VARIAN
medical systems

SMARTBEAM IMRT:
CANCER CARE FOR THE NEXT GENERATION

Description and Overview

SmartBeam™ IMRT—intensity-modulated radiation therapy—is a is a state-of-the-art cancer treatment method that delivers **high doses of radiation directly to cancer cells** in a very targeted way, much more precisely than is possible with conventional radiotherapy. SmartBeam IMRT involves varying (or **modulating**) the **intensity** of the radiation dose. It can deliver higher radiation doses directly to cancer cells while **sparing more of the surrounding healthy tissue**.

With SmartBeam IMRT, very small beams of varying intensities can be aimed at a tumor from different angles to attack the tumor in a complete three-dimensional manner. In fact, SmartBeam IMRT can be delivered with beams the size of 2.5 x 5-millimeter pixels—the size of a pencil tip—each with a different dose.

Clinical studies indicate that higher dose rates delivered with IMRT techniques are improving the rate of local tumor control. At the same time, by limiting the exposure of healthy tissues, SmartBeam IMRT can eliminate or reduce the prevalence of unwanted radiation therapy side effects.

SmartBeam IMRT is being used to treat tumors in organs including the brain, breast, head and neck, liver, lung, nasopharynx, pancreas, prostate, and uterus.

The Benefits of SmartBeam IMRT

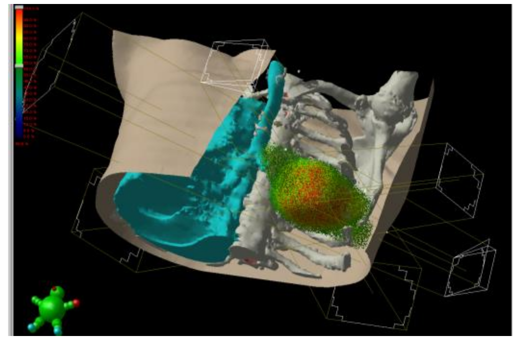
- Higher doses of radiation can be delivered directly to tumors and cancer cells, while surrounding organs and tissues are protected.

- Lower doses to healthy normal tissues may mean fewer complications or side effects. For example, in the case of head and neck tumors, IMRT allows radiation to be delivered in a way that minimizes exposure of the spinal cord, optic nerve, salivary glands or other important structures. In the case of prostate cancer, exposure of the nearby bladder or rectum can be minimized.

- In prostate cancer studies conducted at Memorial Sloan Kettering Cancer Center in New York, local tumor control rates were significantly improved. Prostate cancer patients treated with SmartBeam IMRT showed a 92 percent three-year survival rate for early stage prostate patients, as compared with an 81.6 percent survival rate for cancer patients treated at lower doses with an earlier form of radiation therapy. In addition, the use of SmartBeam IMRT cut rectal bleeding complications from 17% to 3% of the cases.

- more -

- Physicians can treat cancers that were previously untreatable with radiation therapy.
- IMRT can be a non-invasive alternative to surgery in some cases.
- IMRT targets the tumor and not the entire body.



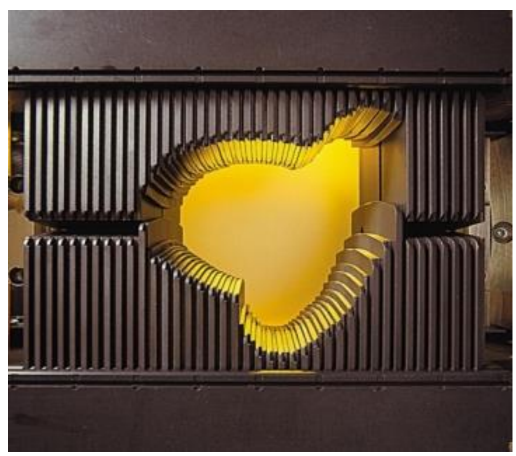
A treatment plan for treating lung cancer. By delivering radiation from a number of different angles, the beams converge on the tumor, seen here enveloped in a "dose cloud."

How SmartBeam IMRT Works

SmartBeam IMRT uses computer-generated images to plan and then deliver tightly focused radiation beams to cancerous tumors. Clinicians use it to encompass the tumor in an exquisitely-shaped radiation cloud within the intersection of several shaped beams delivered from different angles. This dose cloud conforms very closely to the dimensions of the tumor.

The SmartBeam IMRT process starts with diagnostic images, created using computed tomography (CT) and/or positron emission tomorgraphy (PET) scans of the patient's tumor and surrounding anatomy. These are converted into three-dimensional models, and a powerful computer program optimizes a treatment plan based on this information.

The Technology



The Millennium™ Multileaf Collimator from Varian Medical Systems has 120 tungsten leaves or slats for shaping a beam of radiation.

A powerful computer program optimizes a treatment plan based on a physician's dose instructions, and information about tumor size, shape and location in the body. A medical linear accelerator, equipped with a special beam-shaping device called a multileaf collimator, delivers the radiation in accordance with the treatment plan. Varian offers the highest resolution MLC on the market today, one that can deliver unique doses to very small areas.

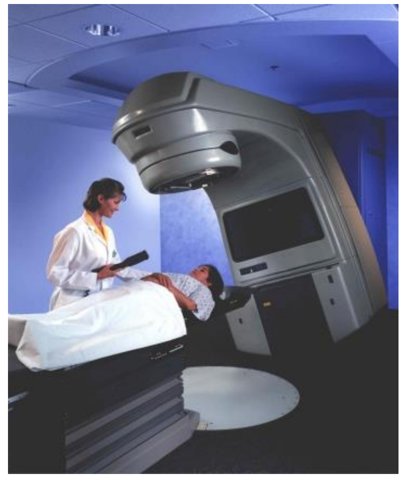
The linear accelerator can be rotated around the patient to send radiation beams from the most favorable angles for giving the tumor a high dose while preserving important healthy tissues.

SmartBeam IMRT requires a number of sophisticated software programs for processing image data, creating three-dimensional treatment plans, and controlling the treatment delivery equipment. Varian Medical Systems, Inc., the world leader in integrated cancer care systems, offers a complete suite of hardware, software, and support services for delivering IMRT.

- more -

VARIAN
medical systems

How Does a Medical Linear Accelerator Work?



Medical linear accelerators are the key systems used for delivering radiotherapy treatments. Standing approximately nine feet tall by nearly 15 feet long and weighing as much as 18,700 pounds, the accelerator consists of four major components: an electronics cabinet called a "stand," housing a microwave energy generating source; a rotating gantry containing the accelerator structure that rotates around the patient; an adjustable treatment couch; and operating electronics. Accelerators are located within specially constructed concrete treatment rooms to provide X-ray shielding.

In operation, microwave energy, similar to that used in satellite television transmission, is used to accelerate electrons to nearly the speed of light (186,000 miles per second). They attain this velocity in a short distance, typically one meter or less. As they reach maximum speed they collide with a tungsten target, which in turn releases photons, or X-rays, with such energy they are measured in millions of volts (MV). Certain models can be switched so that the electrons bypass the target for direct electron therapy. This energy is measured in millions of electron volts (MeV). Radiation oncologists and physicists use electron or photon therapies for different types of cancer treatments.

As the radiation strikes human tissue it produces (largely from naturally occurring water in the body) highly energized ions, which are lethal to both normal and malignant cells. While both good and bad cells suffer from radiation, healthy cells can repair themselves over successive regenerative cycles if the dose is not too high. Malignant cells do not possess this repair mechanism and thus do not survive, a fact that generally dictates the practice of administering repeated radiation treatments rather than a single blockbuster dosage. The body then sloughs off the dead cancer cells.