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Stablishment af a Quality Control Program to PKA Meters

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1. Introduction

In recent years, the number of interventional procedures involving the use of radiation has increased, such as in cardiological procedures using fluoroscopy. The main measuring instrument used in these procedures is the product kerma air-area (PKA) meter. To ensure reliability in delivering the dose to the patient and adequate protection for IOEs, it is necessary that such equipment is properly calibrated [1,2]. The IEC 60580:2019 standard presents the performance requirements for meters of this quantity. The method normally used to calibrate and control these meters is the use of cylindrical reference ionization chambers calibrated to the RQR radiation qualities recommended by the ISO 61267 standard. However, these reference chambers have a very different manufacturing geometry than the PKA meters.

2. Methodology

To determine a calibration methodology that can be used with greater reliability and less uncertainty, 3 different types of quality control tests were carried out, comparing the performance of a reference PKA meter (PDC, from Radcal®) with a clinical system (PTW®) used to determine PKA values.
Quality control tests were carried out to evaluate the equipment performance at the same distance and using measurements with the C-14 check source, with a support designed to this study, in a 3D printer (Raise3D®, in figure 1a), in order to guarantee reproducibility in relation to the source [3].

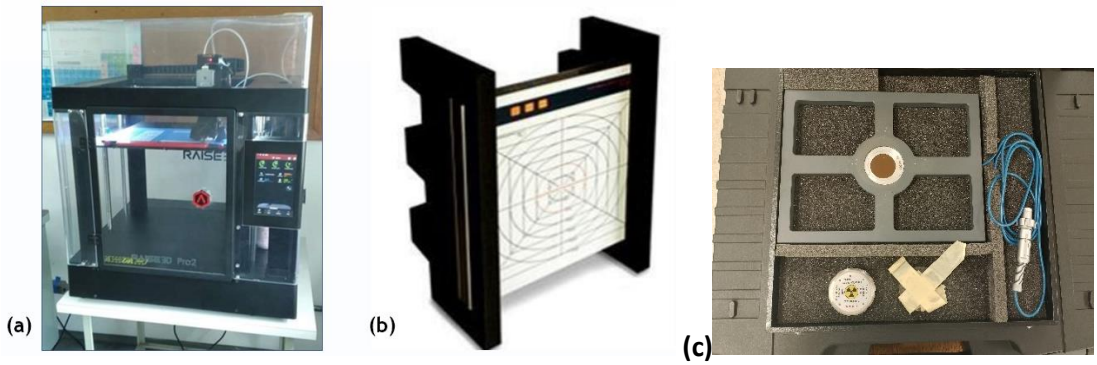

Figure 1: (a) FFF 3D Printer (Raise3D PRO), where we printed the support for radioactive font; (b) Patient Dose Calibrator (PDC), with attached support; (c) the original support for the C-14 source calibration and tests for homogeneity.

Therefore, the 3 tests are: homogeneity tests (comparing PDC (figure 1b) with an ionization chamber, in the same position), stability over time (choosing the position from the previous test, in the center, 20 measurements were taken and they were compared with the average with the reference, comparing the PDC with the ionization chamber) and current leakage (at the same time, as the stability test was carried out, we separated it into a group of measurements, testing the current leakage), aiming to guarantee repeatability and reproducibility in the equipment tested.

3. Results and Discussion

The quality control tests (homogeneity, leakage current and stability over time) were performed using the C-14 check source for all equipment (ionization chamber and PDC) and the results of their behaviors were compared with each other.

This PDC was subsequently tested against the measurements obtained with a clinical meter, subjected to the same tests, for its characterization and guarantee of quality control.

In the future, it is intended, based on the test carried out in this Project, that it will be possible to make comparisons over time for each of the equipment.

4. Conclusions

By comparing these three types of equipment, we verified the traceability of the system, with a good correlation between the measured values and those expected by the reference chamber (compared to the C-14 source). In the future, this project will be optimized by applying the modeling of mathematical simulation with the Monte Carlo Method, comparing the results with those of the calibration system.

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