areas included eyelid (1), nasal dorsum (7), pre auricular region (1), forehead (2) and cheek (1). The planning method was identical to all lesions, although two different immobilization techniques were applied, depending on the size and location of the lesion. The first technique was applied in facial lesions (11) and large lesions of the thorax (4): first the lesion was delineated with a radiopaque marker, followed by the immobilization of the patient with a thermoplastic mask, then one bolus plaque of 2 mm thickness was applied above the mask and the plastic catheters were placed and immobilized with two bolus plaques. The second technique was applied in small central lesions of the thorax (2) and in the eyelid: after the delineation of the lesion with a radiopaque marker, bolus plaques were placed directly above and the plastic catheters were placed and immobilized with two bolus plaques. In these cases, the limits of the mold were tattooed in the patient for reproducibility between fractions. The distance between catheters was always 10 mm. A planning CT with 1,25 (facial) and 2,5 mm (thoracic) slice thickness was acquired. The treatment planning was developed by the treatment planning system (TPS) Oncentra MasterPlan v4.1 taking into account the prescription points, dose to the skin and doses to the organs at risk (OAR). The dose was prescribed to points at 0 (eyelid) and 3 mm depth. All patients were treated by a microSelectron v3 (Elekta) that used a $^{192}$Ir source. Eye protectors were used when necessary and the standard fractionation was 40 Gy in 10 fractions twice weekly. Dosimetric plans were analyzed for the following parameters: dose to the OAR, dose to the skin and dose to the organs at risk (OAR). The dose was prescribed to points at 0 (eyelid) and 3 mm depth. The QA procedure was done using mosfets and gafchromic films.

**Results:** The doses to the OAR were converted to Biologically Effective Dose (BED) and were always under their maximum tolerance dose. The dose verification results were accepted within a range of 10 % deviation of the planned dose to the prescribing points and to the skin.

**Conclusions:** This technique showed to be a viable option to facial and thoracic skin lesions. Due to the steep dose gradient of the $^{192}$Ir sources used in brachytherapy, adjacent healthy tissue and deep structures are spared to irradiation. Furthermore, as masks and applicators are flexible, it is possible to treat lesions in irregular or curved surfaces assuring catheter fixation and treatment reproducibility between fractions.

**EP-1605**

Seed strength quality control in prostate permanent implant with detectors of afterloader system

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**Purpose/Objective:** In the quality control program of the system used in prostate permanent implants (PPI) one of the tests should be the verification of mean value of seed strength of the whole lot of seeds to use in PPI. In this study we have compared the activity of two samples of seeds from the same cartridge. We measured mean value of air kerma strength ($S_k$) of one sample with an ionization chamber, as the other sample was measured, in internal units, with the diode system integrated in the afterloader equipment. The lineal relationship found between both measures could be used to predict $S_k$ of the cartridge of seeds.

**Materials and Methods:** Measured seeds, selectSeed $^{125}$I, are contained in sterile cartridges. The cartridges included in the study were 19, used along 2013 and 2014. In all cases the cartridge calibration certificate determines a $S_k$ value of 0.610 cGy/h cm$^2$ with an uncertainty of ± 4%. Prostate seed implants were made more than seven days after the calibration certificate date. Nucletron application Software seedSelectron v1.26b controls the construction of each seed configuration. The source strength measured of each seed that is taken out of the cartridge by Nucletron afterloader, seedLoader, is registered in a log file. This measurement is made by diodes included in the afterloader. For each case in this study, the average value of all seeds used in the implant is calculated from the diode measurement ($D_i$). Following the implant, $S_{seeds}$ of a seed sample from the cartridge is measured with well ionization chamber SourceCheck of PTW (whichever was smaller, 10% of the initial number of seeds in the cartridge or the seeds remaining therein). A decay factor is applied to this measure to obtain the corresponding value upon completion of the implant, i.e. when measured by the afterloader equipment.

**Results:** Figure 1 shows the scatter plot with $D_i$ as an independent variable and the $S_k$ measurement of the chamber as a dependent variable ($DV$). The regression line (corrected $R^2 = 0.747$) and the lines of CI 95% for individuals are included. Linear regression satisfies the assumptions of independence (Durbin-Watson = 2.063), homoscedasticity and normality of residuals ($p=0.737$ Shapiro-Wilk test). For residuals, standard deviation (SD) was 0.003 cGy/h cm$^2$, i.e. 0.5% of the mean value of the DV (0.552 cGy/h cm$^2$). The mean value of coefficient of variation (CV) in measures with afterloader was 3.4% with SD 0.9% whereas with ionization chamber the mean value of CV was 1.9% with SD 0.7%.

**Conclusions:** Measurements of diode array and use of the regression allow calculation of $S_k$ of the seed cartridge and the comparison with calibration certificate. Limit values of disagreement with manufacturer should be increased by ±1.1%. Due to the higher value of CV, the afterloader has less accuracy than ionization chamber. Afterloader can not be used to compare source strength of individual seeds with the average value for cartridge.

**EP-1606**

Geometrical deviations during cervical carcinoma HDR brachytherapy procedures using vaginal cylinders

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Purpose/Objective: Planning and executing a HDR (High Dose Rate) intracavitary brachytherapy treatment for cervical carcinoma can involve several patient bed transfers. In the current study, patients have to be moved twice, and undergo four bed transfers which can imply a cylinder dislocation from its initial position immediately after the cylinder implant. This study aims to quantify the cylinder displacement due to patient manipulation after the initial implant position, at CT scan acquisition moment and during treatment.

Materials and Methods: Nineteen patients were included in this study. The patients underwent three fractions of intracavitary brachytherapy using vaginal cylinders with diameters ranging from 20 mm to 40 mm. In the first session, after cylinder positioning, two orthogonal x-rays (antero-posterior and lateral) are acquired. Then the patient is transported to the CT room for treatment planning image acquisition. At last, the patient is carried to the treatment room, where two additional x-ray images, in the same conditions as after the implant, are also acquired. The treatment dose is prescribed at a point located 0.5 cm from the cylinder wall and the treated extension is 3 cm. The deviations of the applicator caused by the movement of the patient were assessed with regard to distances and angles between fixed points on the cylinder and the bony structure of the patient. The evaluated parameters were: A) the distance between the lower ring of the cylinder and the superior limit of the pubic symphysis (point ‘x’ in Figure 1A); B) the angle formed by two straight lines that start at the intersection of the central axis of the cylinder with the superior limit of the pubic symphysis (angle ‘α’ in Figure 1B) extending to the upper ring (point ‘a’ in Figure 1B) and the other to the supero-lateral limit of obturator foramen (point ‘b’ in Figure 1B); and C) distances between the treatment couch and the central axis on the upper and lower rings (points ‘y1’ and ‘y2’ in Figure 1C).

Results: The observed geometrical deviations of the vaginal cylinders from its initial position varied as follows: ‘x’ varied from 0 cm to 1.4 cm with an average of 0.39 cm (SD = 0.36 cm); ‘α’ from 0.06° to 6.53°, with and average of 1.93° (SD = 1.61 cm). Measurements of y1 and y2 could not be evaluated due to large geometric uncertainty.

Conclusions: Although the maximum deviation of ‘x’ exceeds the prescription depth, the dose delivered to the vaginal mucosa is equal, since this tissue is elastic and follows the cylinder movement. Nevertheless, undetermined consequences on the dose distribution in organs at risk might arise. The evaluation of the dose uncertainty at healthy tissues will be assessed in a future development of this work.