IAEA Technical Cooperation Programme

Improving radiation therapy techniques in Malta

The challenge

The radiotherapy department at Sir Paul Boffa Hospital in Malta was the only cancer centre for the Maltese Islands. In 2014, the hospital was not using intensity modulated radiation therapy (IMRT). However, newly qualified radiotherapy professionals including radiographers and medical physicists were to join the radiotherapy department in 2015, and it was planned that radiotherapy services would migrate to a new Oncology Centre, the Sir Anthony Mamo Oncology Centre (SAMOC) at Mater Dei Hospital, in the same year.

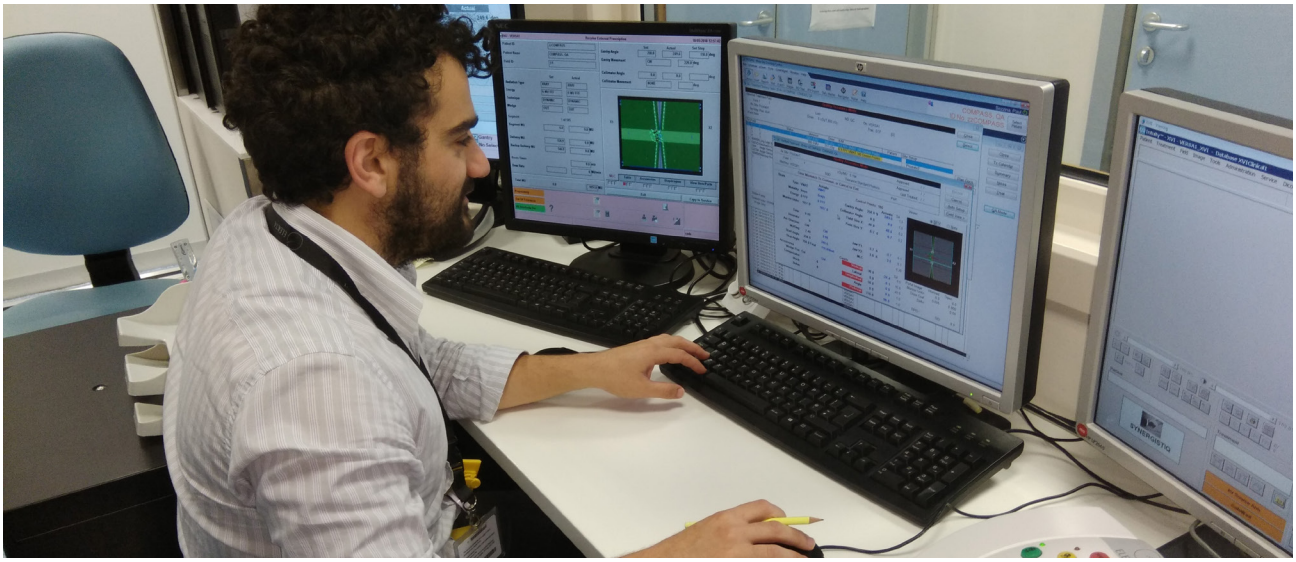
Malta required support for human capacity development to introduce IMRT and volumetric modulated arc therapy (VMAT), coupled with image guided radiation therapy (IGRT). The introduction of Flattening Filter Free (FFF) treatments represented a more significant challenge. Advanced and specialized training was required to complement investments made in equipment and in the basic professional training of human resources. The new therapies and treatments provide highly conformal radiation doses to target volumes, reduce doses to organs at risk and healthy tissue, and increase patient positional accuracy through the application of on-board imaging technology.

The project

With IAEA technical cooperation support, advanced and specialized training required for the safe clinical implementation of advanced radiotherapy techniques was facilitated. The main goal was to implement IGRT and IMRT/VMAT in general use, and to gain sufficient expertise to implement this safely in one body site and to transfer this expertise to implement the technique at a second body site. The project also aimed to provide opportunities for radiographers and medical physicists to attend training courses or conferences on related subjects, supporting continued learning.

Clinical hands-on and academic training opportunities at centres of excellence in Europe were provided through the project. Twenty-three professionals including oncologists, medical physicists and radiographers attended the European Society for Radiotherapy and Oncology training courses and International Centre for Theoretical Physics workshops on VMAT, 3D IGRT and quality management. Extended fellowships and scientific visits were awarded to seven professionals.

Also through the IAEA technical cooperation project, an advanced Patient Dose Verification System



A medical physicist delivering a VMAT plan for quality control testing. (Photo: Dorothy Anne Aquilina/SAMOC)

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was procured to complement the existing nuclear technology available for patient-specific quality control testing. This is necessary to carry out pre-treatment checks to assess machine performance when delivering complex VMAT patient treatment plans optimized on the treatment planning system, and to ensure that predicted dose maps delivered are within acceptable tolerance levels. This quality assurance provides a further safety check of treatment plans used for the VMAT technique.

The impact

The radiotherapy team at SAMOC have established VMAT and 3D IGRT modalities and has fully implemented this technique for all patients requiring radiotherapy for prostate cancer. With faster treatment delivery times, increased patient throughput is minimizing waiting times for patients requiring radiotherapy. The treatment of cancer patients is more efficient and effective, and patient outcomes and quality of life when using this radiotherapy technique are improved.

Through the project, the IAEA provided training opportunities for many professionals working at SAMOC who are still at very early stages in their radiotherapy career and thus require expert guidance to implement new techniques. Professionals who have attended extensive training through fellowships have embarked on training within the department, aiming to transfer knowledge and skills through internal training activities, and are preparing standard operational procedures and clinical protocols as part of a quality system. The team is currently working on implementing the VMAT technique to other clinically relevant sites.

PROJECT INFORMATION

Project No: MAT6008

Project title: Developing Human Resources for Implementation of Advanced Radiation Therapy Techniques

Duration: 2016-2017 (2 years)

Budget: €216 800

Contributing to:

Partnerships and counterparts

- Government of Malta, Ministry for Health
- Sir Anthony Mamo Oncology Centre, Mater Dei Hospital, Malta

Facts and figures

Since December 2016, 100 patients have received radiotherapy using the VMAT technique, while over 1000 patients have benefited from 3D kV based imaging for positional accuracy verification for radiotherapy. All prostate cancer patients referred to radiotherapy are benefiting from VMAT and 3D IGRT techniques. The number of fractionations (fractionated smaller radiation doses) for prostate radiotherapy reduced to 20 from 37, opening up appointments on linear accelerators (linacs), and thus increasing patient throughput.

All VMAT treatment plans undergo patient-specific quality control testing to measure accuracy in linac plan delivery; all plans have successfully passed set tolerance criteria. Machine stability in the delivery of VMAT modality for prostate class solution has been established.

The science

The process for patients receiving radiotherapy is complex and requires the use of specialized equipment. On referral for radiotherapy, patients first undergo a treatment-specific CT scan for localization and delineation of target volumes and organs at risk. These images are required for 3D dose optimization and calculation using a Radiotherapy Treatment Planning System that allows for dose optimization.

Great precision is required in treating patients with radiation, and the accuracy and reproducibility of patient position is imperative and needs to be identical to that at the time of CT scanning. The new linacs are equipped with On-Board Imaging Devices that enable 3D visualization of the patient's anatomy while on the treatment couch and any positional adjustments made to ensure setup accuracy and treatment delivery to the correct area within the patient. The new linacs allow radiotherapy delivery with an innovative technique known as Volume Modulated Arc Therapy (VMAT), which delivers extremely conformal doses to tumours while drastically reducing the dose to healthy tissues. This increases tumour control and reduces complications to normal healthy tissue, resulting in a better quality of life for patients. Another innovative feature on these machines is the ability to deliver doses using a Flattening Filter Free Mode, which decreases the time taken to treat patients, and increases patient throughput.