Tikrit Journal
for
Dental Sciences
https://tjo-ds.com

Radiation Dose Measurement of X-Ray Diagnostic Radiology in Some Dentistry by Using Film Badge in Salah-Din / Iraq

Yasir K. Mohammad [(1)]
Rajaa S. Najam [(2)]
(1,2) Basic of Science Department, College of Dentistry, Tikrit University, Iraq.

Article Info:
-Article History:
-Received: 20/1/2019
-Accepted: 31/10/2019
-Available Online: */12/2019

Keywords:
Radiation Dose, X-ray Diagnostic Radiology, Film Badge

Corresponding Author:
Name: Yasir .K .M [(1)]
E-mail:

Tel: 009647703761990 [(1)]
Affiliation:
(1) Lec. Basic of Science Department, College of Dentistry (2) Prof. Basic of Science Department, College of Dentistry.

Abstract

X-ray has been employing in Iraq widely, but there are no valuable measurements for radiation dosages. In purpose for evaluation of radiation hazard emitted from using x-ray instrument in the medical diagnostic.

This study use performed for five X-ray centers in Salah-din / Iraq we are using film badge method the measurement efficiency of these techniques was 70%. Empirical relation to estimate the radiation dose from X-ray with relative error not exceeds 30%.

The result of measurements radiation dose from diagnostic is different from instrument to anther because the different of the exposure value which used and is not conformed the value of recommended. By using the exit dose from the body to limit entrance dose values for any thickness without used to increase the radiation dose.

Introduction:

The medical applications of irradiated radiation represent the largest source of human radiation exposure, where the proportion of medical radiation about 95% of exposure to radiation and the increased use of X-ray in the diagnosis and treatment and increase the number of specialists in this area and the number of devices manufactured annually is evidence of Increased X - ray use in diagnosis and treatment [(1)]. X-ray is characterized by its ability to penetrate and permeate, and has the ability to ionize atoms and gases when the passage of X-ray during it, and affect the films and have a clear effect in the materials [(2-5)]. When X-ray photons penetrate through the physical medium and their interaction with the material, the type of reaction depends on the X-ray energy and the nature of the materials of the medium, and that the transmission of the energy of the photon or part of it into one of the electrons that lead to the effects and irritation and then the process of energy conversion To the material or living tissue [6]. The white color appears on the film in the event of attenuation in the beam. If the beam is carried out in the middle, the image appears as areas with a high density of light in black and the amount of the intensity of the falling rays [7]. Table (1) shows the values of atomic numbers, density, and electronic density of air and body components. The basis for the prevention is that the dose received is limited to a certain extent does not constitute the effects of a clear the life of the exposed individual and called endurance, but there are genetic effects appear on subsequent generations were not taken into account and on this principle, the International Atomic Energy Agency (IAEA) (ICRP) and the International Commission on Radiation Units and Measurement (ICRU). Maximum permissible potency limits and [8] Table (2) represent the overall body limits as recommended by ICRP. Where the levels of medical exposure to areas of the body are shown in Table (3). William Rawlins, a dentist, was the first to introduce radiation-shielding techniques to encapsulate an X-ray tube. The thickness of the lead was calculated so that if we placed a photographic plate in contact with the lead case and after a radiation exposure for seven minutes [5]. The aim of this study is to measure the radiation doses resulting from the X-ray diagnosis of various dental tests using the film Badge for the purpose of knowing the radiation doses in some dental health institutions, as well as determining the optimal use of the diagnosis to minimize the damage caused by the ionizing radiation effect of patients and workers.

Materials and Methods:

The film Badge is one of the devices used in the field of radiation protection to estimate the radiation doses received by the body [8]. The film consists of a sheet of plastic covering one or both sides of an emulsion containing crystals of silver halides such as silver brine (Ag Br) diameter of 3 micrometers and sometimes added a very small amount of silver ions (Ag I) to increase allergy emulsion [7]. The film is encased in a film to prevent exposure to light or external effects or after a process to improve the film exposure to radiation measured optical density of the film and the beams of light packets through a device (Densitometer) and then turned the virtual density to a radiation dose by bending calibration obtained by exposing the film film to Radioactive doses Information and drawing relationship between optical density and radiation dose [8, 10]. A total of films for radioactive doses were irradiated using a source of cesium (Cs137) card (0.662 MeV) and for different distances and calculation of potions. The solutions were developed by the developer and the fixer according to ISIR instructions. They were prepared in the custom tanks at 20ºC. The films were placed in the solution for a period of (4min) and then in the water receptacle to get rid of the show materials The mixture was then placed in the stabilized solution for 10 min, then the water was running on the films for a period of 30 min to get rid of the chemicals attached to the film and dried for 2hr.

Result and Discussion:

The study was conducted between October 2017 and April 2018 in the city of Salah-Din (in the teaching hospital of the College of Dentistry and some hospitals) in order to identify the radiation dose of workers . It is important to know the radiation doses of medical diagnostic and X - ray. The direct contact method was used by measuring the radiation level (Kodak). The radiation doses of the x-ray machines that were worked on in this study were measured in similar conditions by placing the detector in the direction of the beam position and at a distance of 1m and using a voltage of 70 Kvp and 100 mA. Time is displayed (10 ms). The results are shown in Table (4). After that, the relationship between the radiation dose mGy and the optical density was determined to obtain the calibration curve by which the radiation doses of the films are calculated using the mathematical relationship (1). The factors affecting the results of films are the degree of purity and concentration of the solution, temperature of the solution and the time of the show depends on the effectiveness and type of appearance used. The ratio of films available to us is 70% and the proportion of accuracy can be increased when we adjust the films individually because they are subject to the same conditions of acidification. The irradiated radiation dose was calculated by using the linear absorption coefficient (μ = 0.0975 cm^{-1}) and applying the relationship

$$D = D_o e^{-\mu x} \text{ .... } 1$$

Where (D) represents the dose of radiation inside, and (D_o) radiation dose outside the body of the thickness of (μx) and adopted the value of external dose (0.09 mGy), which gave a clear and clear image and the limits of dosage (1.03-0.43 mGy) Thickness (16-25 cm) which can be relied upon to determine the appropriate exposure conditions for radiography without the need to increase the doses of radiation. Radiation doses can also be reduced more dramatically when using a high-speed film holder. Table (5) shows the levels of radiation irradiation in the mGy resulting from the various diagnostic tests we obtained in our study compared with the internationally approved radiation doses (IAEA) and other studies in the mGy units. The results of the comparison confirm the difference in radiation doses in general and an unjustified increase in the doses produced in the radiological examination, which is due to the reasons mentioned earlier and confirmed by the results of the process also, for example in the X4 The exposure time fixed in the control panel does not represent the true value of time and Less than 59%, which led to a decrease in levels of radiation doses. Through different beam measurements, we noticed that the doses obtained from different tests could be reduced when using the scientific basis for selecting the appropriate exposure conditions, the use of efficient chemicals, and the use of the high speed film holder and the periodic inspection of the validity of the devices. The use of high voltages during imaging leads to a decrease in dosage levels where the radiation dose in the device (x4) (1.14mGy) and became (0.64 mGy). There are many ways in which the doses can be reduced if available, for example, the use of TLD (top-level domain) carriers for the purpose of determining the annual dosages of medical diagnosis workers.

Conclusions:

The levels of radiation doses for diagnostic tests vary from one device to another and differ from the levels of other countries and levels of radiation doses approved internationally and the reasons for the difference are due to:

1- Non-conformity of the technical specifications of the X-ray generating devices used

2- Different time periods for operating x-ray machines

3- Non-calibration of X-ray machines

Recommendations:

1- Determining the appropriate exposure values for each scientific and practical basis test and proving at each radiation device

2- Conduct quality assurance tests for X-ray machines

3 - Conducting a comprehensive radiographic survey of the location of radiology devices

4- Preparing courses and workshops for radiographers

5- Using of modern techniques in medical imaging.

Table (1):- Active atomic numbers, density, electron density [7].

physical medium	Atomic number	Density Kg/m^3	Electronic Density e/Kg
Air	7.6	1	3.01x10^{26}
Water	7.4	1000	3.34x10^{26}
Soft tissue	7.4	1000	3.36x10^{26}
Grease	5.9-6.3	910	3.48x10^{26}
Bones	11.6-13.8	1650-1850	3.19x10^{26}

Table (2):- Represents the maximum limits throughout history for the whole body as recommended by ICRP [8].

Year	MPD
1948	0.5Sv, 50rem
1969	0.3Sv , 30rem
1996	0.15Sv , 15rem
2008	0.05Sv , 5rem

Table (3):- Radiation Levels in Diagnostic Radiology of the Patient and worker [9].

Examination	Patient Dose mGy/y	Worker Dose mGy/y
Lumbar spine	10	20
Abdomen	10	20
Pelvis	10	20
Hip joint	10	20
Chest	1.5	4
Dental	0.6	0.8
Skull	3	7

Table (4):-The results.

No	Sample	Time ms	Dose mGy
Collage of den (1)	X1	10.1	1.06
Collage of den(2)	X2	11.2	1.08
Tikrit hospital	X3	10.5	1.18
Balad hospital	X4	10.9	0.96
Samara hospital	X5	9.8	1.05
Duluiya hospital	X6	10.5	1.07

Table (5):- Shows the levels of radiation irradiation in the mGy.

Test	Study	IAEA [11]	U.K [12]	USA[14]	Canada [13]
Dose	0.96-1.18	0.8-1.0	0.39-0.64	0.44-0.78	0.073-0.14

References

1-Xiance Jin "Evaluation of Large Area Polycrystalline CdTe Detector for Diagnostic X-ray Imaging" Toledo University (2011)

2-Angel, E.; Wellnitz, C.V.; Goodsitt, M.M.; Yaghmai, N.; DeMarco, J.J. and Cagnon, C.H."Radiation dose to the fetus for pregnant patients undergoing multidetector CT imaging: monte carlo simulations estimating fetal dose for a range of gestational age and patient size". Radiology. 2008: 249: 220–227

3-Antonuk, L.E.; Jee,K.W.; El-Mohri, Y.; Maolinbay, M.; Nassif,S.; Rong,X.; Zhao, Q.; Siewerdsen,J. H.; Street,R. A. and Shah,K. S. "Strategies to improve the signal and noise performance of active matrix, flat-panel imagers for diagnostic X-ray applications", Med. Phys.2000:**27**: 289-306.

4-Porquet, D. and Dubau, J. "X-ray photoionized plasma diagnostics with helium-like ions. Application to warm absorber-emitter in active galactic nuclei", Astronomy and Astrophysics Supplement Series, 2000: 143(3) : 495-514.

5-Tirada, N.; Dreizin, D.; Khati, N.J.; Akin, E.A. and Zeman, R.K. "Imaging pregnant and lactating patients", Radiographics. 2015: 35: 1751–1765.

6-Dreizin, D. and Munera, F. "Blunt polytrauma: evaluation with 64-section whole-body CT angiography". Radio Graphics 2012 :32(3): 609–631.

7-"European guidelines on radiation protection in dental radiology" radiation protection 136, 2004.

8-Regional Workshop for the Prevention of Radiation "Measurement dose for Badge Film" Syrian Atomic Energy Commission, 2008.

9-Saha, G.B. "physics and radiobiology of nuclear medicine 2nd " springer N.Y, 2001

10-Bajc, M.; Neilly, JB. and Miniati, M." EANM guide lines for ventilation / perfusion scintigraphy. I. Pulmonary imaging with ventilation / perfusion single photon emission tomography", Eur J Nucl Med Mol Imaging. 2009:36(8):1356–1370.

11-IAEA. Basic safety standers for radiation series No.199. Vienna, 2014.

12-Wall, B.F. ; Meara ,J.R. and Muirhead, C.R., "protection of pregnant during diagnostic medical exposures to ionizing radiation " the royal radiologists College , report 4,2009

13-Wells,L.D, "nuclear medicine technology, diagnostic technology and dosimeter in some health in Toronto", applied radiation and isotopes method, 2014 :165:178-184.

14-Reena, S.; Sunil D. S.; Shramika, P.; Ajay, C.; Kantharia, S. and Babu, D., "Radiation dose to patients from X-ray radiographic examinations using computed radiography imaging system ", J Med Phys. 2015:40(1): 29–37.