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CONCEPT & PHYSIOLOGY OF VISION- AN AYURVEDIC REVIEW

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ABSTRACT

Vision is the special sense of sight that is based on the transduction of light stimuli received through the eyes. It is a complex function of the two eyes and their central connections. The main mechanisms involved in physiology of vision are: Phototransduction; Processing and transmission of visual sensation; and Visual perception. In *Ayurveda,* Physiology of vision based on the normal functioning of *Doshas.* Philosophical textbook of *Ayurveda; Tarka Sangraha* and *Charaka Samhita* gives an idea of certain basic concepts of visual process. Step by step critical analysis of the basic concepts of the visual process generate an idea regarding the eye physiology and its clinical importance in different eye diseases on the grounds of *Ayurveda.*

KEYWORDS: Eye physiology, *Ayurveda,* Visual process.

INTRODUCTION

Sense of vision a complex function of the two eyes and their central connections. The main mechanisms involved in physiology of vision are: Initiation of vision (Phototransduction), a function of photoreceptors (rods and cones); Processing and transmission of visual sensation, a function of image processing cells of retina and visual pathway; and Visual perception, a function of visual cortex and related areas of cerebral cortex.[1] In *Ayurveda,* terms like *darshana* and *adarshana* are used for vision and loss of vision respectively. Like all other sensory phenomenon, Visual perception, is also dependent upon the state of mind and soul.

This process described by *Acharya Charaka* as the conjuncture of soul, mind and the sense organ with the objects.[2]

CONCEPT OF VISION IN AYURVEDA

Sannikrishta Indriyas and *Viprakrishta Indriyas*[3] are two type of senses which classify by Acharya *Kashyapa*. Eyes and Ears are included in the *Viprakrishta Indriyas*, wherein object need not directly fall on the senses. Eye has developed sufficient skills to perceive the object from a sufficiently large distance. The theory of *Panchapanchaka given* by *Acharya Charaka* depicts the phenomenon of sensory perception by enumerating the five important factors that take part in this process. They are *Indriya*, *Indriya Dravya*, *Indriya Artha*, *Indriya Adhisthana* and *Indriya Buddhi*.[4] In case of *Darshanendriya*, these factors are as follows--

Indriya -- *Chakshu*

Indriya Dravya -- *Teja (Jyoti)*

Indriya Artha -- *Rupa*

Indriya Adhistana -- *2 Nethras*

Indriya Buddhi -- *Chakshurbuddhi*

Rupa (*Indriya Artha*) is travelling in the media of *Teja* (*Indriya Dravya*) towards the *Netra* (*Indriya Adhisthana*). Impulses from both these *Netras* are collected at *Chakshu* (*Indriya*), which is one in number. Further it will be analysed at the level of *Chakshurbuddhi* (*Indriya Buddhi*) to give actual knowledge of the objects. As *Doshas* play significant role in all aspects of physiology, their effects on these processes are worth-knowing, to understand ancient thoughts of visual perception.

Vata Dosha is responsible for *Pravartana* (stimulation, activation) of the *Indriya* whereas *Pitta Dosha* performs *Alochana* (perception) of the *Indriya Artha*. *Kapha Dosha* gives *Sthairya* (stability) to the *Indriya Adhisthana by* providing *Tarpana*. Further, the subtypes of *Doshas* like *Prana Vayu* and *Vyana Vayu* are specifically held responsible for *Vata Karmas*, *Alochaka Pitta* for *Darshana* and *Tarpaka Kapha* for *Akshi Tarpana.*

Eyes are most important among the five *Jnanendriyas*. So, its function can be considered as the function of *Jnanendriya*. Here, eye is the *Indriya* and external object is the *Indriyartha*. In order to get a clear image of the external object, there should be *Indriyartha Sannikarsha*, *Roopalochana* and *Jnanotpatti*. In the first step, the externally situated object is conducted into the eye in the form of light rays. Conduction is the function of *Vata*. As the refractive

media are *Kapha* predominant, normal consistency of *Kapha* is absolutely necessary for the normal process of refraction.

In the next stage, the analysis of the object is performed. The *Dosha*, which functions in presence of light, is *Alochaka Pitta* hence all the changes that take place in the retina after the convergence of light rays are due to the action of *Alochaka Pitta*. As a result of this action, a biological factor is formed which includes all the details of the object. Here, mind is considered as the basement factor, because the function of *Alochaka Pitta* is possible only in the presence of mind.

For *Jnanotpatti* to occur, the visual impulse formed is to be converted to actual visual sense. According to Bhela, *Alochaka Pitta* is having two functional fractions namely *Chakshurvaisheshika Alochaka Pitta* and *Buddhirvaisheshika Alochaka Pitta.* The *Chakshurvaisheshika* acts at the level of retina while the *Buddhirvaisheshika* acts on occipital cortex. The *Buddhirvaisheshika Alochaka Pitta* receives impulses sent by the *Chakshurvaisheshika Alochaka Pitta* and gives determination and confirmation; and this confirmed knowledge is known as *Pratyakshajnana*. This conduction of visual impulses is carried out by *Pranavayu*.

Similar ideas are reflected in the description of two phases of *Chakshurbuddhi*. According to *Chakrapanidatta,* the momentary knowledge is obtained by *Kshanika Chakshurbuddhi*, which will be further confirmed in the second stage by *Nischayatmika Chakshurbuddhi*.[5] *Sushruta* relates the theory of common origin (*Tulya yoni*) as the basis of sensory perceptions. It is believed that light which illuminates the objects and the eye which receives the light, both are derivatives of *Tejo Mahabhoota*, hence eye perceives only *Rupa* of the objects and no other characters like sound etc.[6]

FUNCTIONING OF *DOSHAS* IN PHYSIOLOGY OF VISION

Role of *Vata Dosha*

Vayu is the stimulator of all sensory organs and makes them to perceive their respective objects.[7] *Vata* is the key factor for *Aksha Patavam (aksha* means *drik. Patavam* means clarity).[8] *Udvahanam*, a term used by *Acharya Sushruta* in the reference of five *karmas* of *Vayu* Which means 'the conduction of efferent impulses from respective sensory organs – exteroceptors' also describe the role of *Vata Dosha.*[9] Among the five types of *Vata;*

Pranavayu attends the function of *Chakshuradi* sense organs and *Vyanavayu* is responsible for closing and opening of the eyes.[10]

Considering points from modern science- Light falling upon the retina causes photochemical changes which in turn trigger a cascade of biochemical reactions that result in generation of electrical changes. These visual signals undergo considerable processing at synapses among the various types of neurons in the retina (horizontal cells, bipolar cells, and the amacrine cells). Then the axons of retinal ganglion cells provide output from the retina to the brain, exiting the eyeball as the optic nerve.
Light → Photoreceptors →Bipolar cells → Ganglion cells →Axons of ganglion cells exit eye as the optic nerve → Optic chiasma-→ optic tracts → lateral geniculate body→ optic radiation→ primary visual cortex.

Thus, the mechanisms of perception of objects in the form of sensory pathways and all the various extraocular muscle movements control by the nervous system to the physiological functioning of *Vata Dosha*.

Role of *Pitta Dosha*

Darshana is considered as one of the important functions of Pitta *Dosha.*[11] According to *Acharya Charaka*, it is *Agni* alone represented by *Pitta* which is responsible for vision or loss of vision depending on its normal or abnormal state. According to commentator *Acharya Chakrapani* Specially *Alochakapitta* present in *Netra* is responsible for vision or loss of vision. It is said to be same by *Acharya Sushruta*, *Pitta* which is located in the eye is known as *Alochakagni*. Its function is to form the image of an external object presented to the eye. *Bhela Samhita* has quoted another interesting information as *Bhela* has envisaged two aspects of *Alochaka Pitta* viz. *Chakshurvaisheshika* and *Buddhirvaisheshika*. The *Chakshurvaisheshika Alochaka Pitta* begins its function after the co-relation of *Atma* and *Manas*, when the object has made contact with it, leading to the production in *Chitta*, the knowledge of the characteristics, form, colour etc of such things as flowers, fruits, leaves etc. *Buddhirvaisheshika* is that which is located in *Shringataka*, between the two eyebrows. It seizes subtle objects, retains and recalls them. This is the factor which enables concentration, responses and cognition.

Considering points from modern science - The inner layer of the eyeball is the retina. It consists of two parts- Posteriorly and laterally is the optic part of the retina, which is sensitive

to light, and anteriorly is the nonvisual part. The optic part of the retina consists of two layers- An outer pigmented layer and an inner neural layer. Pigmented layer absorb light, carries out phagocytosis, stores vitamin A. Neural layer contains photoreceptors (rods and cones) for visual perception, contains bipolar cells & ganglion cells for visual impulse transmission.[12]

Considering these aspects, we can relate function of retina and its components like rods, cones, rhodopsin etc to the physiological functioning of *Pitaa Dosha*.

Role of *Kapha Dosha*

Providing strength is the important function of *Kapha Dosha*.[13] Along with this, nourishing various body parts is also considered as the important function of *Kapha Dosha*.[14] Among the five types of *Kapha*, *Tarpaka Kapha* is having the function of nourishment of sense organs including the eye.[15]

Considering points from modern science- Anterior and posterior chambers of the anterior segment of eye are filled with aqueous humour, a transparent watery fluid that nourishes the lens and cornea. It helps in maintaining the intraocular pressure and also assist in maintain the shape of the eyeball and hence proper vision.[16] Considering these aspects, we can relate the function of various coats of eye, which provide structural stability to eye and the aqueous humour which also helps in maintaining the shape of the eyeball and nourishing the structures to the physiological functioning of *Kapha Dosha.*

CONCLUSION

The *Doshas* are present throughout the body and it normalcy they perform their normal physiological function.

With respect to eye the neurological functions like sensory functions and function of movement of eyeball are done by *Vata Dosha* very specifically *Prana*, *Vyanavata* respectively.

Capturing the image of External object and helping in recollection about image are function of retina and its components like rods, cones, rhodopsin etc can be related to the physiological functioning of *Pitta Dosha* very specifically *Alochakapitta*.

Function aqueous humor, providing nourishment and layers of eye giving stability and shape to eyeball can be related to the function of *Kapha* and specifically *Tarpaka Kapha* which is responsible for the nourishment of all the 5 *Indriya* including *Netra.*

So all the three *Doshas* perform the various physiological functions in relation to eye. There is the need for further study and research regarding the *sthana* of all three *Dosha* in different structures/organs in the body and its physiology.

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