

Clinical application of GAFCHROMIC EBT film for in vivo dose measurements from total body irradiation

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Purpose

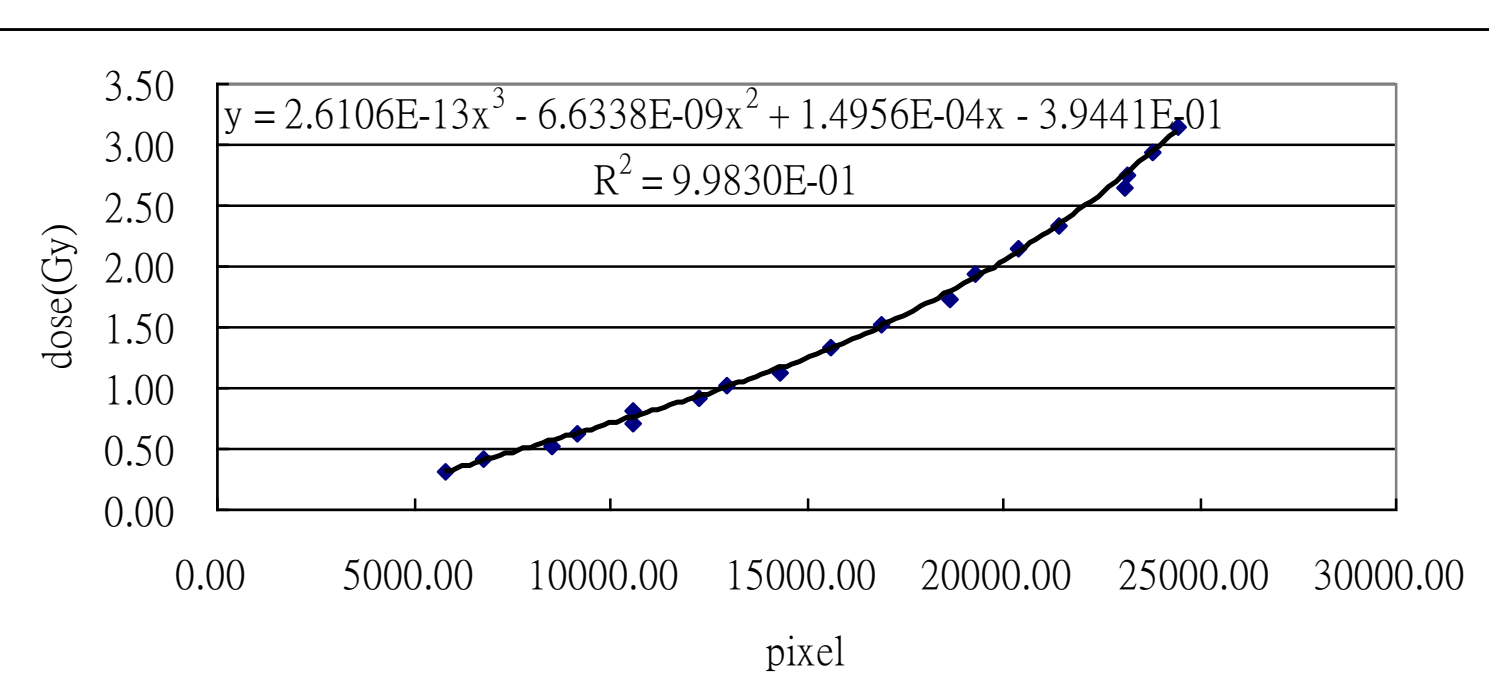
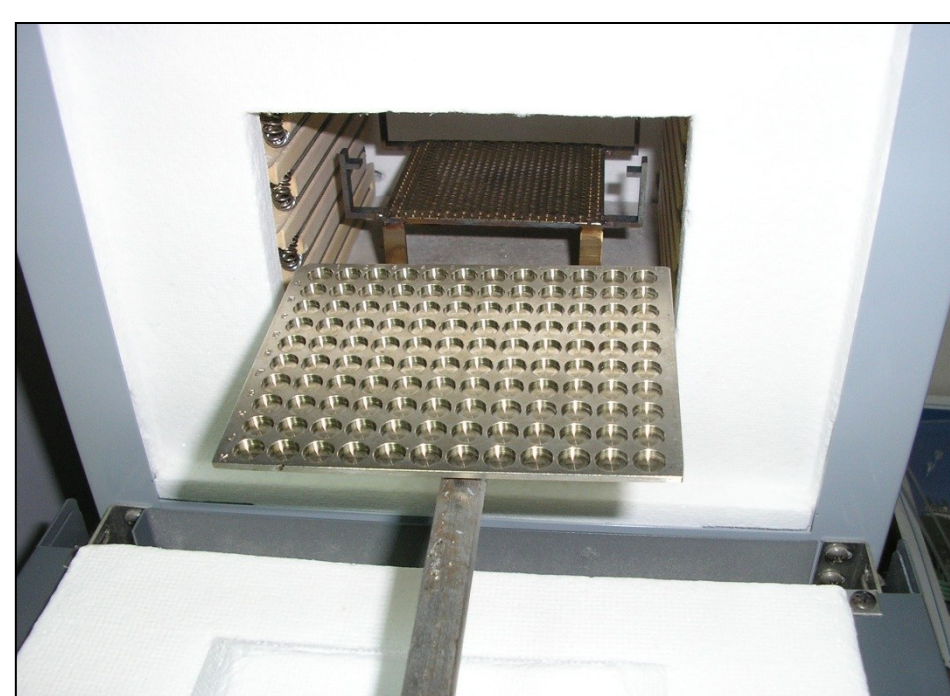
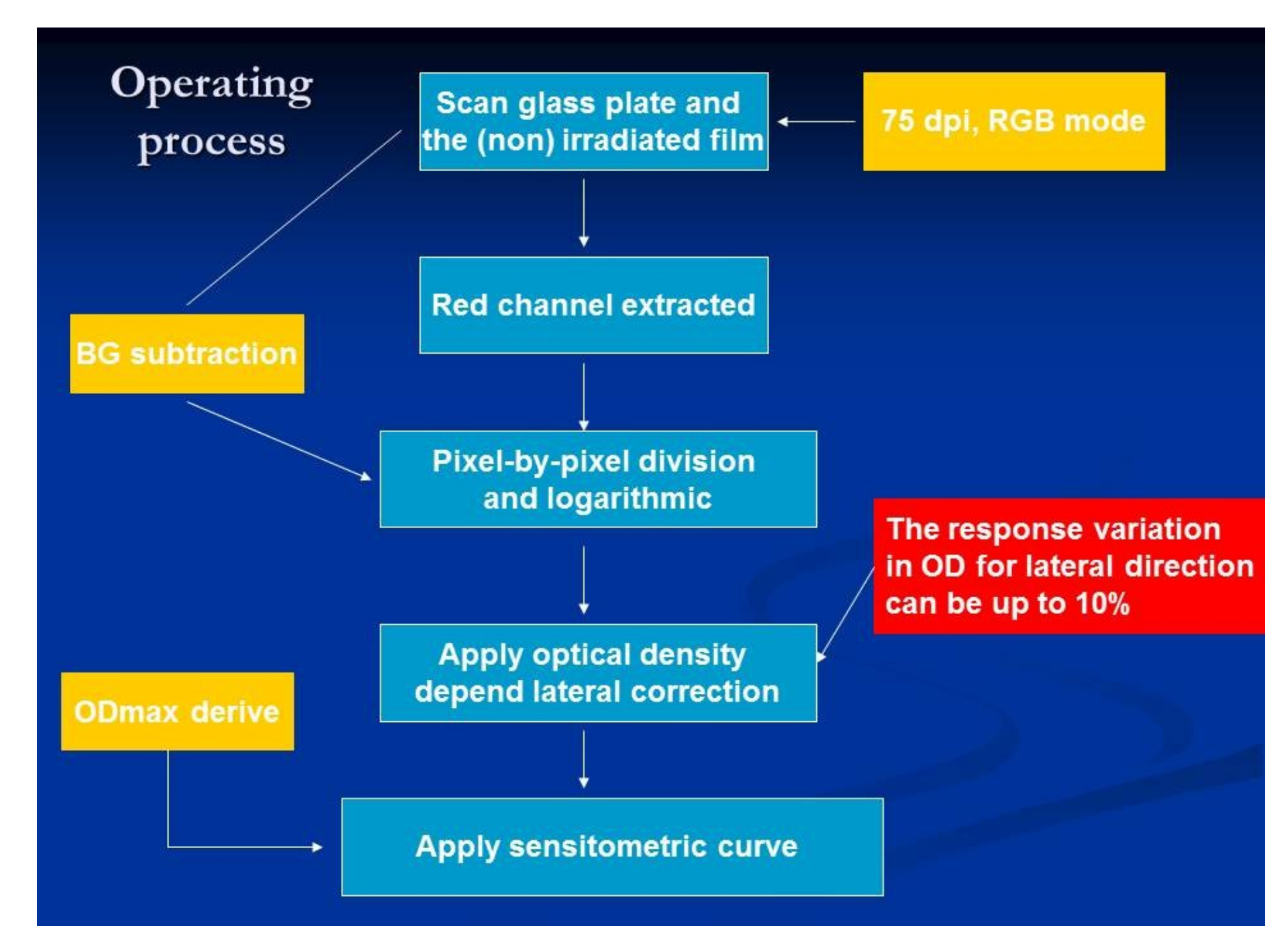
To investigate the in vivo absorbed doses for total body irradiation (TBI) by GAFCHROMIC EBT film, post processing procedure including pixel-by-pixel values, film uniformity, and sensitometric curve were established to evaluate dose uniformity on the patient.

Method and Materials

The 10MV photon beam by Siemens Primus linac was used for TBI. The Rando phantom was set in the treatment position with bilateral opposing TBI technique with a source-to-axis distance of 455 cm and 2136 monitor-unit irradiation(per orientation). The distance from skin entrance to umbilicus was 14.5cm for 150cGy prescribed dose. Four thermoluminescent dosimeters (TLDs) and one EBT film with the size of 3cm x 3cm were placed together at the surface of 6 anatomical regions including umbilicus, genitals, both temples, and chest wall. Epson 1680 color transmission flatbed scanner was used as film scanning system, with only the red-color-channel response extracted from irradiated EBT films converted to the pixel-to-dose sensitometric fitting curve. Furthermore, EBT films were tested for the in vivo surface dose measurements on two patients undergoing TBI.

Results

The overall dose uncertainty determined in EBT film was 3% as compared to the farmer-type ion chamber. In phantom test, the average surface doses measured by TLDs and EBT films at 6 anatomical regions were 2.00 and 2.03Gy(left temple), 2.00 and 2.03Gy(right temple), 1.83 and 1.86Gy(left chest), 1.86 and 1.90Gy(right chest), 2.18 and 2.21Gy(umbilicus), and 1.54 and 1.57Gy(genitals), respectively. It showed the good agreement in phantom between EBT films and TLDs measurements with the average difference of $1.7 \pm 0.3\%$. The average doses measured by EBT films at the corresponding regions on two patients were 1.79Gy/1.78Gy, 1.71Gy/1.64Gy, 1.17Gy/1.21Gy, 1.15Gy/1.17Gy, 2.46Gy/2.32Gy, and 1.65Gy/1.79Gy, respectively.



Conclusions

The performance of EBT film for TBI dosimetry was satisfactory, with the dose difference of 1.7% between EBT film and TLD measurement. The use of EBT film for in vivo dose verification of TBI technique may be applicable and convenient.

