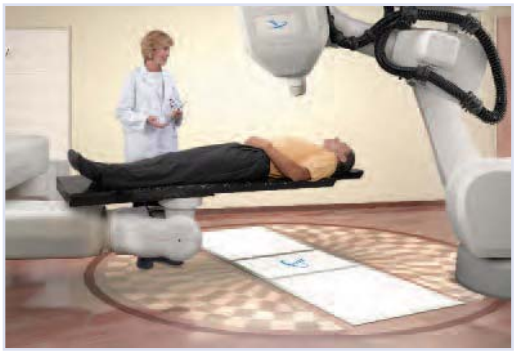
The Royal Marsden NHS Foundation Trust – 160 pioneering years

CyberKnife is the first and only robotic radiotherapy system. The robotic arm can deliver high doses of radiation from a wide range of angles and with pinpoint accuracy.

In 1851, The Royal Marsden became the first hospital in the world dedicated to the study and treatment of cancer. Today, The Royal Marsden NHS Foundation Trust enjoys a global reputation as a centre of excellence for research, teaching and treatment, thanks to a history of groundbreaking developments in the study of cancer. Now The Royal Marsden is once again poised to pioneer cancer treatment with the introduction of CyberKnife.

CyberKnife – the new standard in radiosurgery

The Royal Marsden will be one of the first NHS hospitals in the UK to offer radiotherapy treatment with CyberKnife. Having been successfully used to treat patients in other parts of the world, it's been featured in an ever increasing number of peer-reviewed publications.



The number of treatments a patient undergoes will be greatly reduced enabling faster recovery.

HOW IT WORKS: CyberKnife® dissected

THE ROYAL MARSDEN CANCER CAMPAIGN

More accurate, more intensive, less damaging

Whereas traditional radiotherapy uses a gantry delivery system which limits the angles of treatment beams, the CyberKnife robot "*can move in almost limitless positions around the patient*", according to Dr. Van As. It means more accurate, more intensive – and less damaging – treatment.

Fewer treatments

Because CyberKnife's tracking system is so accurate, and because its imaging technology is so sophisticated, radiotherapy can be focused on tumours with far less risk of damaging the surrounding healthy tissue. Radiotherapy beams can be more intense than in other treatment methods, so fewer sessions are needed – and fewer treatments mean less time in hospital.

Unique technology

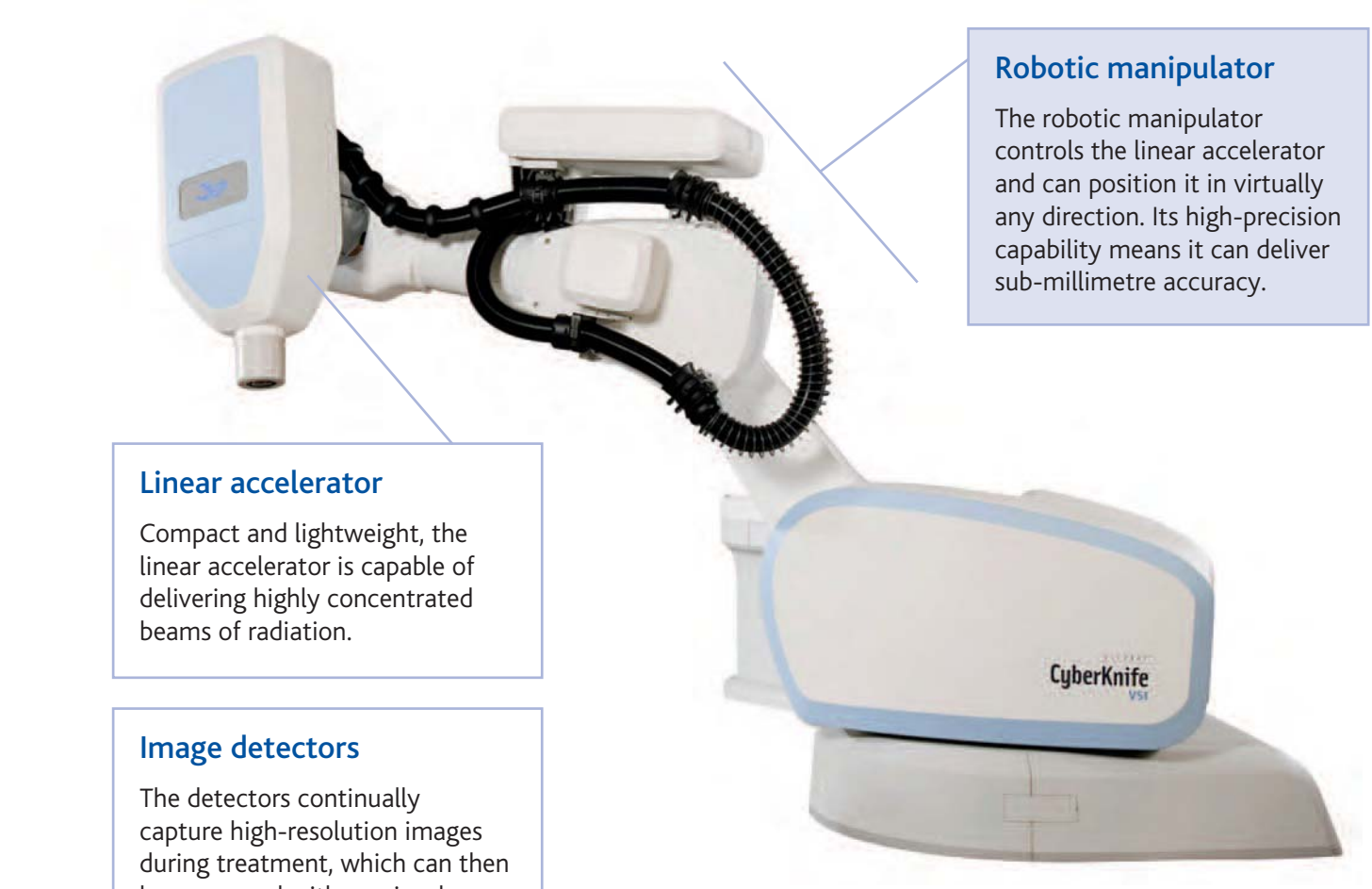
No other technology on the market has the capabilities of CyberKnife. For the first time, doctors are able to deliver highly conformal doses of radiation, with great accuracy, to moving targets in real time. *"It's what we've always wanted to be able to do"*, Dr. Van As asserts.

Synchrony Respiratory Tracking System

Because tumours can shift position when a patient breathes or moves, larger beams have to be applied to account for tumour movement, resulting in greater amounts of normal tissue receiving radiation. The tracking system reduces this problem by constantly tracking and synchronising the delivery of the radiotherapy beam to the movement of the tumour.

X-ray

During treatment, the low-energy X-ray machine acts as a mapping system by generating images that enable CyberKnife to plot a map to best treat the tumour. It works as another check to minimise damage to healthy tissue, focusing high-dosage radiotherapy beams directly on tumours.



Robotic manipulator

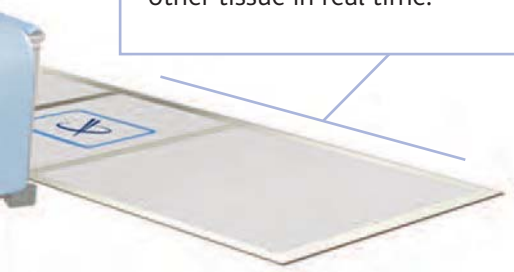
The robotic manipulator controls the linear accelerator and can position it in virtually any direction. Its high-precision capability means it can deliver sub-millimetre accuracy.

Linear accelerator

Compact and lightweight, the linear accelerator is capable of delivering highly concentrated beams of radiation.

Image detectors

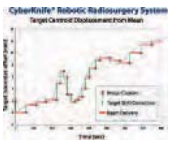
The detectors continually capture high-resolution images during treatment, which can then be compared with previously generated images to build an overall picture and determine the exact location of tumours and other tissue in real time.



RoboCouch Patient Positioning System

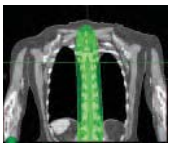
Like CyberKnife's other components, the RoboCouch is finely tuned to provide an expert degree of control. Compared to a conventional gantry system, a patient can be readied for treatment more quickly, and the "seated load" option provides comfortable, simple loading for patients with limited mobility.

DATA Management



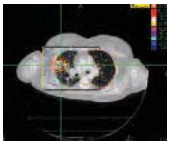
01: Time-based imaging

Responding to the level of precision required by the treatment, the CyberKnife operator is able to build a picture of the tumour's movements inside the body by selecting the frequency with which images are generated in real time.



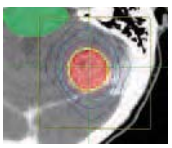
02: Xsight spine tracking system

The Xsight eliminates the surgical implantation of fiducials (tiny markers used as visual reference points when using imaging technology) by using the spine to locate and track tumours, making radiosurgery more precise and also non-invasive.



03: Xsight lung tracking system

Again eliminates the need for the surgical implantation of fiducials by precisely tracking and self-adjusting to the movement of lung tumours.



04: 6D skull tracking

Manipulates imaging technology to non-invasively target a specific area of the head so that precision is maintained throughout treatment.

THE ROYAL MARSDEN CANCER CAMPAIGN

Clinicians are able to pinpoint tumours and treat them with confidence.

CyberKnife®: in brief

Accuracy

The various components of CyberKnife work in harmony to provide submillimetre accuracy, so that clinicians are able to confidently treat tumours using high doses of radiation without harming healthy tissue.

Flexibility

Because the CyberKnife's linear accelerator can be positioned at almost any angle, it can treat tumours that are literally out of reach of traditional radiation delivery systems. Tumours treatable by CyberKnife include brain, spine, lung, liver, pancreas, head and neck and prostate.

Intuition

CyberKnife's accuracy is further enhanced by its live tracking devices, which continuously monitor a tumour's slightest movement so that its beam can be automatically and fractionally adjusted to ensure safe treatment delivery.

Behind the Knife: in control of radiosurgery's most advanced machine

A piece of equipment as complex as CyberKnife requires a unique set of computer operating systems to ensure each component operates smoothly and in harmony with the others.

Multiplan Treatment Planning System

This application monitors workflow to ensure that CyberKnife's components work in union to perform a seamless radiosurgery.

Monte Carlo Dose Calculation

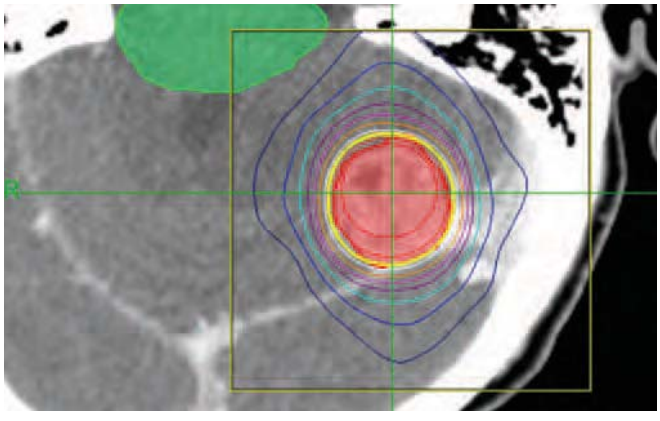
Referred to as the gold standard in dose calculation, the Monte Carlo system produces results in minutes rather than the hours common to other systems.

4D Treatment Optimisation and Planning System

An imaging system that recognises not only the tumour's movement but also the movement and any deformation of the surrounding tissue and critical structures.

CyberKnife Data Management System

All the information that is generated as a patient's operation progresses is recorded and processed here.



The 4D imaging system recognises tumour movements and the movements of surrounding tissue.

All pictures are posed by models

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