018?:	No

Title:	Calibration of well type ionization chamber for measurement of Co60brachytherapy source HDR

Abstract:

Calibration of well type ionization chamber for measurement of Co^{60}brachytherapy source HDR

*Badreldeen M.Musa Ahmed, **Moustafa M.ELhassanTaha,

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**Medical Physics department,Radiation Isotopes Center of Khartoum (RICK) P.O. Box: 846

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badrmohm@gmail.com , moustafarick@gmail.com

Abstract

Brachytherapy means use of encapsulated source deliverer of a radiation dose at a short distance in a short time to treated a malignant tumors (1). The purpose of this work to determine the reference air kerma rate for cobalt 60 source with well type ionization chamber and calibration factor for cobalt 60 source using well type ionization chamber.

The study was done by fabricate scatter phantom from wood with different distances as show in figure (1).The measurements were performed according to the multiple distance method ,where special design of scatter phantom was used.

The measurement were done According to the TG43, the value of reference air kerma rate is11.35X10^{-6} mGym^{2}hr^{-1}and the calibration factor of well type chamber is 0.1781 x10^{2}.

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Abstract - ID: 507

Author(s):	Abdul Raheem Kinsara, King Abdulaziz University Ahmed El Gizawy, University of Missouri-Columbia Essam Banoqitah, KAU Professor Xuewei Ma, University of Missouri-Columbia Fuad Nadwi **(Presenter)**, King Abdul Aziz University
Are you an invited speaker/presenter to ICRM2018?:	No

Title:	Dose Reduction of the Scattered Radiation from Medical Radiation Exposures using 3D-printed Organ-shaped Fillable Shields

Abstract:

Scattered radiation generated during diagnostic or therapeutic radio-applications in hospitals has always been a serious concern due to its risks to patients' healthy tissues and organs.

Our innovation is to use a 3D-printing technology to produce a customizable radiation shielding tool designed in a shape that specifically fits and covers a radiosensitive body part that we are seeking to protect. Moreover, this tool is designed to be filled with radiation shielding material (e.g. lead or tungsten) to make these 3D-printed plastic covers reliable enough to protect against scattered radiation.

Testing experiments were set in the therapeutic radiology department at King Abdulaziz University hospital (Saudi Arabia, Jeddah). These tests were applied on a RANDO phantom and were planned to include only one-breast irradiation treatment (with a linear accelerator - 6 MV). A 3D-printed breast-shield (filled with 2.5 mm diameter of lead beads) was placed on the out-of-field breast, which we wanted to protect against scattered radiation. For radiation dose analysis, radiation detectors (OSLDs and MOSFETs) were placed directly on the top area of both breasts and on top of the shield as well.

Dose analysis results for these radiotherapy experiments presented a scattered radiation dose reduction of at least 60% for the protected phantom's breast.

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Abstract - ID: 515

Author(s):	SULTAN ALHUJAILI **(Presenter)**, University of Wollongong Giordano Biasi, Centre for Medical Radiation Physics, University of Wollongong, Wollongong, New South Wales, Australia. Faisal Alzorkany, KFSHRC MD ABDULLAH AL KAFI, King Faisal Special Hospital & RC Sami Alshaikh, Ministry of Health Abdullah Aldosari, Ministry of Health Anatoly Rosenfeld, Center for Medical Radiation Physics, University of Wollongong, Australia Marco Petasecca, Centre for Medical Radiation Physics, University of Wollongong
Are you an invited speaker/presenter to ICRM2018?:	No

Title: Quality assurance of Robotic SRS (Cyberknife) with an innovative angular independent silicon detector

Abstract:

Purpose/Objective-

The aim of this work is to evaluate the implementation of the edgeless diodes based probe for the machine and patient-specific QA on a Cyberknife.

Methods-

New diode probe based on edgeless diode packed in a Kapton pigtail utilizing CMRP drop in technology were used for measurements of tissue-phantom ratio (TPR), output factor, off-axis ratio (OAR) and beam profiling. In addition, four absolute dose measurements have been performed using four different patient-specific plans. The results have been compared to PTW 60018, PTW 60016, SN edge, Pin-point IC, EBT3 film, and TPS.

Results-

The TPR measurement performed by edgeless diode shows an agreement within 2.2% with data obtained by PTW 60018 and PTW 60016 diodes (Fig.1a). Output factor for both fixed cones and Iris collimators agrees within 2.6% with that measured by PTW 60018 and SN edge diodes which have been corrected according to Francescon et al. (Fig.1b). The beam profiles obtained with both fixed and Iris collimators match PTW 60018 and SN edge diodes with a measured FWHM within 2.57% and penumbra widths within 0.21 mm (Fig.1c). The absolute dose point measurements with four edgeless diode probes for patient-specific QA demonstrate an agreement within 4.72% and 3.11% with TPS and EBT3 film, respectively (Tab.1).

Conclusion-

The edgeless diode based probes have been proved to be an excellent candidate for QA of Cyberknife reproducing commercial dosimetry devices measurements without need of correction factors. They are accurate for patient-specific QA on a Cyberknife with no need for correction of angular dependence.

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Abstract - ID: 522

Author(s):	Areej Alosaimi **(Presenter)**, King Fasial Medical City for South region Shadei Alanazi, shadeialanazi.86@gmail.com Refaat AlMazrou, KFSHRC
Are you an invited speaker/presenter to ICRM2018?:	No

Title: Quality Control Procedures for the Combined SPECT/CT Systems

Abstract:

Several guidelines do not include tests for the SPECT/CT systems, particularly the involvement of CT in the SPECT images. Therefore, in this study extension QC tests for the SPECT/CT systems to these standards are explored. These tests are: (1) SPECT/CT image spatial registration and (2) Accuracy of CT attenuation correction.

Test (1) was performed to determine the accuracy of alignment between the SPECT and CT images. Two different techniques were used. The first is by using three Micro Hematocrit tubes. The fused images were analyzed by finding the highest counts pixel in SPECT image and the central pixel in the corresponding CT image. The second method was done by three metallic line sources. The fusion misalignments were quantified by the scanner software with 6 degrees of freedom.

Test (2) was performed to verify the attenuation correction algorithm function. Two methods were also used; the first was done by using a 20 cm diameter cylindrical phantom filled with Tc-99m.

ROIs of areas ranging from 0.7 cm^2 to 13 cm^2 centered on the trans-axial slices were used on the CT attenuation corrected (CTAC) images and the non-attenuation corrected (NAC) images to find the linear attenuation coefficient (μ). These values were compared with the theoretical known μ value of 0.15 cm^{-1}. In the second procedure, a Tc-99m solution was used to fill three identical tubes. The evaluations of the measurements were based on comparing between the three tube's profiles curves for each dataset (CTAC and NAC).

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