New technology to allow simultaneous tumour imaging and radiotherapy treatment

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The Institute of Cancer Research, London, and The Royal Marsden NHS Foundation Trust will be the first in the UK to gain access to a state-of-the-art radiotherapy system after entering into a pioneering research collaboration with manufacturer Elekta.

They will develop the system, called the MR Linac, so radiation fields can be adapted to a patient's anatomy during treatment for a large range of cancers that are challenging to image effectively and to target with radiation.

The MR Linac offers the potential to combine two advanced technologies: magnetic resonance imaging (MRI), which uses a powerful magnetic field to acquire images of the body's internal anatomy, and a linear accelerator, which accelerates electrons to almost the speed of light before converting them to X-rays. Combined with onboard adaptive treating planning, this technology aims to ensure that each patient receives an optimal treatment – balancing the benefits of tumour control and the risks of side-effects.

The Institute of Cancer Research (ICR), working with its clinical partner The Royal Marsden, has signed a contract with Elekta to become an academic partner in an international consortium of leading research organisations, including the University of Texas MD Anderson Cancer Center, the National Cancer Institute in Amsterdam and the University of Utrecht in Holland.

The research collaboration aims to exploit the excellent soft-tissue contrast of MR images to dramatically improve the accuracy and effectiveness of high-precision radiotherapy. The development of the MR Linac is led by Elekta, a Swedish-based health technology company with manufacturing operations in Crawley, Sussex, UK, and Philips, a healthcare technology and consumer electronics company.

A team of physicists, computer scientists and clinical consultants at the ICR and The Royal Marsden will support Elekta in developing the technology through a rigorous preclinical research programme – before clinicians at the ICR and The Royal Marsden make the MR Linac available as a treatment option for cancer patients.

Elekta engineers developed the first prototype of the technology with the University of Utrecht. The ICR is the first UK academic institution to partner with Elekta, and only the sixth in the world.

The ICR and The Royal Marsden will now aim to secure additional investment in their research on the MR Linac, to expand the scope of the research effort and develop the technology as quickly as possible for cancer patients.

The research will help ensure treatment can be delivered accurately even in the presence of the strong magnetic fields required for MRI – a major challenge because the two technologies are usually incompatible.

Professor Uwe Oelfke, Head of the Joint Department of Physics at The Institute of Cancer Research, London, and The Royal Marsden NHS Foundation Trust, said: "Radiotherapy is a hugely important and highly effective element of cancer treatment, but we need to develop new and smarter ways to direct X-rays at tumours and further reduce the side-effects associated with collateral damage to healthy tissue.

"I'm very excited to be part of the first research collaboration in the UK to gain access to Elekta's state-of-the-art MR Linac system. Our research teams will use the MR Linac facility to develop real-time magnetic resonance imaging to shape radiation beams to where the tumour is, even as it moves within the body. This new technology has the potential to improve the effectiveness of radiotherapy, by targeting high doses of radiation to exactly where they are needed, and to have significant benefits for cancer patients. In the future we foresee that MRI-guided radiation therapy will lead to an even more personalised treatment by exploiting functional and biological information provided by MRI images."

Professor Christopher Nutting, Consultant Clinical Oncologist at The Royal Marsden NHS Foundation Trust and Joint Head of the Division of Imaging and Radiotherapy at The Institute of Cancer Research, London, said: "We are delighted to join this pioneering research partnership to develop the MR Linac, which represents the very latest in radiotherapy technology. It's hugely exciting to be at the forefront of research into new approaches to radiotherapy, with the potential to directly benefit patients at our hospital and across the NHS."

Kevin Brown, Global Vice President, Scientific Research at Elekta, said: "We are very excited to have the team of clinicians and scientists from the ICR and The Royal Marsden to join this collaborative effort to maximise the value to patients of this new technology. We will need to overcome many challenges and their expertise will be invaluable."

Provided by Institute of Cancer Research

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