The effect of X-rays leaking from the X-ray device on the human body

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ABSTRACT

That X-rays in the field of different fields is that X-rays are used in the field of printing in the field of printing. Bones and dental abnormalities are also used to detect traces and organize crystals. and that leads to an effect that leads to its effect, and that leads to leads to causes that to happen. And to get a fresher out of the body. It is not necessary to shed sexual infrared. And the danger multiplies many times when using a fluorescent plate, ie, the radioscope. Take samples from take samples from the analysis. As for the diagnosis by fluorescent plate, it takes approximately thirty 183 seconds, which is a thousand times more than the image. X-ray medical diagnosis. Many children in many dreams. Should it be avoided?

On the other hand, some surgeons use a fluorescent plate in order to put a certain part of the human body in place precisely. This way of working will affect the attending physician. A reference to a reference to the rays refers to this danger to humans from the rays that send x-rays in diagnosing rays before x-rays in cases of necessity. The lecture is in the field of the United Nations work This danger does not necessarily motivate some researchers for some time to research study. The progress of science, any science, subject to the rush of those interested in it.

Keywords: X-rays , human body, electromagnetic radiation

➢ Introduction

X-rays are a range of the electromagnetic radiation between the high-energy gamma rays and the lower-energy ultraviolet rays. Thus, they are invisible rays, because the energy of their photons is much greater than the energy of visible rays, which means that their frequency is large and their wavelength is short. X-rays have wavelengths in the range of 10-8 cm, so the wavelength in the X-ray range is expressed in angstroms Au is produced when the electromagnetic ray falls on the material , and the particles of the material absorb the X-rays, which leads to the occurrence of Electronic transitions between energy levels in the atoms that make up the molecules of matter, such as when absorbing ultraviolet or visible rays, but here the energy is much higher - with the moment there are oscillatory and rotational changes also in the molecules of the material. It is known that the electrons occupy energy levels or orbits.

➢ Research problem

Damage when using x-rays

➢ The aim of the research

The bones of the body absorb X-rays more than the flesh and muscles. X-rays are also used frequently to destroy cancer cells, but this must be done very carefully, as excessive doses cause damage to living tissues or leukemia.

- Search content:

This research contains three chapters. The first chapter deals with the research problem, research objectives, and research content.

1- X-rays

X-rays or X-rays: They are electromagnetic rays with a wavelength ranging from 10 picometers to 10 nanometers, which are equivalent to frequencies between 30 petahertz to 30 exahertz 301015 Hz to . They range from 124 electronvolts to 124 kiloelectronvolts. X-rays are widely used in radiography and in many technical and scientific fields.

2- Characteristics of X-rays

- X-rays flow in a straight line with a speed equal to the speed of light.
- It is not affected by the presence of a magnetic field or an electric field, which indicates that it does not carry any electric charge. Depending on the nature of the cathode metal, the wavelength of X-rays varies between one thousandth of angstroms 5 A and one thousand angstroms of 0.001A.
- Affect the shooting films.
- It causes fluorescence or phosphorylation of some objects.
- It has a chemical effect.
- It can injure or kill living cells and sometimes cause organic changes in them.

- The diversity of these characteristics has created many important applications.
  - They are electromagnetic radiation with a wavelength ranging from 0.01 to 10 nanometers.
  - The energy of X-rays ranges between 120 to 120 thousand electron volts.
  - X-rays helped photograph the bones of the human body and are also used to eliminate cancerous cells.
  - It is used to monitor security performance by detecting any prohibited items in travelers' bags or in public places.
  - Exposing healthy cells to a high amount of X-rays that may lead to damage and turn into cancerous cells because they are ionized rays; Therefore, caution should be exercised when using it. [4]

3- X-ray generation method

Generating X-rays When electrons moving at a high speed approaching the speed of light collide with a metal target, the sudden stopping of the electrons by the atoms of the target material results in a type of ray that has the ability to penetrate materials, which was called X-ray or Roentgen rays in relation to its discoverer Roentgen. The X-rays are generated in a tube called a College tube from a wick made of tungsten wire. Electrons are emitted by heat, and the cathode electrons are released towards the target under the influence of a high voltage difference of 10^5 volts between the cathode and the anode, and despite the high energy of the electrons.

4- X-ray detection methods

1. Dental rays can be detected or their radiation measured using one of the following properties:
2. When the radiation passes through a gas, it causes its ionization.
3. Photographic plates are affected when exposed to X-rays.
4. It causes a flash when it falls on some special boards. The ionization characteristic is usually used in studies and research related to physics when measuring or recording these rays, and as an application to this, the Geiger-Müller counter is used, while the properties 2, 3 are used in the field of industrial and medical purposes [6].

5- X-ray spectrum

When studying the spectrum of X-rays, it was found that it consists of a continuous spectrum, and separate lines of specific positive lengths (linear spectrum), and these rays were interpreted according to the Bohr model as follows:

5-1. Connected Spectrum

Electrons have kinetic energy and when they hit the target, and as a result of their interaction with the atoms of the target material, their speed decreases, and thus their

kinetic energy decreases, and this energy deficiency appears in the form of a photon, its energy equal to the amount of kinetic energy lost, and as a result of these successive reactions in which electrons lose varying amounts From the energy are emitted photons of different lengths. As in Figure (1). The continuous spectrum depends on: the potential difference inside the tube, and the lowest wavelength in the spectrum band is called the cut-off wave [7].

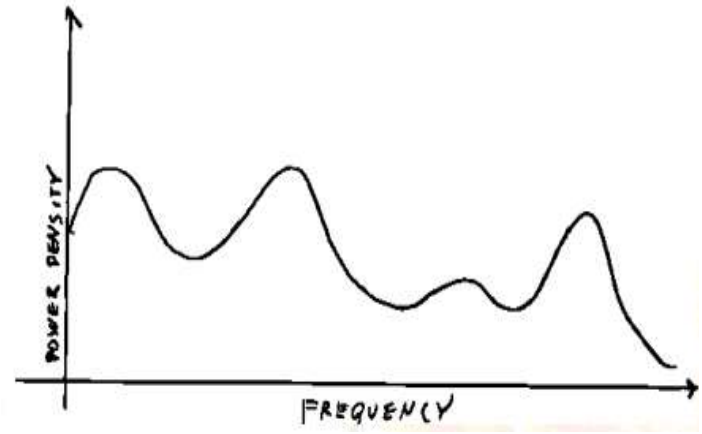

Figure (1) X-ray spectrum (continuous spectrum) [7].

5-2. Line Spectrum

It is formed when one of the speeding electrons collides with one of the electrons in the target atom's internal energy levels. The "emission" of a photon with a specific energy equal to the energy difference between the two levels occurs as part of the transition process. The linear spectrum, as shown in Figure (2), is affected by the target material [7].

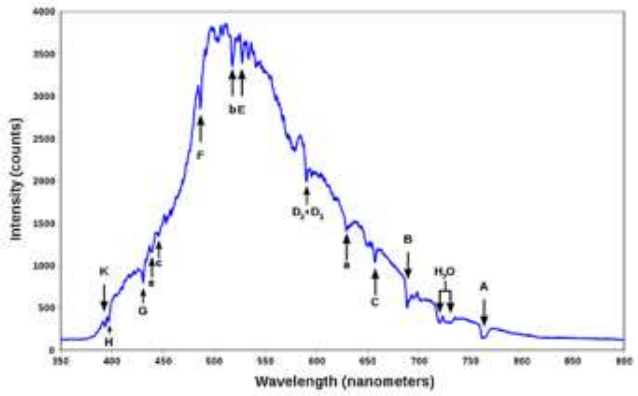

Figure (2) X-ray spectrum (linear spectrum) [7].

6 - Components of the X-ray machine

All X-ray devices, no matter how many and varied their shapes, consist of three main components, as shown in Figure (3), which are:

a) Control unit:

It is the unit responsible for the operation or shutdown of the device completely, and it also controls the intensity of the radiation, which ranges from 40 kV to 120 kV [8].

b) KV . Lifting Converter

This part is also known as the High Tension, which receives the electric charge and outputs high voltage energy to feed the anode and cathode ends in the glass tube of the device [8].

c) X-ray tube

The X-ray tube is a vacuum glass tube with a negative and positive end, and a wick composed of high-melting material, tungsten, is inserted within. Because the melting point of tungsten is 2000 degrees Celsius, the tube provides energy to the electrons in the atom's outer shell, causing these electrons to be discharged towards the anode and then an electromagnetic beam comprising X-rays to be emitted [8].

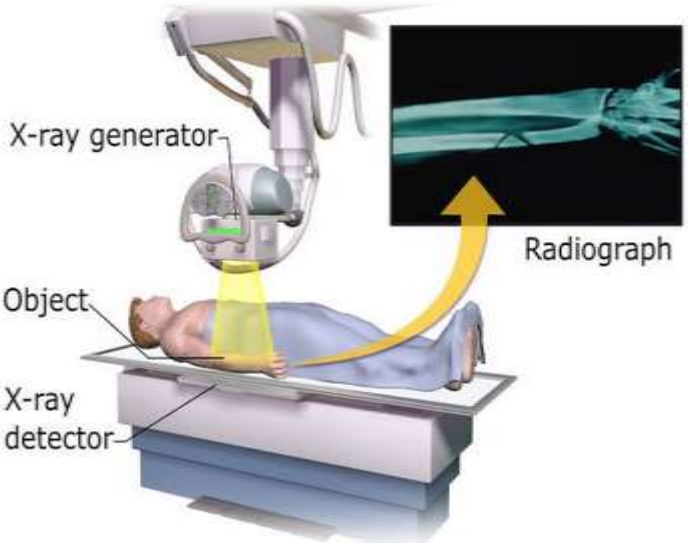

Figure (3) Components of the X-ray machine [8].

7- How the X-ray machine works

The parts of the X-ray machine work together in an integrated way to emit X-rays, as the operating switch helps to reach the electron beam to the vacuum glass tube, and thus the electrons in the outer shell acquire energy that

is transmitted between the ends of the tube, the cathode and the anode, and from here an electromagnetic beam is generated It contains X-rays that are issued with different cards, where the X-rays come out of a hole designated for them in the device and are directed to the patient's body or the physical body to reveal its internal nature [9].

8- The danger of X-rays

Radiation that is ionized includes X-rays. In other words, it separated some electrons from atoms and molecules, causing the medium it was moving through to become ionized. It can alter live cells in ways that could eventually cause cancer. As a result, governments develop regulations and rules governing the use of X-rays in industry and medicine, as well as oversee the implementation of those regulations and the punishment of those who violate them [10].

But by concentrating X-rays on cancer cells, X-rays are also used to treat cancer. Given that it grows more corrosive as it absorbs X-rays, DNA is regarded as a deoxyribonucleic acid in living creatures that is extremely susceptible to these rays. exposure to a little amount of

9- X-ray reactions

There are two main types of interactions that we can obtain with X-rays that occur between electromagnetic waves and body tissues:

- Photoelectric effect: where the photon will be completely absorbed, and the ionization of the atom results in a complete shutdown and does not come out of the body and will not appear on the X-ray detector (X-RayDetector).
- Compton scattering effect: where the photon loses part of its energy and changes direction [11].

9-1. Photoelectric phenomenon

(Effect of photoelectricity) Simply explained, photoelectric phenomena are the processes by which electrons are emitted from solid materials when light energy is absorbed. Because an electric current is a stream of electrons, the photoelectric phenomena refers to the removal of electrons by light. For example, the thermoelectric phenomenon refers to the process of eliminating electrons via heating (heat). The most simple example of this occurrence is taking a certain metal plate, as illustrated in Figure (4), and shining a light on it "under acceptable conditions" to start liberating electrons from the metal's surface "via a given procedure." The first observation of photoelectric effects can be traced back to Heinrich Hertz, the German physicist who invented the radio wave [12].

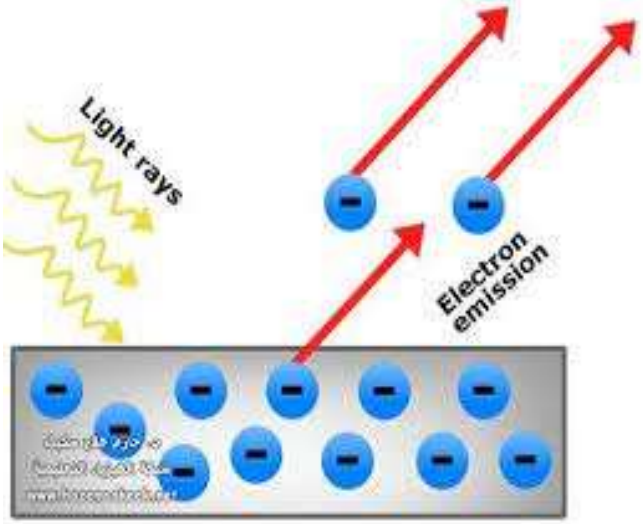

Figure (4) The photoelectric phenomenon [12].

That is, electromagnetic energy (light) with short wavelengths can cause a solid body to emit electrons if it is dropped on it. However, the occurrence required a comprehensive explanation based on several notions, which Hertz and all classical school followers at the time were unable to provide.

Although the electromagnetic theory was one of the basic theories that could explain many optical phenomena such as polarization, interference, diffraction, and many others, it failed to explain the photoelectric phenomenon.

Later that year (1900), the brilliant physicist Max Planck was born. [12].

9-2. Compton phenomenon

Because the wavelength of scattered light differs from the wavelength of input light, the Compton effect is an example of non-uniform scattering. This effect, however, is caused by an elastic collision between the photon and the electron. The Compton shift is the value of the wavelength difference. Despite the fact that

Compton scattering can occur in the nucleus. Compton scattering, on the other hand, usually refers to a reaction involving only the electron in an atom. This effect was discovered in 1923 at the University of Washington by physicist Arthur Holly Compton, and was later validated by one of his graduate students. Compton was awarded the Nobel Prize in Physics in 1927 for his discovery [12].

The Compton effect is significant because it shows that the behavior

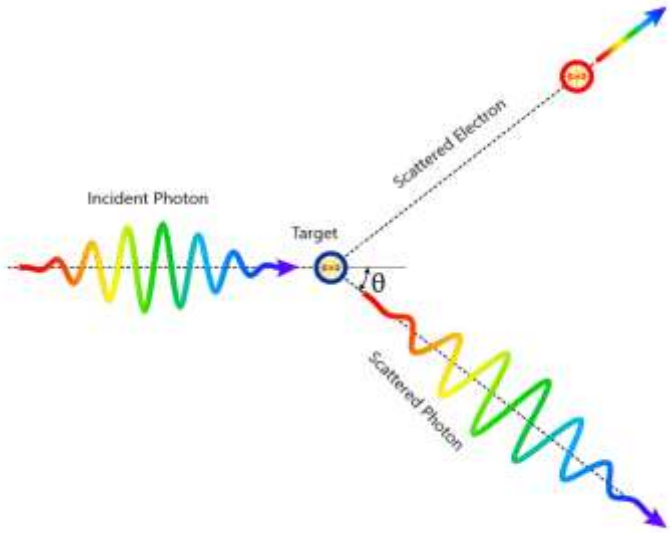

Figure (5) The Compton phenomenon [12].

10- Due radiation dose

It is the amount of radiation to which the patient or the radiologist is exposed, but our primary goal is the patient because the doctor will not be in the radiology room and will not be exposed to the same amount of radiation as the patient, as the greater the amount of radiation, the greater the ionization of atoms, and the possibility of mutations and tumors increases cancerous.

Because the human body is asymmetric and composed of many different types of atoms that make up tissues and internal organs, the amount of radiation exposure is determined by the interacting medium, which is the human body. These differences

1- Exposure (X), measured in terms of the number of ions resulting from exposure to EM radiation in a given volume of air [16]. Its unit is C/Kg, which is equal to 3876 R. The amount of exposure decreases with distance; That is, the greater the distance of the object from the source, the lower the exposure, according to the inverse square law:

$X(d_2)=X(d_1)* (d_1/d_2)^2$

2- Dose (D), which is the amount of energy that has been absorbed into the body through the previously mentioned reactions. Its unit is rad.

1 and 2 are linked into one equation:

D = f * X , where f-factor is the conversion factor.

3- Equivalent dose: (H), where the body is affected by multiple types of radiation differently when exposed to the same dose, and this describes the equivalent dose.

It is calculated by the following equation:

H=D*Q

Its unit is rems if the dose unit is rads, or Silevert (SV) if the dose unit is gray.

where : Q (quality factor) ; And for X-rays it is approximately equal to one.

4- Effective dose (Defectives): where each part of the body exposed to radiation is given a specific weight.

where Defective =sum (wi*Hi)

It must be sum (wi)=1 . [17,18]

11- Effect of X-rays on normal cells

The first phenomenon in the episode of x-ray effects on living cells is entirely physical. The interaction of sigmoid photons with electrons of atoms and molecules of substances in the cell results in one of two phenomena:

- The liberation of a chypre from one of the atoms that becomes an ion.
- Electric absorption of the energy of the x-photon and its transfer to a higher energy level within the same atom, which turns into an excited atom [19].

The stimulated atom and ion have properties that differ from regular atoms that have not been subjected to X-rays.

Thus, protein features vary as a result of requirement, and its molecules can transition into molecules of other substances that are simpler than protein molecules [19].

This refers to the presence of substances that are foreign to the live cell and cause a change in the form and function of the cell.

The following observations can be made in this regard:

After the cells have been exposed to X-rays, the modifications appear after a latency period, or after some time has elapsed. This interval may be fairly brief if we know the chemical and biological changes in the drug. And it can be quite protracted if the changes are limited to mortality or the development of a clearly visible defect, such as dermatitis. To this notion, we might respond that the chemical changes caused by x-rays in the cell nucleus build up gradually, thus their influence does not become apparent until the process is complete [20].

Many individuals feel that prolonged X-ray exposure reduces the cell's ability to breathe.

12- The effect of X-rays on the tissues of the human body

Depending on the change in the value of the dose of X-ray directed, four degrees of skin injury can be determined

- First degree: there is no irritation on the skin, the hair comes out, and the skin color changes. This condition lasts two to four weeks before entirely recovering.
- Second degree: a slight skin rash, visible dilatation of the blood vessels, a sense of heat in the affected area, and hair loss with skin discoloration. The illness lasts six to twelve weeks, with the possibility of healing and skin color change.
- Third degree: a red-blue skin rash, hair loss, sweat gland death, and a sense of agony. The infection lasts between eight and sixteen weeks and is cured, leaving no evidence of skin condition and without developing a single hair. There is a chance that complications will arise after many years of injury [22].
- Fourth degree: a blue rash that tends to red, the appearance of blisters and what looks like ulcers, and terrible pain. There is no doubt about the possibility of recovery [23].

Non-dermal tissues produce varied results due to the differing sensitivity of the living cells that comprise these tissues:

The gonads are also extremely delicate: 200 Roentgen results in temporary sterility, while 300 Roentgen results in permanent sterility [24].

The liver is less sensitive. The sternal airway is also less sensitive [24].

- The inner wall of the intestine dies under the influence of a heavy dose [24].
- Nervous system, spine and marrow: It tolerates strong doses and does not show any abnormal symptoms [24].
- The eye is not sensitive except for the iris [25].
- Bones are less sensitive under the influence of moderate doses. As for young children whose growth has not yet completed, of course, the doses can lead to a cessation of growth in the organ exposed to x-rays [25].
- The blood is not affected much by X-rays, but its ability to clot is diminished, but long exposure, even in small quantities, to X-rays leads to serious complications such as anemia [25].
- Bone marrow tissue is very sensitive [25].

13 - Chemical effects

We stated that the rays are capable of displacing organic molecules and thus analyzing the chemical bonds in them, and thus the rays are able to dismantle many molecules of the body's mixtures, with the majority of the body being composed of water, which the rays decompose into hydrogen, oxygen, and hydroxyl where the union is recombined and oxygen water is formed or the radicals unite with other radicals lead to harmful outcomes [26].

14 - X-ray damage

These threats are divided into two sections, the first of which is the dangers of radiation to the patient, and the second of which is the dangers

of radiation to the doctors and technicians who work in it.

And they have two types of injuries: local injuries and general injuries, and it can be argued that these injuries are becoming scarce due to the advancement of medical technology and the enhancement of functional roles [26].

A - local injuries

1- Skin: mild lesions appear in the form of redness between 2-12 days after exposure, as shown in Figure (6).

Figure (6) X-ray damage [26].

2 - Late injuries, by which we mean the inflammatory radial injuries of the skin or subcutaneous and dermis, which appear within 2-4 weeks after exposure. Figure (7) shows the radiation injuries.

Figure (7) Radiation injury [27].

3- Very late injuries, which are atrophy and skin cancers, and it often appears on the radiographic Figure (8) shows the dangers of x-rays on the skin.

Figure (8) Skin cancer [28].

4- Orthopedic injuries:

The most serious of which is radial osteonecrosis, which is produced by secondary rays such as the jaw bone and often appears several weeks or months after exposure, as seen in Figure (9).

Figure (9) orthopedic injuries [29].

5- Ocular injuries:

The most important eye injuries are cataracts and appear months after exposure, as shown in Figure (10)

Figure (10) Eye injuries [30].

6- Sexual Injuries:

The most significant event is infertility in both sexes, where radiation can damage sex cells and the transfer of genes to embryos, affecting the structure and integration of the fetus's growth, and fetal defects frequently appear due to the incorrect transfer of genes [26].

B- General injuries:

Mild headache, nausea, dizziness, loss of direction, and hypotension within 24 hours Severe headache arises within days and is accompanied by issues with the blood formula and absorption abnormalities, particularly when radiotherapy is performed for tumors that regress severely, and there are occasionally digestive disorders, lack of appetite, weakness, and wasting.

14- Protection of radiology workers, including doctors and technicians:

Radiological examinations should be brief, with special attention paid to keeping hands away from the imaging field and its path, as well as wearing lead paws and chest for protection when performing radiographic endoscopy and using the field limiter, and a high KV and a low MAS.

It is necessary to understand the so-called dangerous radiation dose, which must be stopped when this dose is reached, and its measurement is determined by the radiation rongen unit of measurement, which is in milliamperes Roentgen, with a maximum of 600 milliliters per week on the skin and 300 milliliters per week on the eye. [31]

- **Medical protection:**

Its purpose is to safeguard non-radiology doctors and nurses who are subjected to radiographic endoscopy. Skin injuries must always be monitored because metonin or cortisol extracts are utilized in ointments. Vitamin B6 and B complex plus cortisone are used to treat neurological damage and headaches. [31]

Conclusion

Saying that X-rays are electromagnetic waves, and that X-rays are now extremely important in many spheres of life. We discovered that X-rays are utilized in airports to inspect baggage and check product quality. They are also widely employed in the realm of medicine, where they are utilized to detect fractures in patients. Traces and crystals are also detected and organized using bone and dental anomalies.

Many people who are interested in this topic now believe that a few x-rays, when used arbitrarily, can lead to major difficulties. X-rays are hazardous to the exposed human body, but they are far more hazardous to the skin, spinal cord, and sex glands.

- Recommendations

In conclusion, we thank God for His help and ease, to Him be praise first and last, for His grace and His renewed blessings, and He is the Possessor of grace and bounty, then we commend some recommendations:

• Using lead barriers because the x-rays cannot penetrate the lead

• Directing the x-rays towards the target spot only, rather than being negligent in using them randomly

• The pregnant woman should be exposed to x-rays in cases of necessity

• It is not permissible to use x-rays except after providing adequate protection to all persons

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