

DANGERS OF RADIATION

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The news media all too often has reports on the dangers of radiation disproportionate to the amount of danger that potentially can be caused by the small amounts of radiation to which patients having dental radiographs, should be exposed. It is important that you understand the potential dangers and that you are able to explain the advantages and possible dangers to your patients.

Before a radiograph is taken, a clinical assessment must have been made by a licensed dentist that:

1. the radiograph(s) are required
2. which views are required
3. the decision is made that the **probable** advantage to the patient outweighs the **possible** disadvantage.

Radiographs should not be taken if recent radiographs can be obtained. Radiation can have **biological** and **genetic** effects/ biological effects occur some time after the exposure to radiation and this interval is known as the **Latent Period**. There are many other factors that produce the same results as ionizing radiation and there is no way of knowing that the radiation produced a specific result. Radiation however is **carcinogenic** and can possibly produce mutations in later generations. In human beings, within the range of dental exposures, no cause and effect relationship has been shown.

Effects of radiation on teeth and supporting structures: -

1. Direct Effects

- a. no tooth formation
- b. enamel hypoplasia
- c. reduced root formation
- d. early tooth eruption
- e. combination of above

2. Indirect Effects

Decreased saliva formation that is more acidic and ropy – xerostomia – rampant caries and periodontitis. Loss of buffering action of saliva assists with development of cervical caries.

3. Decrease bone formation

- a. no tooth formation - - decreased alveolar bone formation
- b. decreased epiphyseal growth – TMJ

4. Osteoradionecrosis.

Occurs when used for therapeutic radiation but the dentist must be able to diagnose and treat the results. The exposures we use are for **diagnostic radiation**.

There are **three groups** of **people** to consider

1. The **general public** who are not to come into the operatory when radiographs are being taken. Exception is a parent required to hold a patient but the parent **must** then be covered with a lead apron and shield.
2. The **operator**. Repeated exposure to small doses probably is deleterious to one's health in the long term
3. The **patient**. ALL that follows –

RADIATION CAN BE REDUCED BY: -

- a. **Filtration** of the beam Aluminum filter
- b. **Collimation**
 1. Using a long lead lined cone [increased focal-object distance]
 2. Diaphragm aperture
 3. Collimator tube - (particular rectangular cone) Reduces radiation to the patient by limiting the size and shape of beam
- c. **Long focal-object** distance and **short film object** distance. Indirect effect, as good quality radiographs are more diagnostic and do not require repeats.
- d. **Lead apron** and **thyroid shield**. Psychologically also shows the patient that you care. Thyroid shield is not used for pan projection.

Most sensitive tissues to radiation: female breast, gonads; bone marrow; thyroid.

Sensitivity Male: Female

- e. **High kVp** it is important to bear in mind that the deleterious effect of radiation is to increase energy content in tissue by an amount equal to the energy absorbed. Higher kVp causes less absorption.

50kVp D Speed = 500 mR / film
90kVp E Speed = 50 – 90 mR/ film

- f. **Fast** film. Changing to E-speed film is one of the most important cause of reducing radiation to the patient
- g. The pregnant and very young patients
- h. **New** film and
- i. active chemicals. Both will result in good quality radiographs, which will avoid retaking the film or accepting inferior quality radiographs with poorer diagnostic qualities.
- j. **Beam size** and **room size**.
The higher the kVp and the greater the beam size the greater the amount of **scatter radiation**. The smaller the room the greater the amount of scatter. $I = 1 / d^2$ square

- k. **Accurate switch.** The mechanical type produces longer exposure times as the spring wears out over a period of time. If it fails it can fail in the on or the off position and if in the on position can give off large amounts of radiation. In certain States the mechanical type of switch is not permitted.
- l. **Shortest exposure time.** Use faster film and higher mA so that shorter exposure time can be used. Less chance of patient moving.
- m. **Intensifying screens.** The exposure time can be reduced significantly where intensifying screens are used.
- n. **Grids.** Not used in dental radiology. Removes scatter radiation so that a clearer film results. The greatest source of scatter radiation is the patient. When using grids the exposure time is increased but the total radiation to the patient is reduced.

Facts to consider:

Patients may consider radiographs as a type of treatment. Carefully taken radiographs increase the overall amount of radiation minimally when considering back ground radiation which varies greatly in different parts of the world. Cancer incidence does not appear to be affected by background radiation. Research workers have shown that in basic life forms minimal amounts of radiation may be beneficial and that no radiation at all retards growth and development.

Affect on hemopoietic tissue

Gonads Exposure to gonads. With the patient in the supine position less radiation is aimed in the direction of the gonads. Lead apron reduces gonad dosage to virtually zero.

Exposure to eyes

Stochastic estimates. Stochastic = scientific guess. There is no literature between 1983 and 1989 showing a definite relationship between malignancy and radiation.

Beware of excessive radiographs taken per examination

Beware of excess radiation per radiograph

Beware of excessive examinations per patient

Remember **ALARA Principle** – as low as reasonably achievable

Amount of radiation. FMS versus Pan

RISKS TO PATIENT IF RADIOGRAPHS ARE NOT TAKEN.

Early carious lesions, perio problems, periapical pathology are often found radiographically. Not able to do complete examination resulting in

1. Irreversible damage to teeth and supporting structures
2. Compromised treatment
3. Increased risk of treatment failure
4. Long term more costly care.