COMMISSIONING TEST FOR OPTICALLY STIMULATED LUMINESCENCE DETECTORS FOR RADIOTHERAPY DOSE LEVEL

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INTRODUCTION

The optically stimulated luminescence (OSL) has been used for many years monitoring the occupational radiation dose. Recently, with the advance of the technology, the OSL material is being manufactured as a dosimeter. This fact gives at first, the possibility of using it in radiation dosimetry [1], [2].

Different prototypes using the OSL dosimeters have been tested for in-vivo dosimetry [3].

The present work, which has the collaboration of the IAEA Coordinated Research Project - 13111, shows the first results aiming the performance of the OSL dosimeters for *in-vivo* dosimetry in radiotherapy in the Radiotherapy Service of the National Cancer Institute in Rio de Janeiro, Brazil.

An Inlight™ microstar reader and OSL dosimeters called "dots", both manufactured by Landauer Inc, were used. The detectors consist of Al2O3:C sample and are encapsulated in light-protective plastic films.

The Al2O3:C dots are stimulated using a readers LED of 540 nm, emitting a luminescence of 420 nm.

The luminescence intensity is dependent of the detector dose absorbed and the laser used in the read out process.

MATERIAL END METHODS

During all the procedures the OSL dosimeters (dots, Figure 1) were positioned over solid water slabs and were irradiated with buildup caps located over its 5 mm of active area (Figure 2).

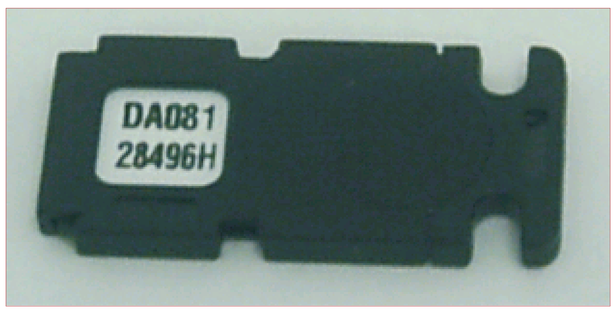

Fig. 1: OSL Dosimeter (dots)

Fig. 2: Buildup caps

The irradiations were carried out in a 40x40 cm^2 solid water phantom. An square field of 10x10 cm^2 with SSD = 80 cm were used. The same solid water slabs were use to the absolute dosimetry using an ionization chamber PTW 30013, 491series with the Unidos-E 280 series electrometer, in the same geomatry. All the irradiations with ^{60}Co energy, were carried out in a Theratron 780C machine.

An Inlight™ microstar reader, manufactured by Landauer Inc (Fig. 3) was used to read out the OSL dosimeters.

All the dots were irradiated under standardized conditions of pressure, temperature and humidity with a predefined experimental setup for the different tested parameters:

- Sensitivity dosimeter-reader curve,
- Stability of the reader,
- OSL dot reproducibility,
- Non-linearity corrections,
- The early fading of the dots,
- Post-irradiating reading stability.

Figure. 3: InLight microstar reader

RESULTS

The sensitivity curve showed in Fig.1, shows a great coherence (R2=0,9957) between reader and dots. Fig.2 shows the stability of the reader within ±10%, which is according to the manufacturer. When irradiated several times with the same dose, the dots showed a reproducibility less than 2%(1sd) (Fig.3).

Figure 4 shows that non-linearity dose response corrections are less than 5% and the early fading current of the several readings from the same detector, after one irradiation (in this case more than 40th times), is in the range of 1% (Fig.5).

Figure 2 shows the high stability of the readings 10 min after the dots irradiation.

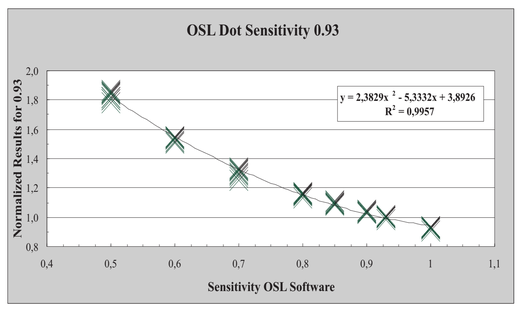

Figure 1. Sensitivity curve between reader and dots

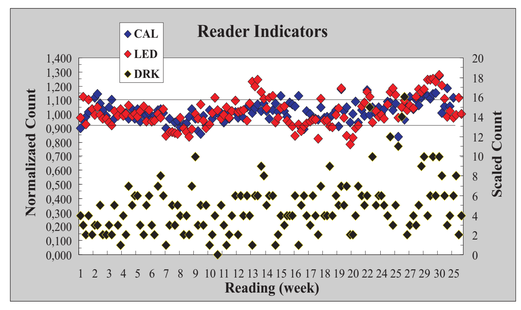

Figure 2. Stability of the reader

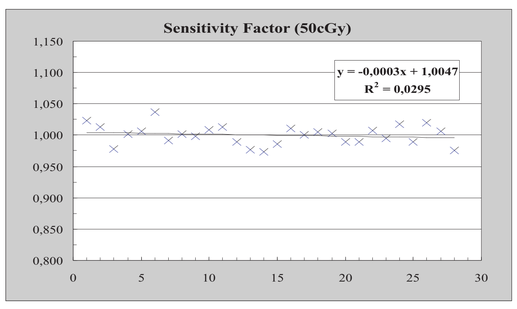

Figure 3. Reproducibility of the dots

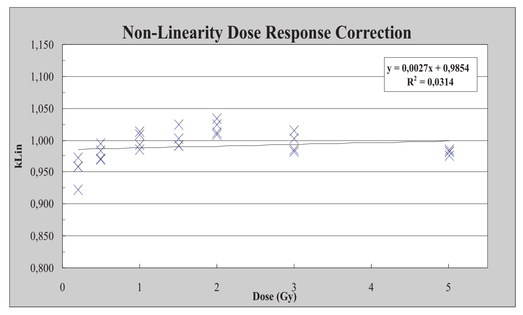

Figure 4. Non-linearity dose response correction

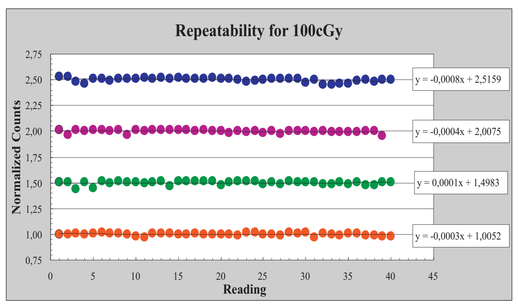

Figure 5. Early fading curve

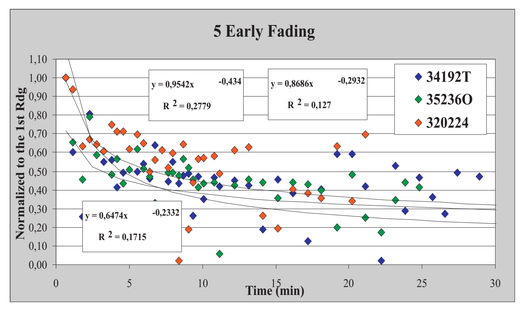

Figure 6. Stability of the readings

CONCLUSIONS

The initials results of this research show the possibility of having the OSL dosimeters as one more tool to develop quality control programs in radiotherapy services.

The good stability of the detectors and the reader response makes the system suitable for other applications in radiation measurements in clinical radiotherapy.

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