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Biomedical Engineering Ltd.

Questions about the process, safety and necessity of x-rays are common concerns posed to medical, dental or veterinary workers. Below are answers to some of the most common issues about radiation.

Why do you need an X-ray?

X-rays provide the opportunity for a medical professional to see inside your body. They take pictures of bone structure and soft tissue details that assist in diagnosis. The ability to view these details is one of the most important tools available to the medical professional.

What to X-rays do?

As the rays pass through your body they strike various tissues, cells, atoms, molecules and so on and react with these in various ways. In some cases the x-rays are absorbed by these and their important characteristics are changed so that they may behave differently than normal. In other cases, the x-rays may bounce off whatever they strike and only leave a bit of their energy in whatever they hit. The remaining x-ray may change its direction and scatter in a random direction. Whenever an x-ray interacts with any part of your body, some energy is deposited in the struck part and the energy of the departing x-ray is diminished somewhat. It is this change of x-ray energy that permits the medical professional to visualize inside your body.

How do X-rays react with your body?

Various regions of the body are more or less dense than others. X-rays are absorbed more thoroughly by more dense material (ie: bones) than less dense material (ie: skin and fat). Your body is made up of many tissues and organs and each has differing densities. As such, the x-rays that pass through your body are absorbed at different levels and when they leave your body each x-ray has an energy that is related to the density of the tissue that it has passed through.

How do X-rays produce images of the inside of my body?

It was learned a long time ago that x-rays will interact with photographic film. It was learned quite recently that x-rays also interact with materials used to produce digital images such as those created by digital cameras. It turns out that the amount of energy that an x-ray has as it leaves your body determines how reactive it will be with either photographic film or a digital imaging system. Generally, the higher the energy of the x-ray that strikes the film or digital sensor, the darker will be the spot on the film or sensor. Hence, the density of the tissue exposed to an x-ray can be related to the “darkness” of the resulting spot created by the x-ray. A beam of x-rays is made up of millions of x-rays which, when leaving your body will interact with film or a digital sensor to produce various levels of “darkness” which our eyes are trained to interpret as images. In this way, the emerging x-rays can create an image of the part of your body that they have passed through.

What are the risks of X-rays?

X-rays are very small and can interact with your body at the level of atoms and molecules. In your body, each atom and molecule has a distinct role to play in how well you function. If the interaction between the x-ray and one of the atoms or molecules inside your body results in a malfunction of that atom or molecule, your body may be compromised in some way. Fortunately, your body has evolved several ways to compensate for such changes because we live in a world where all kinds of radiation are present, even x-radiation that is naturally occurring. Science has spent a great deal of time and effort in finding ways to determine the effects of x-radiation on your body in measurable ways. We have concluded that the risk is never zero, but can be very small if we use x-rays wisely. As a result, we now have ways of measuring the risks associated with medical x-rays and relating these to the risks associated with not being able to diagnose certain diseases. This is known as the risk benefit ratio and is used by medical professionals when they decide whether or not to use x-rays to assist in diagnosis and treatment of various diseases. In addition, medical practices utilize the services of Engineers and Physicists to help them both measure x-rays and to develop ever better ways of reducing the energy needed to produce quality images from inside your body.

What are the benefits of X-rays?

The main benefit of x-rays comes from their ability to assist with the creation of images from within your body. X-rays also find use in the actual treatment of certain diseases such as various cancers. The details of their use in treatment are presented elsewhere.

What questions should you ask your doctor or the radiation technologist who does the exam?

You should ask if the imaging equipment is modern, up to date and properly calibrated. You are encouraged to explore the risks and benefits of the examination and should ask if there is any other imaging modality (system) that would be less risky to use.

What should you know if you're pregnant?

If you are pregnant and need to be x-rayed you must advise the persons ordering and taking the x-rays of your condition. It is important that the developing fetus be protected from the x-rays as much as practical and radiation technologists are trained in providing that protection to your fetus. The medical professional that is treating you must also know of your condition so that alternative diagnostic methods are prescribed whenever possible.

Are X-rays the same as microwaves?

X-rays and microwaves are related along what is known as the electromagnetic spectrum. However, because of a number of distant physical characteristics of the two, they interact with your body in quite differing ways. Both can do harm if used unwisely and both can provide great benefits if used properly.

What are digital X-rays?

A digital x-ray is an x-ray type of image that is presented in a digital format as opposed to a photographic format.