مجلة الدراسات التربوية والعلمية - كلية التربية - الجامعة العراقية
العدد الثاني والعشرون - المجلد الثاني - علوم الفيزياء - أيلول 2023 م
doi.org/10.52866/esj.2023.02.22.12

Characteristics of X-ray Film Used in Diagnostic Radiology in the College of Dentistry - Tikrit University

Yasir K. Mohammad, Basic Sciences Dept., College of Dentistry, Tikrit University
Muataz A. Majeed, Ministry of Education

Abstract :

The study of the characteristic of X-ray films is one of the important projects in medical diagnosis .There are three types of instruments with different origin and fabricate .An aluminum filter with5) cm (thickness was made to measure the optical density in the range(4—0.1) Lux .For each value of the optical density ***($logI_0/I$***)between (0.22-3.38) by knowing the total attenuation coefficient of))Al).(The contrast ,range ,and speed of each of the three films were estimated from the curve .It was found the contrast increased for the films (Kodak is Japan origin ,Cea dent is Germany origin ,ergonom-x is China origin) respectively .It was also found the speed of the film is directly proportional to the contrast .The relationship between the thickness filter and optical density was also studied under fixed voltage .It was found that the optical density increased whenever the thickness was reduced.

Key Words *:X-ray Film ,Diagnostic Radiology ,Dentistry ,Attenuation ,Silver bromide.*

خصائص فيلم الأشعة السينية المستخدم في الأشعة التشخيصية في كلية طب الأسنان - جامعة تكريت

ياسر خلف جادر[1] , معتز عيال مجيد[2]
[1]كلية طب الاسنان - جامعة تكريت , تكريت , العراق.
[2]مديرية تربية صلاح الدين , وزارة التربية , العراق.

مستخلص:

تعتبر دراسة خصائص أفلام الأشعة السينية من المشاريع المهمة في التشخيص الطبي. هناك ثلاثة أنواع من الاجهزة ذات منشأ وتصنيع مختلفين. تم استخدام مرشح ألمنيوم بسمك (5 سم) لقياس الكثافة الضوئية في المدى (4–0.1) لوكس. لكل قيمة للكثافة الضوئية ($I / logI_0$) بين (0.22–3.38) لمعرفة معامل التوهين الكلي لـ (Al). تم تقدير التباين والمدى والسرعة لكل من الأفلام الثلاثة من المنحني. تم الحصول على زيادة التباين في الأفلام (كوداك هي اليابان الأصل، Cea dent هي ألمانيا الأصل ، ergonom-x هي من أصل صيني) على التوالي. كما وجد أن سرعة الفيلم تتناسب طرديا مع التباين. كما تمت دراسة العلاقة بين سمك المرشح والكثافة الضوئية تحت فرق جهد ثابت. وجد أن الكثافة الضوئية تزداد كلما قل السمك.

الكلمات المفتاحية : فيلم الأشعة السينية ، الأشعة التشخيصية ، طب الأسنان ، التوهين ، بروميد الفضة.

Introduction

X-Ray film consists of a thin layer of transparent material that is known as) film base (which is covered with gelatin that contains a large number of radiation sensitive crystals and almost it consists of silver bromide crystals. which consists of a simple crude silver proportion and this film can be of unilateral or bilateral side covering according to the aim of using .[1] When the film is exposed to X-Ray band .Some of the photons absorbed by of the silver bromide crystals may cause some chemical changes the Crystals which are called) latent image .[2] (The range of the affected area of the X-Ray film depended upon the number of photons that an area of the image that is carried by the X-Ray band which is printed on the film.[3]

The susceptibility of the film to the least degree of radiation exposure is known as the sensitivity of the film on the instance and is measured by inverted exposure Roentgen .Per the generation part above horizontal density base named film speed/1 = exposure) Roentgen .[16] (And for getting a good quality image radiology .There are three important factors to be taken into consideration in diagnostic radiology and they are as follows) blow-up, distortion and x-ray tube.[4] (X-ray is characterized ability to penetrate .It is called a soft X-ray with relatively high penetration hard X-ray and has the ability to ionize atoms and gases when the radiation passes through them ,and affect photographic films .[5] photographic film is made for the purposes of radiography from a thin plate of a transparent material of cellulose known as the base of the film with a thickness of 0.2mm covers one or both sides emulsion contains a sensitive material for a class of gelatin light containing crystals of silver halides ,silver bromide)AgBr (In the medical films(90-99%) and to increase the emulsion allergy add (1-10%) of the silver iodine.[6] When the film is exposed to a beam, the electrons are released from the bromine ion and work within the crystal until the center of sensitivity caused by the effects of silver sulfide [7] that the traps of electrons attract and equal silver ions and the atoms of silver equivalent deposited on the film is a hidden error in the emulsifier ,so turning into chemical processes.[8] Where the film

is placed in the solution of the appearance to reduce the silver ions exposed to radiation to the atoms of the black space deposited on the film ,then wash the film to remove the materials showing the base and explains in the fixer solution where the reaction of the solution with silver halides are not exposed to radiation and converted into a dissolved solution .After washing and drying ,the film is ready and shows the radial image ,where the exposed parts of the radiation appear dark ,while the non-exposed radiation appears transparent .The accuracy of the results depends on the purity of the solution concentration ,the solutions temperature ,and the time of the show.[9] 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 black light and the intensity of the falling beam .[10] As the beam inside the body and the dimensions vary according to the capacity and distribution of regular ,graduated with a specific model of distribution to carry the beam image and pass in a heterogeneous medium and depending on the difference in attenuation.[11]

The type of reaction depends on the energy of the falling photons ,the atomic number of the medium ,and the density of the electrons .[12] The proportions of the x-ray film that are used in medical diagnosis vary according to the nature of the film to log the organs that are to be diagnosed body.[13]

In ,2001 the British Institute holed a study on the relationship between radiation dose and the quality of the image, which resulted to get good technics in x-ray photography and avoiding the necessary patient exposure to radiology to use 141 Kev in radio film .[14] In ,2011the University of Toledo holed a study on the Quality Control Beam alignment for some X-ray machines, the result of this study it was found that the instruments of Spanish and Germany have good linearity because of the Japanese try of cylindrical .While Japan had bad alignments.[15]

Material and Method

In this study ,used three types of x-ray film) Kodak ,Cea dent ,and ,Ergonom-x (these films are characterized by high sensitivity and made of a large-size crystal emulsion in comparison with other films and they are

distributed into types (blue and gree) and their dimensions are fluctuating from (31x41)mm ,Digital Transmission Densitometer – TD1125 was used. This detector has properties with its high precision ,and large range measurement of optical density ,and high degree of consistency .The optical density detector is consists of a light source targeted through a pin hole on the optical detector ,that transmits the optical energy into an electric current. The film is put between the light source and the detector to obtain the necessary optical density of the film .The optical density of 15 films was measured and with 5 points for each film was decided to the optical density of radiology film. The necessary thickness to get optical density through the use law of intensity .[17]

$$I=I_0 e^{-\mu x} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

X =thickness of x-ray film

μ =mass attenuation coefficient of AL

I/I_0 =radiation fall intensity and parsing

And transmit the intensity into optical density we get the equation

$$x = \frac{log 2.3 * OD}{\mu} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Table (1) represents the relation between optical density and the average exposure of the Ergonomic x -film.

Kv_p Voltage	mAs Exposure Log	Density Optical
70	0.3	0.22
70	0.6	0.37
70	0.9	0.58
70	1.5	2.41
70	1.8	3.17

Table (2) represents the relationship between the optical density and the average exposure of the Cea Dent -film

Kv_p Voltage	mAs Exposure Log	Density Optical
70	0.3	0.25
70	0.6	0.42
70	0.9	1.02
70	1.5	2.79
70	1.8	3.25

Table (3) represents the relationship between the optical density and the average exposure of the Kodak -film

Kv_p Voltage	mAs Exposure Log	Density Optical
70	0.3	0.47
70	0.6	0.65
70	0.9	1.04
70	1.5	2.81
70	1.8	3.38

Results and Discussions

A curve has been drawn for the three films mentioned earlier in one figure in order to find the variety ,range ,and speed of the film ,and the curve showed in Fig (1) .are depending a pone the quality of the film in a other world the film deferring a cording to the crystal that there emulation from which they are made .For Ergonom-x film it has to degree more than that Cea dent and Kodak .As the slope of as the slope of curve of first film is more than that of the other two .One characteristic of curve of the x-ray film in to measure the range of the film that refer to range of the sensitivity of the film at the optical density that are used in diagnosing process which is to be between the beginning and the end of liner of the properties .Figure (1) shows the differences among the range of three films, in which the Kodak film has a bigger range that of the two other film I.e .to the data of fig (1)it has showed that the range and the variety are in revers properties as for the range and speed they are of forward proportion .As mentioned in table .(4) The film variety also depend on from of curve of film, properties and the differ a according to the relation speed due to the difference among the size of the crystals that the films are made from

Table (4) shows deferent in variety and range from radiology film

film of Types	Speed	Variety	Range
x-Ergonom	90	1.92	2.02
Dent Cea	93	1.83	2.27
Kodak	95	1.68	2.46

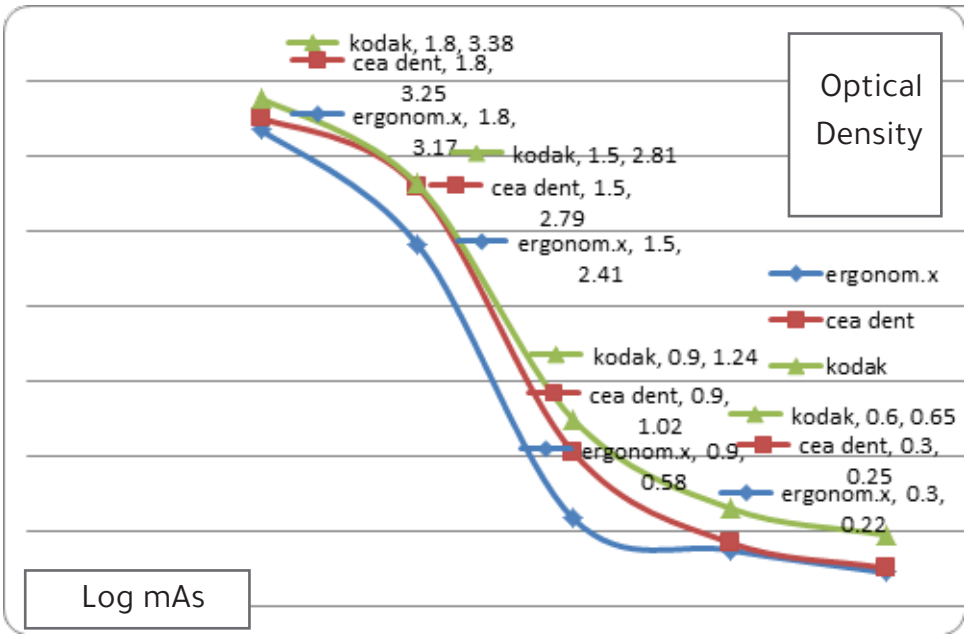

Fig (1) shows between log mAs and optical density all the x-ray film

Conclusions

1 -The range and the variety are in revers properties as for the range and speed they are of forward proportion.

2 -The relation between dose radiology and average exposure that liner relation.

Recommendations

1. Using of new modern techniques in medical imaging.

. Test the quality of X - rays periodically.

3. Improve the quality of the radiographic image ,by bringing the best films and chemical appearance of images.

Assign health physics to apply ICPR instructions.

References

1 .Antonuk L E" ,Electronic portal imaging devices :a review and historical perspective of contemporary technologies and research ",Phys. Med .Biol:47 :2002.R31-65

2. Antonuk L E" ,a-Si:H TFT based active matrix flat-panel imagers for medical X-ray applications ",Thin Film Transistors ,Materials and Processes Vol :1 Amorphous Silicon Thin Film Transistors , ed Y Kuo) Boston Kluwer395- :2004:1.(.,484

3 .International Commission" on Radiological Protection of the Pentient in X-rays Diagnostic((" TCRP))Publication Per amen Press led Oxford.(2019)

4. L.E .Antonuk ,K-.W .Jee ,Y .El-Mohri ,M .Maolinbay ,S .Nassif ,X. Rong ,Q .Zhao ,J .H .Siewerdsen, R .A .Street ,K .S .Shah" ,Strategies to improve the signal and noise performance of active matrix ,flat-panel imagers for diagnostic X-ray applications ",Med .Phys:2014:**27**. .289-306

5. D .Porquet and J .Dubau .X-ray photoionized plasma diagnostics with helium-like ions .Application to warm absorber-emitter in active galactic nuclei .Astron .Astrophys. Suppl .Ser495-514 : (3) 143 :2000 ,.

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

7 . Peter Vock .Clinical perspective on diagnostic X-ray examinations of pregnant patients .European journal of medical physics–43:165 :2017 . 171

8 . Angel ,E ,.Wellnitz ,C.V ,.Goodsitt ,M.M ,.Yaghmai ,N ,.DeMarco, J.J ,.Cagnon ,C.H .et al .Radiation dose to the fetus for pregnant patients undergoing multidetector CT imaging :montecarlo simulations estimating fetal dose for a range of gestational age and patient size .Radiology227–220 :249 :2022 .

9 . Woussen ,S ,.Lopez-Rendon ,X,. Vanbeckevoort ,D ,.Bosmans ,H,. Oyen ,R ,.and Zanca ,F .Clinical indications and radiation doses to the conceptus associated with CT imaging in pregnancy :a retrospective study .EurRadiol:26 :2021 . 985–979

10 . Dreizin D ,Munera F .Blunt polytrauma :evaluation with-64 section whole-body CT angiography .RadioGraphics.631–609:(3)2012:32

11 . Bajc M ,Neilly JB ,Miniati M ,et al .EANM guidelines for ventilation/perfusion scintigraphy .I .Pulmonary imaging with ventilation/perfusion single photon emission tomography .Eur J Nucl Med Mol Imaging .1370–1356:(8)2019:36

12. Raman SP ,Johnson PT ,Deshmukh S ,Mahesh M ,Grant KL ,Fishman EK .CT dose reduction applica-

tions :available tools on the latest generation of CT scanners .J Am CollRadiol.41–37:(1)2020:10

13 . Rffar ,PJ Allisy-Roberts" Physics for Medical Imaging "London-University of Birmingham(2021)

14 . Kelly.JP ,Trout .ED "Radiography Modern in dusty "from-12 pulse x– ray equipment Radiology report.(2021)

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

16. berkhout,W.E,.G.C",A comparison of digital and film radiography in Dutch dental practices assessed by questionnaire " Dentomaxillofacradiol31:93-99 :2018

17. V .Tsapaki " Radiation protection in dental radiology – Recent advances and future directions " Physica Medica (2017)44 page222-226