

IMPACT OF RADIATION ON THE EYE AND ITS AYURVEDIC MANAGEMENT

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Article Received on 12/10/2016

Article Revised on 02/11/2016

Article Accepted on 22/11/2016

Purpose

1. To study physic of Radiation in environment and its hazardous effects on various ocular media.
2. To explore contribution of Ayurved to prevent and minimize effect of radiation on eye.

MATERIAL AND METHOD

Radiation

In terms of classical theory, electromagnetic radiation, the flow of energy at the universal speed of light through free space or through a material medium in the form of the electric and magnetic fields that make up electromagnetic waves such as radio waves, visible light and gamma rays.<sup>[1]</sup> In such a wave, time-varying electric and magnetic fields are mutually linked with each other at right angles and perpendicular to the direction of motion. An electromagnetic wave is characterized by its intensity and the frequency of the time variation of the electric and magnetic fields.<sup>[2]</sup> (Fig. 1).

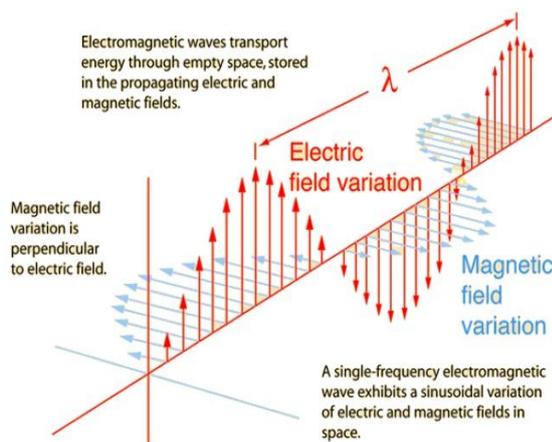


Fig.1. Electromagnetic radiation

Generically, electromagnetic spectrum is formed by radio waves, microwaves, infrared, visible light, X-rays and gamma rays. Their applications are presented in Fig. 2.



Fig.2. The electromagnetic spectrum from lowest energy/longest wavelength (at the top) to highest energy/shortest wavelength (at the bottom)<sup>[3]</sup>

INFRARED RADIATION EFFECTS ON EYE

Most of people enjoy the heating effect of infrared from the sun, but, in the same time, most of the industrial sources of infrared with high temperature furnaces are harmful for the human eye, such as in the glass and steel industries. In industrial activities are using arc lamps, electric radiant heaters or some type of laser (YAG or carbon dioxide laser) which also give off infrared (Fig. 3). Evidently, IR-C is the most dangerous for the human eye, because of the higher wavelength, farthest from the visible spectrum (the most safe and healthy for ocular media).

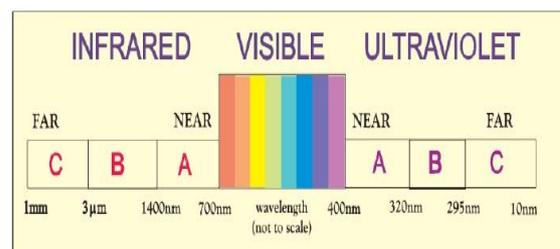
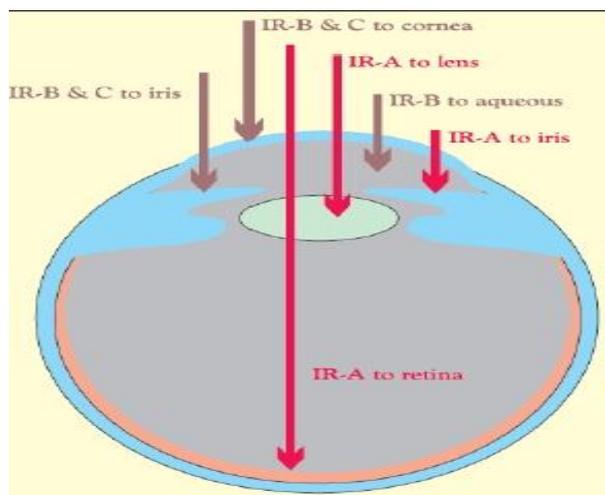


Fig.3. Electromagnetic spectrum that affect eye

Radiations cause different changes in cellular structure. Depending of the medical condition infrared is absorbed by most of important ocular structure. As the studies provided by the literature shows, the energy of infrared radiation is lower than visible light or ultraviolet radiation. Because the infrared radiation raises the overall temperature in the anterior eye, the most vulnerable tissues at this radiation are in cornea and aqueous humour. Crystalline absorb some small part of this radiation, vitreous another part, so the part that reach the retina is smaller, but very important in ophthalmology.

According<sup>[4]</sup>, in the IR-C domain of infrared, cornea absorbs the wavelengths greater than 3000 (nm) and most radiation with a wavelength above 1400 (nm). This ocular layer is very important because is gateway thru the eye. Also, the crystalline lens absorbs radiation between 900 (nm) and 1400 (nm) (IR-A) and the retina absorbs most of the remaining infrared with a wavelength less than 1400 (nm) (IR-A) (Fig. 4). As is the layer where the image is formed, the retinal cells must be better protected from harmful effects of radiation. Cataracts and retinal burns from exposure to industrial sources (e.g. xenon lamps, infrared lasers and metal arc inert gas welding) are the most important problems that must be analyzed in ocular protection and ergonomics.<sup>[5]</sup>



**Fig.4. Infrared radiation absorbed by the ocular tissues**

#### The effects of the IR on ocular structure

**Eyelids-** The most common affections on the eyelid range from mild reddening to third degree burns and, in extreme cases, death of the skin, when are exposed to very high levels of infrared delivered over a short period of time or to low levels of infrared over a long period. Infrared eyelid affections are hardly ever found in the industrial applications.

**Cornea-** Because the cornea transmits 96% of incident infrared in the range 700-1400 (nm), the level of damage to occur is quite high, especially in the range of 750-990 (nm). The radiation effects on the cornea from this type

of radiation involve protein coagulation of the front and middle layers (the epithelium and stroma). At higher dose of IR, damage to the cornea produces immediate pain and vascularization. Eventually, the burn can causes ulcers, which leads to loss of transparency and opacification.

**Iris-** Depending on the degrees of pigmentation, the iris can absorbs between 53% and 98% of incident infrared in the 750-900 (nm) range. In long exposure, the most common medical affections are swelling, cell death, hyperaemia and pupillary miosis. The higher wavelengths can cause inflammations and burns.

**Lens-** The crystalline transmits wavelengths higher than (1400 nm) selected by the cornea and aqueous humour. The most common affection is cataract, which is associated with certain types of occupations involving prolonged exposure to IR.

**Retina-** The energy radiation that is reaching the retina is absorbed by the epithelium. Depending on some factors (pupil size, the optical quality of the retinal image, exposure duration, size of the retinal image, quality of the retina), high infrared energy causes a rise in temperature and some kind of damage. In industrial applications, the radiant power and the exposure duration are essential. Also, the retinal pigmentation is very important, that is the cause that the most common damages are burns and depigmentation.

#### Management through Ayurvedic Science

No remedial measures for the prevention and care of this pathology except use of spectacles, contact lenses, gas permeable hard lenses, intraocular lenses, goggles, shields, or helmets that use absorptive or reflective filters to control the undesirable radiation. This prevalence in modern ophthalmology opens the door to the other systems of medicine to suggest, experiment and contribute the drugs to alleviate or to check the deterioration. This challenge of the time was accepted by the *Ayurvedic* scholars, as they believed that nature provides both the diseases and drugs together. Eyes were greatly valued by ancient Indians and much importance has been accorded to their protection.

#### DISCUSSION

*Chakshushya*, the term indicating regeneration of eye sight was in practice in India since centuries. The classics of ancient Indian's wisdom have invented and practiced many drugs like *Triphala*, *Saptamrita lauha* etc., diets, procedures (i. e. *Tarpana*, *Nasya*, *Putapaka*, *Parisheka* etc.) and regimen for the benefit of the weak eyes.

**Parisheka-** Various types of *Parisheka yogas* are mentioned in *Samhitas* for treatment of Dry eye like *Saindhav* mixed with milk restores normal osmolarity of tears which helps in nourishment and rejuvenation of ocular surface.

**Nasya-** Good numbers of *Nasya yogas* are also described for treatment of eye disease because nose is a gateway of drug administration in case of *Urdhwajatrugata rogas* & *Nasya* is the only procedure which directly influences all *Indriyas*.

**Anjana**<sup>[6]</sup>- wide number of *Anjana yogas* mentioned specifically for treatment of *Timira* in *Samhitas*. Probably, it acts as subconjunctival injection, permeability is also possible through the sclera and enters into the systemic circulation and may act on posterior segmental disorders of the eye.

**Tarpana-** The word *Tarpana* is derived from root 'Trup' which means to become satisfied. Thus the word *Tarpana karma* means anything which satisfies or regenerates or rejuvenates. Absorption of the drug in *Tarpana* procedure is more because the drugs used are lipid suspension. Penetration of the fat soluble substance is high irrespective of molecular size. Tissue contact time of the drug is also more so the bio-availability and therapeutic concentration can be achieved.

**Putapaka-** numerous *yogas* of *Putapaka* is mentioned in severe xerotic condition of eye. By application of *Putapaka* as *Tarpana* procedure enhances more effects in term of epithelio-trophic growth of ocular surface and nourishment of choroid and retina by means of concentric properties of medication used in *Putapaka*.

## CONCLUSION

Although *Ayurved* is holistic science takes care of human being with helps of nature. Medicaments and procedure of application described compensate vitiated *Doshas* and *Dhatus*. So, it is irrelevant to exactly explain pharmacology of *Ayurvedic* medicines on bases of Modern science. But for globalization of *Ayurved* and increased numbers of life style disorders in world population it is mandatory to find a better solution for prevention and management of diseases occurred due to impact of radiation on eye. Management mentioned by author is adaptive to restore normalcy and strengths of ocular structure.

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