SUMMARY OF RADIATION DOSE EQUIVALENTS FOR PATIENTS

When a patient is irradiated in order to take an X-ray, an area of their body is exposed to "ionising radiation". This form of radiation has the potential to damage normal tissue cells if it is used in a high dose for a prolonged time. However, modern X-ray equipment is designed to minimise this dose of radiation in order to limit, as far as possible, any damaging effects on the human body while obtaining a clear image for diagnostic purposes. All members of the medical and dental team are committed to minimising the dose of radiation and keeping the exposure of the patient to a level as low as reasonably achievable.

NATURAL BACKGROUND RADIATION LEVELS

All people are exposed to naturally occurring ionising and non-ionising radiation arising from our environment and our sun. It is difficult to give a meaningful measurement of dose of this naturally occurring radiation but the level to which we are all exposed is low. One way in which we can quantify this background radiation dose is by comparing it to the dose required to carry out X-ray examinations.

The quantity of natural background radiation we receive varies depending on where we are. The nearer to the sun you are, the greater the dose of this radiation you will receive. For example flying in commercial aircraft as a passenger at an altitude of 40 thousand feet will expose you to a higher dose of radiation than walking on the surface of the earth. Therefore we can compare the radiation received from many activities and X-ray investigations.

We can express the quantity of this naturally occurring background radiation as "background equivalent radiation times (BERT) – *Abbott P. Aust Dent J 2000; 45(3): 208-213*).

Radiation doses can also be measured in micro-Sieverts. However, the dose received by a patient undergoing X-ray investigation may vary significantly depending on the make of the Xray equipment, the model of the Xray unit in use, the settings used which depends on the size of the patient (a higher dose must be used for larger patients with thicker bone).

ACTIVITY	BERT	MICRO-SIEVERTS
Trans-Atlantic commercial flight	5 days	37.5
Europe to Australia commercial flight	15 days	112.5
Full Plate Chest Xray	2-4 days	<30.0
Dental OPG (panoramic survey)	28 hours	3.0-40.0
Dental periapical Xray in the mouth	8 hours	0.65-10.0
Dental full mouth periapical survey	21 days	150.0
Dental Cone Beam CT scan (CBCT)	25 days	(50-1000) *190.0
Medical multi-slice CT scan (head)	243 days	>1750

*This value in microSieverts is the dose on the actual machine used in Dr Priestland's practice (*Planmecca ProMax 5x8 format;*

Table 1: Information obtained from European Commission, Radiation Protection Report 118 and *Xing-min Qu et al Oral Surg Oral Med Oral Pathol Oral Radiol Endodont 2010; 110(6): 770-776)*

For our patients the most interesting information in this chart concerns the equivalent radiation doses for different dental Xrays.

Each small intraoral Xray (referred to as periapical films or bitewings) used inside the mouth provide a dose of 1-10 micro Sieverts while the OPG (panoramic Xray) provides 3-40 micro Sieverts.

The range is large because there is a large variation in dose depending on whether the patients is a child with thin bone or a large thick-set adult with thick bone. Dental X-ray machines also vary in the dose administered.

In some cases, a dentist may advise that a 3D cone beam CT scan (CBCT) should be taken to provide additional information to assist in making a diagnosis. A cone beam scan taken at our practice using the Planmecca system will provide a dose of <200 micro Sieverts. This is equivalent to 4-5 panoramic OPG Xrays.

The 3D cone beam scanner uses a great deal less radiation than the medical multi-slice CT scanners (MSCT) where the dose can be in the range of 1250-1750 micro-Sieverts. This is nearly 10 times the radiation dose received with CBCT scans. This makes the CBCT an attractive option in dentistry where we want to image a small area and wish to minimise the dose of radiation used.

SUMMARY

While ionising radiation has the potential to damage normal cells, it also has the potential to assist in diagnosis. Failure to reach an accurate diagnosis results in failure to provide the correct treatment and continuation of the disease process.

On a risk benefit analysis the use of X-rays is advantageous and if used correctly, using approved and regularly serviced equipment, good technique and appropriate settings to minimise the dose of radiation while providing sufficient radiation to achieve a film of diagnostic quality, the benefits of taking an X-ray far outweigh the potential problems.