

SeedTracker – A Safer & More Precise Procedure to Deliver Radiation Therapy to Cancer Patients

Flagship Program This Case Study is Attributed to
Targets & Therapeutics (T1/T2)

Translational Pipeline Focus
T1/T2

Type of Cancer(s)
Prostate Cancer

Location(s) Where Research is Based
South West Sydney Local Health District

Summary

Real-time target position monitoring using general purpose radiotherapy machines is a goal of the radiotherapy community. Current commercial solutions are expensive (>A\$500,000 per treatment unit), specific to particular tumour sites, and have complex workflow challenges for existing treatment delivery systems. These barriers have proven to be prohibitive, with very low utilisation of existing solutions. Our work has developed an advanced system to perform real-time position verification using the equipment already available on a general-purpose radiotherapy machine (Linac) without the requirement of additional equipment.

As of 2011 there were 168 Linacs in Australia and this number is expected to rise to 267 by 2022 to meet the increasing cancer burden. Worldwide, SeedTracker is the first system and clinical implementation of real-time position verification for the particular treatment delivery system used in SWSLHD. In Australia >50% of centres have similar equipment in which SeedTracker could be implemented.

All prostate cancer patients prior to treatment have 3 gold seeds inserted into the prostate. During treatment, SeedTracker automatically identifies the gold seeds (and hence the prostate position) by a novel extended Marker Enhancement Filter. SeedTracker then compares the detected seed location with the expected position at any given point in time. If the seeds and prostate move beyond a defined threshold distance away from the planned position, SeedTracker alerts the treating team so the treatment can be paused, the patient repositioned, then treatment resumed. This system can be adapted to treat other tumour sub-sites where fiducial seeds are inserted.

The Contribution, Impact or Benefit to Community

Radiotherapy aims to maximise destruction of tumour cells but keeping healthy tissue intact. However, delivering accurate and reliable radiation treatment for solid cancer therapy is technically challenging as the tumour tissue has to be

located and treated in patients who are moving targets, due to normal organ movements and the patient's breathing.

Championed by Dr Sankar Arumugam, the Medical Physics team at Liverpool Hospital and Ingham Institute has developed SeedTracker, a new method to image location and motion of solid tumours; this new method more accurately locates both the tumour and the surrounding healthy tissue compared to standard approaches. Subsequently, the radiation beam can be specifically guided to the tumour regions, thus sparing healthy tissue. Importantly, SeedTracker is seamlessly integrated into the existing workflow for radiation oncology treatment, which is vital for continuous improvement of operations management.

The current beneficiaries of SeedTracker are patients that suffer from prostate cancer; in future other groups like lung, liver or brain cancer patients could benefit from SeedTracker.

The pilot study initiated in 2016 has treated 53 prostate cancer patients at Liverpool Hospital. After cancer patients have undergone standard surgery to insert location markers into their prostate, the Seed Tracker process is integrated into the standard of care activity chain used for prostate cancer patients. Documented evidence (Arumugam S et al Med Phys 2016; Arumugam S et al Physica Medica 2017) has shown that SeedTracker delivers more precisely radiation doses to tumour tissue with reduced margins to healthy tissue; in addition the treatment workflow using SeedTracker takes less time compared to previous treatment flows thus increasing working efficiency and patient throughput. Based on these pilot data, the SeedTracker clinical protocol has been expanded to other hospitals in the SWS LHD and will be of benefit for an estimated 14,300 of prostate cancer patients (based on data by Barton MB et al. Radiother Oncol. 2014 and <https://www.aihw.gov.au>). Seed Tracker has received the prestigious Bob Leece Transforming Health Award at the 2016 NSW Health Awards.

In summary, the combined benefits of SeedTracker not only reduce unwanted treatment variation but also have tangible and intangible economical benefits to the health care system.

Contact Person

Name: Dr Sankar Arumugam, CONCERT Member