ddi imaging • center

Dear Dr. Armstrong,

I received the article you sent regarding dose in Pediatric imaging. I saw in your note which was on a sticky paper that you had done some conversions and I just wanted to make some clarifications for you and provide you with some info regarding the units.

Here is a little conversion table of radiation units:

1 Sievert (Sv) = 100 rem
1 Sv = 1000 mSv
1 Sv = 1,000,000 mSv
1 mSv = 1,000 mSv

Medical CT does fall in the range of 2-5 mSv or if you convert it to microsieverts it would be 2000-5000μSv with a head/sinus CT usually around 2200 μSv.

The ICAT scans are in the range if 68-136 μSv for the 20 sec and 40 sec scans.

So in effect, the ICAT dose can be up to 50 times less than conventional CT. The point you need to know is that dose is dependent on the field of view (size of area scanned) and the mA, which can be different in other units.

Remember that the average background dose is about 3 mSv a year or 3,000 μSv or as you stated in your note 8 μSv a day.

For fun I thought I would include this tidbit I found on a British Airways website on how much radiation you get flying…

Concorde: 12-15 μSv (microsieverts) per hour
Long haul aircraft: 5 μSv (microsieverts) per hour
Short haul aircraft: 1-3 μSv (microsieverts) per hour dependent on the altitude reached.

I hope this helps and please feel free to call me if you would like to discuss this some more.

Sincerely,

Shaza

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CT, CBCT, and ALARA

W. Bruce Howerton, Jr. DDS MS

Recently, articles and news casts have emerged regarding high exposure of radiation from medical computed tomography (CT) scans that have generated misconceptions about dental CBCT (Cone Beam Computed Tomography).[1] [2] [3]These articles discuss possible links to cancer from medical CT scans. It is important to note the differences between medical CTs and CBCT technology available for dental practices today. Traditionally, dentists and medical professionals follow the ALARA (As Low As Reasonably Achievable) protocol concerning radiation levels to expose their patients to the least amount of radiation possible while still gaining the most useful information for proper diagnosis.[4] CBCT is being used in dentistry as a revolutionary method of gaining three-dimensional information without high levels of radiation compared to medical CT scans.[5] CBCT offers different fields of view that reduce radiation exposure to the patient[6] to determine bone structure and tooth orientation, as well as view nerve canals, pathology, and in many cases, eliminate the need for exploratory surgery.

Cone beam technology opens up new possibilities for safer and less invasive dental treatments. The 3D "surgical views" offer views/slices of the entire anatomy from anterior to posterior, lateral, and axial positions with non-distorted magnification provided by the software. Before beginning treatment such as placing implants, this information is imperative to determining anatomical variations that can affect the success or failure of procedures.

Because CBCT offers unparalleled detailed information of the oral and maxillofacial complex, it is important to determine whether the patient absorbs more radiation from CBCT or medical CT. Here are some facts concerning radiation exposure from a panoramic image, CBCT scan, or a medical CT scan.

For more than 20 years, dentists have referred patients to hospitals for medical CT data, mainly to determine the amount of hard tissue available and document pertinent anatomy for dental implant placement. The average medical CT scan of the oral and maxillofacial area can reach levels of 1200-3300 microsieverts, a measurement of radiation absorbed by the body's tissue. [7] [8]These significant levels are attributed to the method of exposing tissues to radiation. The anatomy is exposed in small fan-shaped or flat slices, as the machine makes multiple revolutions around the patient's head. In order for adequate information to be collected from the exposure, there is overlapping of radiation.

In recent years, researchers have developed a different technology to achieve the same information gained from medical CT. These scanners work much differently compared to medical CT scanners. They capture all the anatomy in one single cone-shaped beam rotation. This method exposures to the patient to up to 10 times less radiation. [9]For example, the radiation exposure of a standard scan (13 cm height x 16 cm D, .4 voxel) from an i-CAT® CBCT machine (Imaging Sciences International) is 36 microsieverts.[10] (A voxel is the 3D version of a pixel.) Keep in mind that the typical two-dimensional full-mouth series runs 150 microsieverts while a two-dimensional digital panoramic image ranges between 4.7-14.9 microsieverts.[11] Because CBCT imaging is becoming more available in most areas of the country, dentists now have the opportunity to acquire valuable diagnostic information without exposing the patient to higher exposure levels.

As an Oral Maxillofacial Radiologist and an educator in this field, I believe that the knowledge that is achieved through three-dimensional imaging is essential for dentists, but along with that

knowledge comes increased responsibility to use imaging effectively and efficiently, and, most importantly, provide safe and effective patient care.

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[1] Liz Szabo. Radiation from CT scans linked to cancers, deaths. USA. Today Online. http://www.usatoday.com/news/health/2009-12-15-radiation15_st_N.htm?loc=interstitialskip. Updated 12/14/2009

[2] Jonathan LaPook. New Focus on Dangers of CT Scans. CBS News online http://www.cbsnews.com/stories/2009/12/14/eveningnews/main5979332.shtml. Dec. 14, 2009.

[3] Shirley S. Wang. CT Scans Linked to Cancer. Wall Street Journal online. http://online.wsj.com/article/SB126082398582691047.html. December 15, 2009

[4] American Dental Association. Peer Review and Quality Assessment--Radiation. http://www.ada.org/prof/prac/tools/peer_components.asp

[5] Radiation Doses and Risks of CBCT. http://www.sedentexct.eu/content/radiation-doses-and-risks-cbct

[6] Interview with W. Bruce Howerton: CBCT Imaging: Discussing the Field of View Concept. http://www.osseonews.com/cbct-imaging-discussing-the-field-of-view-concept/

[7] Dictionary of Radiological Terms. U.S. Department of Health and Human Services http://www.remm.nlm.gov/dictionary.htm

[8] Radiation Doses and Risks of CBCT. http://www.sedentexct.eu/content/radiation-doses-and-risks-cbct

[9] Patient benefits. http://www.conebeam.com/patient

[10] Imaging Sciences International. http://www.imagingsciences.com/pro_icat_ng_specs.htm

[11] Radiation Doses and Risks of CBCT. http://www.sedentexct.eu/content/radiation-doses-and-risks-cbct