

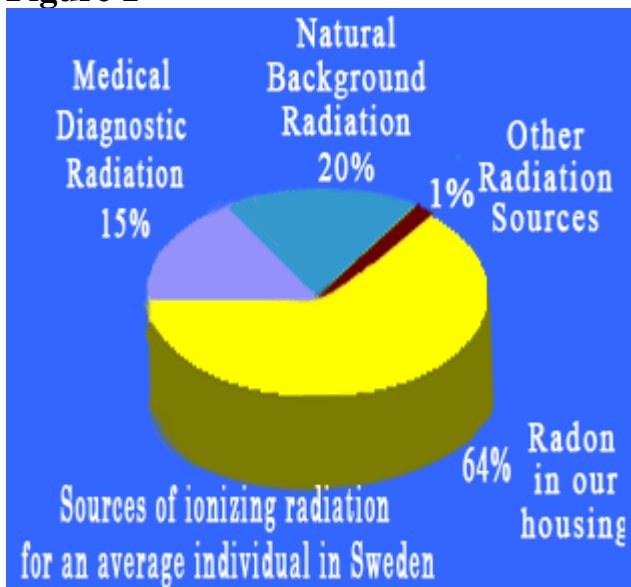
HOW DANGEROUS ARE THESE RADIOGRAPHS, DOCTOR??

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Radiation means energy and mankind has been sustained to it from time out of mind. In fact, it has contributed to mankind's high development among the mammals. Radiation comes from different sources in our surroundings and the medical diagnostic source is of minor magnitude. Medical diagnostic radiation corresponds only to about 15% of the total radiation dose for an average human being during one year (Figure 1). Dentistry is only responsible for some percents of the total source from medical diagnostic imaging.

Figure 1



There are two types of radiation: Particulate and electromagnetic. The X-rays that we use in medicine and dentistry belong to electromagnetic radiation.

Particulate radiation consists of atomic nuclei or smaller atomic units, which move with a high velocity, while the electromagnetic radiation is a combination of electric and magnetic field energy waves. **The largest single radiation source for mankind is radon**, which is particulate radiation. This is a gas which is radioactive and it is naturally created from uranium available in the ground. Uranium disintegrates by itself and during this process the gas is created. Radon gas can penetrate houses from many sources.

Radiation can also be divided into ionizing or non ionizing radiation. Examples of **non-ionizing** radiation are microwaves and visible light, magnetic fields, laser, radiation from screens and radiation in a solarium. Examples of **ionizing** radiation are electromagnetic waves such as nuclear radiation and the x-rays that we use when we take radiographs.

Ionizing radiation has enough energy to remove tightly bound electrons in an atom while non ionizing radiation does not. It is the ionizing effect of radiation, which later on may cause damages in our tissues (free radicals are created within the human body). At low doses, such as the one which we receive every day from background radiation, a cell can repair the damage, but with higher doses a cell is often not capable to repair the damage, and the cell may either be changed permanently or die. Cells that die can be replaced by the body and cells that are changed permanently may go on to produce abnormal cells. Since these cells may become cancerous, this is an origin of an increased risk in cancer due to radiation exposure.

This injury to cells is caused by mechanisms that, in many cases, are similar for radiation and chemicals. However the effects from radiation have been more studied than such exposures to chemicals. This is a surprising fact; the chemical agents seldom cause such big headlines as radiography in newspapers. A large number of chemicals, that are human carcinogens, are known. Tobacco smoke contains thousands of such identified chemicals!

Different organs have a different sensitivity to radiation. The primary risk from dental radiography is radiation induced cancer in the thyroid, since this is the most sensitive organ near where we deliver our dose (in the jaw and neck area).

If then the risk is calculated for fatal cancer per million full mouth intraoral examinations, the following values have then been found (according to

White SC. Assessment of radiation risk from Dental Radiography. Dentomaxillofac Radiol 21:118-126 1992).

Organ Cancers

| | | | |
|-------------|-----|--------------|-----|
| Gonads | 0 | Breast | 0.1 |
| Bone marrow | 0.7 | Liver | 0 |
| Colon | 0 | Esophagus | 0.1 |
| Lung | 0.1 | Thyroid | 0.8 |
| Stomach | 0 | Skin | 0 |
| Bladder | 0 | Bone surface | 0.5 |

These risk estimations can be compared with the risk for a lot of daily activities: There is a relative risk of 1 in a million chance of death from the following activities;

- Eating 40 tablespoons of peanut butter (aflatoxin)
- Smoking 1.4 cigarettes (lung cancer)
- Spending 2 days in New York City (air pollution)
- Driving 40 miles in a car (accident)
- Flying 2500 miles in a jet (accident)
- Canoeing for 6 minutes (drowning)

(Adapted from DOE Radiation Worker Training. Based on work by B.L Cohen, Sc.D. "Catalogue of Risks Extended and Updates", *Health Physics*, Vol. 61, September, 1991.)

Summarizing we can say that the risk for making dental radiographs is negligible, ***dental radiographs are not dangerous***. But still even if it's a small contribution to the total dose to a human being, we should only use it when we have a real need.