



CAUSES OF RADIATION, HEAT AND ITS EFFECTS ON THE OCULAR SYSTEM

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1.1 INTRODUCTION

The human eye is exposed daily to radiation and heat sources such as cellular phones, monitors and wireless networks as well as lasers and other electromagnetic fields commonly found in the workplace.

The temperature distribution through the ocular system has been found in animals and the profiles in human ocular nature remains elusive due to ethical issues involved with the use of damaging and invasive procedures to monitor temperature deep in eye.

It is pertinent to develop accurate heat and radiation module of the ocular processes because it could be used to predict the temperature effects of external thermal sources on the eye as well as detect eye problems and initiate early resolution.

However, following rapid technological advancement over the centuries resulting in the widespread use of wireless/cordless communication devices such as medical imaging instruments, mapping equipment and other electromagnetic tools both at home and workplace, there has also been exponential rise in environmental and health hazards arising from the impact of these radioactive materials on the ocular systems. Notably, the ocular system of the human body is the most sensitive to the absorption of the radiation from wireless networks on electromagnetic fields.

Moreover, there have been experiments invasively measuring ocular temperature distributions in animals while there exist lack of data for human eyes because of the damage done by these invasive techniques.

Consequently, during the past few decades, research on the thermal properties of the eye has focused on developing modes of heat transfer through the organ. Not only can these modules be used for early detection of eye diseases and enables early treatment.

1.1 RADIATION DEFINED

Is energy that comes from a source and travels through some materials or through space. There are two types of radiation.

- (i) Electromagnetic(light) Radiation, sub-divided into;
 - Gamma radiation and
 - X-ray Radiation

- (ii) Radiation from particulate Dimension (mass given off with the energy of motion), also sub-divided into;
 - Beta Radiation and
 - Alpha Radiation

There is also a kind of radiation exposure arising from natural background. It comes from cosmic rays and from naturally occurring radioactive materials contained in the earth and in living things.

1.2 HEAT DEFINED

As a force in nature which is recognized in various effects but especially in the phenomenon of fusion and evaporation and which is manifested in fire, sunrays, mechanical action, and chemical combustion etc. becomes directly known to us through the sense of feeling. In literal sense, heat means to grow warm or hot by the action of fire or friction etc. or the communication of heat; as could be seen from a pressing iron.

1.3 OCULAR SYSTEM

The examiner's ability to help a patient clarify or elaborate on an ocular symptom and the examiner's knowledge of the significance of some common ocular symptoms will often facilitate correct diagnosis on the basis of the history alone. When a patient complains of eye pain, it is essential to describe the ocular discomfort clearly. The examiner's must differentiate between itching, tearing, burning, foreign body sensation, photophobia, deep pain, pain on the movement, or tenderness to touch which ultimately is aimed at diagnosing the ocular symptom. The ocular system involves the ophthalmic examination of the patient's eye on the basis of diagnosing common ocular problems.

1.4 SOURCES OF RADIATION AND HEAT

As started earlier, it has been noted that the sources of radiation and heat have been associated with electromagnetic fields mostly common with wireless devices which includes radio action elements such as AM/FM radio-wave systems. The two major sources of radiation are:

- (i) Ionizing radiation
- (ii) Non- ionizing radiation

(i) Ionizing Radiation

Contains sufficient electro-magnetic energy to strip atoms and molecules from the tissue and alter chemical reactions in the body (converting molecules totally or partly into ions). X-ray and Gamma Rays are two forms of ionizing radiation. These rays are known to cause damage which is why a lead vest must be worn when x-rays are taken of our bodies and heavy shields surrounding nuclear power plants. Human beings are constantly exposed to low levels of ionizing radiation from natural sources. This type of radiation is referred to as natural background radiation and its main sources are:

- Visible light, ultraviolet light and infrared light (sunlight)
- Radioactive materials on the earth's surface (contained in coal, granite etc.)
- Radioactive gases leaking from the earth (radon)
- Cosmic rays from outer space entering the earth's atmosphere through the ionosphere, Natural radioactivity in the human body.

(ii) Non –Ionizing Radiation

The lower part of the frequency spectrum is considered non- ionizing. It is an Electromagnetic Radiation (EMR), with energy levels below that required for efforts at the atomic level. Examples of non-ionizing radiation are:

- Static electromagnetic fields from direct current (O Hzo)
- Low frequency waves from electric power (50-60 Hz)
- Extremely low Frequency (ELF) and Very Low Frequency (VLF) fields (up to 30kHz),
- Radio Frequencies (RF) INCLUDING Low Frequency (LF), Medium Frequency (MF), High Frequency (HF), Very High Frequency (VHF), Ultra High Frequency (UHF) and Microwaves (MW) and Milimeter - Wave (30 KHz to 300 GHz).
- Infrared (IR) light, visible light and ultraviolet (UV) light (above 300 GHz)

1.5 EFFECTS OF RADIATION AND HEAT ON THE OCULAR SYSTEM

Some heat /radiation effects are generated by all of these waves. Insufficient energy is available from most common sources to produce any type of damage to human tissue , although, it is probable that higher power densities, such as those densities very near high-voltage power lines or high-power (megawatt) broadcast transmitters could have long-term health effects. Some of

the effects of radiation and heat sources arising from electromagnetic fields include:

- Biological disorder
- Heating of the human tissue
- Cornea discomfort

There are at least five separate types of hazard to the eye arising from optical sources.

Ultraviolet photochemical injury to the skin (erythema and cataract of the eye (180 nm to 400 nm)

Thermal injury to the retina of the eye 400 nm to 1400 nm

Bluelight photochemical injury to the retina of the eye (principally 400 nm to 550 nm)

Nea- infrared thermal hazards to the lens (approximately 400 nm to 1 mm) and of the cornea of the eye (approximately 1400nm to 1mm)

Heat generation is due to metabolism or external sources such as radiation of electromagnetic waves.

OPTICAL EFFECT (ULTRA VIOLET VISIBLE AND INFRARED LIGHT)

Sources of optical radiation exposure include: sunlight, Heat lamps, Lasers and Other incandescent sources. Intense optical radiation causes electron excitation. This means that electrons in tissue near the body's surface can absorb energy from intense optical source, thereby causing heating and even burns. Optical radiation are not very penetrating, therefore, the eye and the skin are the organ of greatest concern. The immediate effects can be retinal injury to the eye. Delayed effects includes cataract, retinal degeneration, accelerated aging and skin cancer

(iii) EFFECTS OF INFRARED (IR)

Infrared (IR) is an energy field seminal to visible light but with a longer wavelength. This radiation typically emitted by heat lamps, molten metal or glass, fireplace embers and characteristic of the (IR) region, extend into the spectrum of visible light. However while visible light energy is emitted by objects only at a high temperature, infrared energy is emitted by all objects at ordinary temperatures.

(iv) EFFECTS OF ULTRAVIOLET (UV)

The main effect of Ultraviolet (UV) radiation is photochemical. The harmful effect of UV depends on the level of exposure, the duration of exposure and differences in the susceptibility of individuals to UV light. UV radiation has both positive and negative effects:

Positive effects: Warmness, Photosynthesis in plants, Vitamin D synthesis in human body

Negative effects: Sunburn, Skin Cancer, Eye damage, Immune System suppression, Premature aging.

1.6 SUMMARY

The eye is protected against bright light by natural aversion response to viewing bright light sources, such that human eyes are exposed daily to radiation and heat

mostly generated from electromagnetic and radioactive materials such as wireless devices.

For most bodies on the earth, this radiation lies in the infrared region of the electromagnetic spectrum. The electromagnetic (EM) spectrum contains an array of electromagnetic waves increasing in frequency from Extremely Low Frequency (ELF) and Very Low Frequency (ELF/VLF) through Radio Frequency (RF) and Microwaves To Infrared (IR) Light, Visible Light, Ultraviolet (UV) Light, X-Rays And Gamma Rays.

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