Technology Development & Commercialization
UNIVERSITY HEALTH NETWORK
Toronto General Hospital • Princess Margaret Hospital • Toronto Western Hospital

TANDEM IMAGING SYSTEM:
Real-time Imaging During Radiation Therapy Treatment

Overview of Technology:

Image guided radiotherapy (IGRT) was recently adopted due to changes in organ-filling or breathing movement during radiotherapy. The technology allows for imaging information from the "planned CT" scan performed earlier in the treatment process to be overlapped with a CT image that is taken immediately before treatment delivery. Unfortunately, the current system cannot track tumor movement due to breathing during the treatment - thus variability in the dose delivered still exists.

A group of UHN radiation treatment specialist has developed a novel imaging system that will allow the acquisition of high contrast images of patient position using built-in diagnostic quality kilovoltage (kV) X-ray beams on linear accelerators, simultaneously with the megavoltage (MV) radiation treatment delivery beam. For high precision and high dose per fraction radiation treatment, it is extremely desirable to verify that the organs of interest are at their assumed locations with respect to the radiation beams. This is to ensure that the cancer volume is receiving the intended dose while significant dose delivery to the surrounding normal tissues and critical organs is avoided. At present no such system is available, therefore patient position information is captured and assessed minutes before actual treatment delivery. It is assumed that the patient's internal organs will not move between imaging and completion of treatment. However, studies suggest that internal organs can move involuntarily and unpredictably by a significant amount. Simultaneous X-ray imaging during radiation treatment delivery has been attempted; however, due to the large amount of scatter produced by the treatment beam, image quality is degraded substantially.

The system, consisting of two imaging panels, is termed a tandem imager. A proof-of-principle tandem imager has been demonstrated in a simulated environment using linear accelerators with built-in kV imaging systems at the Princess Margaret Hospital.

A fully developed tandem imaging system (currently under development) will enable clinicians to more accurately target the cancer volume during the delivery of prescribed dose of radiation while sparing normal tissues. This approach will help advance the field of high precision radiation therapy further, and in particular, will widen the clinical deployment of hypo-fractionated treatment regimes. With hypo-fractionated treatment, highly effective radiation therapy can be administered over fewer treatments (5-10 sessions), in contrast with the current practice of administering 20 to 30 treatment sessions over several weeks. The overall cost of radiation treatment will thus be reduced while providing greater convenience to patients.

Patent:

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