second session by Mosfet detectors (Arplay Medical) positioned at the entrance beam.
- Group 3: an integrated image of each treatment beam is performed during all sessions to try to detect errors positioning by compare the measured deviation and matching with the DRR.

Results: The deviation of the measured dose to the calculated is around 3.6% (±1.5%).
Both measurement methods of in vivo by Mosfet and DosimetryCheech have a deviation of 2.8% (±2.1%).
Taking a tolerance of 0.5 cm on the error positioning, a concordance rate of 73% was observed for deviation dose >5%.
Conclusion: This method of in vivo dosimetry is in agreement with those performed by conventional detectors.
She has two advantages: on the one hand do not require additional set up during sessions, and another allows to highlight repositioning errors.
However, the calculation algorithm used (Pencil Beam) don't take into account of heterogeneity so it made systematic differences of dose.

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TPS PERIPHERAL DOSE CALCULATION CONTROL WITH IN VIVO DOSIMETRY

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Introduction: In the clinical context of a treatment of a left thigh's rhabdomyosarcoma for a young male patient (16y-o), we have been brought to measure the peripheral dose received at the testis with In-Vivo Dosimetry (IVD) in order to verify the pertinence of the out-of-field dose calculation of the treatment planning station (TPS).
Material and methods: Planning: Treatment plan of 23 fractions of 1.8 Gy with 3 oblique fields, realized with the Pinnacle V8.0 m TPS for an accelerator Elekta Synergy.
Dosimeters: out-of-field calibration, at 12 cm of the beam axis, of two dosimeters for the IVD, MOSFETs (BMC) and thermoluminescent dosimeters LiF (TLD)(GR200A, Fimel), with an ionization chamber (IC) (CC13, IBA).
Phantom measurements:

- Received dose at the testis evaluation in a water equivalent phantom (RW3 polystyrene slab) for the same plan treatment.
- Comparisons between the IC and dosimeters measurements.

In-vivo measurements: Ten measurements have been performed during the whole treatment.
Results:

Dose estimation in a phantom:
Measured dose by the reference IC: 7.0 cGy (σ = ±0.1%)
Measured dose by the TLDs: 8.1 cGy (±7.7%)
Measured dose by the MOSFETs: 6.4 cGy (±8.2%)
Mean dose calculated by the TPS: 6.5 cGy (±10.7%)

In-vivo measurements.

Mean recieved dose by the TLDs: 9.7 cGy (±34%)
Mean recieved dose by the MOSFETs: 9.3 cGy (±70%)
Mean dose calculated by the TPS: 9.1 cGy (±21.6%)

Conclusion: A relative agreement has been found between measurements and the TPS calculation for the specific condition of this treatment, considering the order of magnitude and the standard deviation. Nevertheless, these results cannot generalize the validation of the TPS calculation for all the peripheral doses. However, this case allowed us to create a protocol in order to measure accurately peripheral doses at the testis, in a context of a hospital with an important pediatric activity.

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POSTER SESSION: BRACHYTHERAPY, PER OP, CONTACT RADIOTHERAPY

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TWENTY YEARS OF EVOLUTION IN BREAST CANCER INTRAOPERATIVE RADIATION THERAPY

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Introduction: Since the first breast cancer Intraoperative Radiation Therapy treatment in October 1992 performed in our institution, this technique never stopped to evolve.
Until 2011 a linear accelerator delivering high energy electron beam was used to treat approximately 130 patients. The first treatments with INTRABEAM® system (Carl Zeiss SAS) using low energy X-rays were performed in October 2011.
Materials and Methods: Nighty-four patients have now been treated with INTRABEAM®. For each, the radiation dose required was 20 Gy to the surface of the surgical margin in a single fraction. The Intrabeam® system produces low energy photons from a 50 kV and 40 μA source while preceding irradiation technique used electrons energy of 6 or 9 MeV. The isotropy of the low energy photon beam and the dose rate were measured before each treatment. Sterile applicators with variable diameters from 3 to 5 cm are selected to exactly fit the surgical cavity, thus allowing a homogeneous spherical irradiation.
Results: With INTRABEAM®, the dose attenuation is rapid (5 Gy at 1 cm from the applicator surface), thereby reducing damage to surrounding healthy tissue. The mobile X-ray source is installed in one of two operating ambulatory surgery and does not require as before the immobilization of a radiotherapy bunker.
The time needed to deliver the dose was between 20 and 53 min and depends on the size of the applicator. The total time needed for the room and the staff for the dose delivery step is not more important with Intrabeam® system as before.
Conclusion: The shift from breast intraoperative radiotherapy using a linear accelerator to Intrabeam® was realized with no major problems in our institution.
Using this new system has improved the workflow of radiotherapy and surgery, and thus increases the number of patients that can benefit from this technique.

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CONSIDERATION OF SEEDS ORIENTATION IN PROSTATE BRACHYTHERAPY AND DOSIMETRIC ANALYSIS

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Introduction: Concerning prostate brachytherapy there is no software which takes into account the true seed orientation in postoperative dose calculation. Commonly it is considered that seeds are oriented along the CT axis. However a difference up to 20% has been highlighted by some studies when orientations form part of the calculation. Methodology has been developed within DOrGIPro project to determine the spatial layout of radioactive sources and the dose matrix which results of.

Material and Method: Dosimetric analysis of patients is achieved from a post-implant CT scan, a month after surgery, performed on a GE LightSpeed RT16 with the following parameters: 120 kVp, slice thickness of 0.625 mm and a reconstruction matrix of 512 × 512. A specific image processing method has been developed for accurate sees localization. Thanks to the open-source framework CamiTK developed by TIMC laboratory we have implemented codes calculating seeds orientation and dosimetric data. Dose calculation is based on the recommendations of the AAPM TG43. Dosimetric analysis relies on dose-volume histograms and on the dose distribution to prostate and organs at risks (rectum, urethra).

Results: The module for seed localization has been validated on phantoms and tested on patient's data. It gives accurate orientations and separates automatically adjoined seeds. Modules have been coded to display isodoses and dose-volume histograms. They allow making true and accurate comparisons.

Conclusion: Determining source direction is now available and it allows to work as close as possible to the patient situation. We will continue by determining the dosimetric impact of seeds orientation and by evaluating the clinical significance of the observed differences in dose. If it would be confirmed clinical practice could evolve post implant prostate dosimetry.

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METHODOLOGY FOR HDR LEIPZIG SKIN APPLICATOR COMMISSIONING

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Leipzig H-Type applicators are used with a microSelectron HDR (Elekta, Nucletron, Stockholm, Sweden) for treatments of small size cutaneous lesions (up to 2 cm) and shallow depth (3–5 mm). This work presents the checks for the commissioning and the tests for clinical implementation of these devices.

Applicators have three different diameters (1, 2, 3 cm). Controls are:

- Determination of reference source to indexer distance (DSI): the optimal DSI is determined with EBT-3 gafchromic film. The evaluation criteria are the centering position of irradiation and the orthogonal profiles symmetry.
- Comparison with Monte Carlo simulations provided by the manufacturer:
  - PDD and profiles at different depths (surface, 3 mm, 5 mm, 10 mm) comparison with gafchromic films
  - Output verification (cGy/h) at 3 mm depth on axis, with a well chamber and specific insert measuring the corresponding factor and compared with the reference values (Perez- Calatayud et al., Med Phys 33(1) 2006),
  - comparison with small parallel-plate ionization chamber (Markus),
- Profile symmetry evaluation with gafchromic films.
- checking irradiation time calculated manually with Oncentra TPS (v4.3).

The reference distance is 1321 mm. Dose differences are less than 7% for the implemented techniques. The profiles symmetry is between 2% and 5%. Double checking is an efficient technique to prevent human error which may occur during manual calculation of the irradiation time.

Testing results validate the Leipzig applicators clinical use for skin lesions treatment.

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MODELING AND VALIDATION ON MONTE CARLO OF A VERTEBRAL METASTASES TREATMENT ON PHANTOM BY KYPHOPLASTY AND INTRAOPERATIVE RT (KYPHO-IORT)

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For many cancer patients who develop spinal metastases in the natural course of the disease, percutaneous kyphoplasty is a valuable treatment option. Using IORT with INTRABEAM® during kyphoplasty, metastases can be sterilized and the vertebra stabilized at the same time. This solution results in reduced patient discomfort and also restores mobility, thereby improving the quality of life of the patient. The aim of our study is to model the INTRABEAM® system with applicator "needle" dedicated to the application of kypho-IORT and verify and validate the doses actually received for such treatment.

A first step is to calibrate the model with the applicator needle with simple simulations in a water tank. In a second step, a simulation of clinical treatment is performed on an anthropomorphic phantom RANDO and dose measurements are collected from thermoluminescent detectors placed on the skin and inside the phantom around the X-ray source. Finally, dose calculations are performed on the platform Monte Carlo GATE by integrating CT images of the phantom with the applicator integrated in the phantom. The validation is performed by comparing simulations and experimental measurements on the phantom.

The first simulation results show a good fit with the experimental measurements and confirm with personalized study on CT images of the phantom. The mean relative deviation between experimental measurements and calculated doses is 1% (Min: 0.2% High: 7.5%) with a maximum uncertainty of 0.3% in GATE.

This model has been validated for the breast and can be considered validated for vertebral metastases. However, it is necessary to confirm this study on patients taking into account tissue heterogeneities.

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RESULTS OF AN INQUIRY AMONG END USERS AND CALIBRATION LABS ABOUT THE USE OF MEDIUM ENERGY X-RAYS FOR THERAPY THROUGHOUT EUROPE – A METREXRT WORK PROGRAM

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