

## **Measurement of skin dose from very low energy x-rays during partial breast irradiation**

Armoogum K<sup>1</sup>, Parry J<sup>1</sup>, Mackay C<sup>1</sup>, Thompson A<sup>2</sup>, Vaidya J<sup>2</sup>, Ackland C<sup>2</sup>, Gardner J<sup>2</sup>, Munro A<sup>2</sup>

Departments of <sup>1</sup>Medical Physics and <sup>2</sup>Surgery and Molecular Oncology, Ninewells Hospital and Medical School, Tayside University Hospitals NHS Trust, Dundee, DD1 9SY, UK.

### **Background**

Intraoperative radiotherapy (IORT) using a low kV, miniature X-ray source (XRS) has the potential to impart the same clinical benefit as external beam radiotherapy. IORT facilitates partial breast irradiation by delivering an isotropic dose to the tumour bed. The skin dose must be quantified due to the larger dose fraction and smaller target volumes. Gafchromic XR Type-R film (GC-XRR) (International Specialty Products) enables the measurement of absorbed dose of low energy photons and readout is simple.

### **Methods**

GC-XRR consists of three layers with a 100 µm top layer of translucent yellow dye which acts as a protective barrier, a 15 µm active middle layer and a 100 µm white, opaque base layer providing image reflection. The XRS (Carl Zeiss AG) operates at 50 kV and 40 µA (HVL 0.11 mm Al) and was used to obtain a sensitometric response curve (1 to 10 Gy). A reflection densitometer (X-Rite Inc.) was used to read the optical density at each exposure. Four pieces of film wrapped in Tegaderm™ are placed by the surgeon around the wound site before irradiation. After treatment, the absorbed dose is deduced from the sensitometric response curve.

### **Results**

We used GC-XRR film on 16 patients to quantify breast skin dose. The prescribed dose was 5 Gy to a uniform 1 cm margin in the tumour cavity. Treatment times ranged from 16.81 to 33.11 minutes (mean = 26.41) and the median applicator size was 4.5 cm. Absorbed doses ranged from 0.90 to 6.15 Gy (mean = 3.01 Gy). This is comparable with values obtained earlier in the Targit trial.

### **Conclusions**

GC-XRR film is a useful tool for the determination of breast skin surface dose during low kV IORT. It is easy to use in the operating room, requires no prior preparation and provides a direct read-out.