

### How does radiation therapy work?

Cancer cells grow and divide more rapidly than many of the normal cells around them. High doses of radiation can kill cells or keep them from growing and dividing, and it has proven to be particularly effective in killing cancer cells and shrinking tumors. Although some normal cells are affected by radiation, most normal cells recover more fully from the effects of radiation than do cancer cells.



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Clinac® Accelerators: Clinac 23EX with MLC-120 and PortalVision™

A patient is positioned for radiation therapy treatment using Varian's Clinac Linear Accelerator.

### What is IMRT (Intensity Modulated Radiation Therapy)?

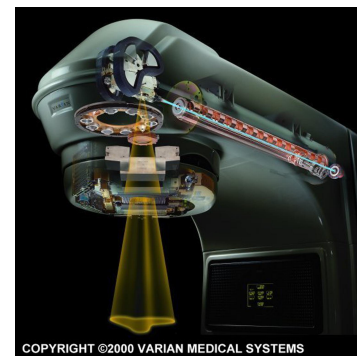
SmartBeam IMRT involves varying (or **modulating**) the **intensity** of the **radiation** (in this case, X-rays), being used as **therapy** for cancer. It is a new form of radiation therapy that uses computer-generated images to plan and then deliver more tightly focused radiation beams to cancerous tumors than is possible with conventional radiotherapy. With this capability, clinicians can deliver a precise radiation dose that conforms to the shape of the tumor, while significantly reducing the amount of radiation to surrounding healthy tissues. Consequently, the technique can increase the rate of tumor control while significantly reducing adverse side effects.

### Why would I want to be treated with IMRT?

IMRT is the most precise form of radiation therapy available. It allows physicians to escalate the radiation dose to cancer cells, and in some cases, even more precisely to specific metabolically active regions within a tumor, while keeping the dose to surrounding tissues as low as possible. An analogy might be painting with a paintbrush as compared to using an airbrush and masking tape to protect outlying areas. The airbrush allows you to deposit variable amounts of paint in a highly controlled fashion. IMRT does something similar with radiation.

### What kind of radiation is used in IMRT?

Currently, photons (X-rays) are used to deliver IMRT. The radiation is generated by a machine called a medical linear accelerator. This machine stands approximately nine feet tall, is nearly 15 feet long and can be rotated around the patient with great precision. Operationally, microwave energy, similar to that used in satellite television transmission, is used to accelerate electrons to nearly the speed of light. As they reach maximum speed they collide with a tungsten target, which in turn releases photons, or X-rays.



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Clinac® 23EX Interior

Varian's Clinac Linear Accelerator is used to generate high doses of radiation to kill cancer cells. With SmartBeam IMRT, clinicians can deliver more tightly focused beams to the cancerous tumors.

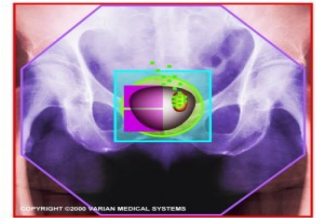
Very small beams with varying intensities can be aimed at a tumor from various angles to attack the target in a complete three-dimensional manner. In fact, SmartBeam IMRT can be delivered with beams the size of 2.5 x 5-millimeter pixels—the size of a pencil tip—each with varying intensity. The idea is to deliver the lowest dose possible to the surrounding tissue, reducing the chance of causing a radiation side effect, while still delivering the maximum dose to the tumor.

**Does radiation therapy expose people to radioactive substances?**

Many people, when they hear the word “radiation,” think immediately of radioactive substances. However, no radioactive substances are involved in the creation of X-rays or electrons by a medical linear accelerator. When a linear accelerator is switched “on,” radiation is produced and aimed directly at cancer cells. Then, like a flashlight, when the machine is switched off, there is no more radiation—none is “stored” or “transported.”

**What happens when a person is treated with SmartBeam IMRT?**

SmartBeam IMRT treatment involves three basic steps: diagnosis, treatment planning and delivery. As part of diagnosis, physicians generate three-dimensional diagnostic images (usually CT or MRI) of the patient’s anatomy and uses these to specify the dose of radiation each area will receive. In some cases, treatment planning includes a simulation session to further localize the cancer and finalize the radiation treatment plan.



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“Varian’s SmartBeam™ High Resolution IMRT: An Evolutionary Process with Revolutionary Results”  
The evolution of 48 years of research, from cobalt-based blocks to 3D conformal therapy, has now led to IMRT—Intensity Modulated Radiation Therapy. With Varian Medical Systems’ introduction of the Millennium™, MC-C 120 and CoolPlan Pro Optimizer™ software, Varian’s SmartBeam High Resolution IMRT has proven to reduce radiation exposure to normal tissue by as much as 20% over conventional IMRT treatments, allowing the oncologist greater freedom to explore the clinical effects of target dose escalation with less patient risk.

**With SmartBeam IMRT, the tumor can be precisely targeted for higher doses of radiation.**

Patients receive the SmartBeam IMRT treatment according to various schedules, usually five days a week for six or seven weeks. Each treatment takes ten to fifteen minutes.

**What is the IMRT process like?**

The IMRT process is similar to a typical radiation treatment, and it depends, to some extent, on a particular hospital’s approach to radiation oncology. Typically, after conducting a physical exam and a medical history review, the radiation oncologist determines an individualized course of treatment for each patient.

***Treatment Preparation***

Most cases require a treatment preparation session. Special molded devices that help the patient maintain the same position every day are sometimes developed at this point. Colored, semi-permanent ink is often used to mark the patient’s skin, to assist in aligning the radiation equipment with the target area. X-rays may be taken in preparation for a treatment planning CT scan. The treatment preparation session might take from thirty minutes to an hour and the CT scan might take an additional 15-30 minutes.

Following the CT scan, the IMRT planning process usually takes several days. When the plan is complete, the patient is given an appointment to begin radiation treatments.

### ***Treatment Delivery***

The first IMRT treatment session is sometimes longer than subsequent ones so that additional X-ray films and checks can be done. A typical IMRT treatment session lasts about 15 minutes.

In the treatment room, the radiation therapist uses the marks on the patient's skin to locate the treatment area. The patient is positioned on a treatment table. Sometimes, special molded devices are used to help with positioning. Receiving external radiation treatments is painless, just like having an X-ray taken.

The radiation therapist leaves the treatment room before the machine is turned on. The machine is controlled from a nearby area. The patient can be seen on a television screen or through a window in the control room. The therapist can talk with the patient through an intercom. Patients do not see or hear the radiation and usually do not feel anything. If a patient becomes uncomfortable, however, the machine can be stopped at any time.

### **Who gives the treatment?**

A doctor who has had special training in using radiation to treat disease--a **radiation oncologist**--prescribes the type and amount of treatment that best suits a particular patient's needs. The radiation oncologist works closely with other doctors and also heads a highly trained health care team. This team often includes: 1) a **radiation physicist** who participates in the planning process and ensures that the machines deliver the right dose of radiation, 2) a **dosimetrist**, who plans the treatment with the oncologist and the physicist, 3) a **radiation therapy nurse**, who provides nursing care and helps patients learn about treatment and how to manage any side effects, and 4) a **radiation therapist**, who sets the patient up for treatment and runs the equipment that delivers the radiation.

### **How Long Is a Course of IMRT Treatment?**

Radiation therapy usually is given five days a week for six or seven weeks. When radiation is used for palliative care, the course of treatment lasts for two to three weeks. For each radiation therapy session, the patient is in the treatment room for about 15 to 30 minutes. These types of schedules, which use small amounts of daily radiation rather than a few large doses, help protect normal body tissues in the treatment area. Weekend rest breaks allow normal cells to recover. The total dose of radiation and the number of treatments a patient needs depend on the size and location of the cancer, the type of tumor, the patient's general health and other factors.

### **What Are the Effects of Treatment?**

External radiation therapy does not cause a patient's body to become radioactive. Patients need not avoid being with other people because of treatment. Even hugging, kissing, or having sexual relations with others poses no risk to them of radiation exposure.

Side effects of radiation therapy most often are related to the area that is being treated. Most side effects that occur during radiation therapy, although unpleasant, are not serious and can be controlled with medication or diet. They usually go away within a few weeks after treatment ends. With SmartBeam IMRT, some patients have no side effects at all.

**Is IMRT Expensive?**

Treatment of cancer with radiation can be costly. It requires very complex equipment and the services of many health care professionals. The exact cost of your radiation therapy will depend on the type and number of treatments you need.

Fortunately, as of January 1, 2001, Medicare will provide additional reimbursement for IMRT treatments given by a hospital outpatient department. Many health insurance policies cover charges for radiation therapy. It's a good idea to talk with your insurer or with your doctor's office staff or the hospital business office about your policy and how expected costs will be paid.

**How is Varian's SmartBeam IMRT different from other forms of radiation therapy?**

The main advantages of Varian's SmartBeam IMRT are precision and speed.

The system achieves a very high resolution and therefore maximizes tissue sparing. With SmartBeam IMRT, a computerized tool called a multileaf collimator (MLC) shapes the beam in accordance with the optimized treatment plan. Varian offers the highest resolution MLC on the market today, one that can deliver unique doses to very small areas.

In addition, Varian's SmartBeam IMRT is fast. The patient is only positioned once per session, rather than multiple times. The multileaf collimator eliminates the need for clinicians to enter and leave the treatment room numerous times to insert and remove lead beam-shaping blocks. Also, Varian offers the only completely integrated suite of hardware, software, and support services for delivering SmartBeam IMRT treatments. Because the Varian system is entirely integrated, information can be moved electronically and seamlessly from one part of the process to the next.

For more information, please visit [www.varian.com](http://www.varian.com).



An image of the Varian Multileaf Collimator which shapes the radiation beam in accordance with the most optimized treatment plan.