The Xoft Axxent® X-Ray Source Stability While Simulating IORT Procedures

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ABSTRACT

The Xoft Axxent® Brachytherapy System is used to deliver intraoperative radiation therapy (IORT). The Axxent System provides accurate, consistent radiation dose delivery which is critical to accurate radiation dose localization. The Axxent System includes a proprietary X-ray source, which delivers a radiation dose to a very deep point inside the body. The Axxent X-ray source delivers high-dose-rate x-rays that can penetrate deeply inside a patient, allowing high-volume breast IORT to be feasible as well as other applications in oncology and cardiology.

MOTIVATION

The Axxent® X-Ray Source was used for a variety of purposes, including but not limited to, the delivery of IORT to patients. The X-ray source stability was maintained during each treatment, and the variation in source radiation output was less than 1% during any one dwell interval. Representative "drift" can be seen in dwell point position change, so that the data must be post-processed to correct the source stability data. The X-ray source stability data was demonstrated to be better than 1% of source dwell time.

RESULTS & DISCUSSION

EXPOSURE DATA

An example of the exposure rate data for Treatment #16 is shown in Figure 4. The blue diamonds indicate the exposure rate values measured at each of the nine dwell positions. The exposure rate during each dwell interval is indicated by a black triangle. The exposure rate data was obtained from the Victoreen 451B Ion Chamber Survey Meter placed 10 cm below the table supporting the phantom as in Figure 3. Data were downloaded to a MS Excel spreadsheet for analysis.

Table 1: Detailed information on the 25 patients treated including the time which each patient was treated, the variation in calibration in each set of four treatments, and the variation in exposure rate measured during the treatment delivery.

The Axxent® X-Ray Source delivered consistent, accurate radiation dose delivery to each patient, allowing high-volume breast IORT to be feasible as well as other applications in oncology and cardiology.

SUMMARY & CONCLUSION

Exposure rate were measured near a full-body phantom for simulated IORT treatments using the Xoft Axxent Brachytherapy System. Four treatments were given per day with only 45 minutes separation to simulate a high volume breast IORT patient environment. These measurements represented an indirect indication of the instantaneous source dose rates which varied by an average standard deviation of 0.72%.

The Axxent® Brachytherapy System performed stably during simulated IORT treatments using worst-case conditions.