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A critical review of *Netra sharir* explored in ancient era with special emphasis on *Daivakruta chidra*.

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Abstract :

Sense organs are important part of human body. Important function of perception of knowledge is done by these organs. *Sushrutacharya* has explained sense organs. He has narrated nineteen chapters in *uttartantra* to explain the diseases, treatment and surgical aspect of *netra*. Other references of *netra* are also scattered in entire *Sushruta samhita* but all the terminologies used to describe the *netra* are not clear. e.g *Daivakruta chidra*. Apart from the fact that *netra* is a Marma, some points such as *Daivakruta chhidra* are mentioned, which should be used as a site of incision during many operative procedures of eye such as extraocular expulsion of lens material in *linganash* (cataract). While its exact correlation with modern anatomical structure is still unknown. In day today practice each surgeon uses different location for intraocular procedures. This article is honest attempt to explore different terminologies of *netra* with reference to modern anatomy and elaborate about *Daivakruta chhidra*.

Keywords: *Netra, sharira, anatomy, eye, Sushruta Samhita, Daivakruta chidra*

Introduction

Sharir is the study of human body from its structural as well as functional point of view. In Ayurveda, *sharir* has been explained in depth by *Sushrutacharya* as compared to others. Since *Sushrut Samhita* is dedicated to surgical part, the *sharir* which is explained is mostly clinically as well as surgically significant. Along with general surgery, some special surgical procedures related to *Shalakyta tantra* are also explored by *Sushrutacharya* and hence accordingly, *Sharir* of specific parts is described.

Netra sharir is one of the most significant explained in *Sushruta Samhita* which is applicable in surgical procedures of various deformities of *netra*.

One important surgery which is elaborated by *Sushrutacharya* is *Linganash shastrakarma* i.e. Cataract surgery and to carry out this surgery, *Daivakruta chidra* is an important structure, but is not described in detail.

In the present study, there is an attempt made to elaborate *sharir* of *Netra* with special emphasis on *Daivakruta chidra*. For this research, the literature has been collected from the *Ayurvedic* classic texts with the commentaries, as well as modern science text books have been referred for understanding of the concept along with its comparisons and correlation with modern science.

Review of literature :

***Netra Sharir* explained in various texts in ancient era:**

While narrating the importance of *Netra*, it is said that, *Netra* is an vital organ for *indriya janya gyana* (sensory knowledge) which is necessary for *pratyaksha gyana* (direct perception). We acquire clear knowledge with the help of *indriya* (five sensory organs) and out of the five *indriya*, most important among which is the *netra*.¹ *Netra* is included in the *bahirmukha srotasa* (external apertures) which are used as a route for drug administration .²

***Netra Utpatti* (Embryological Development of the Eye):**

Absence of light has been mentioned as the cause of lack of knowledge and hence *Acharya* has mentioned *surya* (Sun) as the God of *netra*.³

According to *Ayurveda*, all body parts are made up of *Panchmahabhuta* i.e. *Akash*,

Vayu, *Teja*, *Jala* and *Pruthvi*. *Netra* is a *Teja mahabhuta* dominant organ. There is a dominance of *teja mahabhuta*, but other four *mahabhuta* also contribute in the formation of eyeball in a developing embryo.⁴ *Mamsa*-muscle, fascia are from *prithvi mahabhuta*, *Rakta* – blood vessels are from *teja mahabhuta*, *Krishna bhaga*-cornea/iris is from *vayu mahabhuta*, *Shweta bhaga*- sclera is from *aapa mahabhuta*, *Ashrumarga*- lacrimal apparatus is from *aakasha mahabhuta* and the entire eye ball is appeared to be a bubble of water.⁵ All the *indriyas* become definite during the third month. *Charaka* and *Kashyap* has accepted the same that the genesis of all sense organs including eyes and organogenesis occurs in third month of intrauterine life. According to *Janaka* of *Videha*, the seat of senses is first formed. *Punarvasu Atreya* concluded that all the five sense organs are developed simultaneously.⁶

Shape of eye ball:

Sushruta described two shapes of eyeball, one is *suvrutta* (perfectly spherical) and another is *gostanakar* (like nipples of Cow)⁷. These can be correlated as follows:

- 1) *Suvrutta* = exactly spherical.
- 2) *Gosatanakar* = eye ball with optic nerve which is covered by Tenon's capsule.⁸

Measurements of Eyeball-

Acharya Sushruta has given the term *Nayana budbuda* for an eye ball.

Sushruta has mentioned the dimension of eyeball in terms of *angula* wherein one *angula* is equal to the central part of the patient's own thumb. Two *angula* is the antero-posterior diameter of the eyeball while vertical and horizontal diameter is two and half *angula*. Shape of the eyeball

resembles with the teat of a cow and it arises from all the *bhutas* (*akasha, vayu, agni, jala, prathivi*) with their attributes. In modern perspective, dimension of an adult eyeball is as follows: anteroposterior diameter is 24mm, horizontal diameter is 23.5mm, vertical diameter is 23mm, circumference is 75mm, volume is 6.5ml and weight is 7gm.⁹

Eye colour:

In fetal life, *teja* is responsible for vision and if this *teja* doesn't reach the *drushti bhag* (visual apparatus), the child is congenitally blind (amblyopia). Color of the eye relies upon whether *tejo dhatu* combines with *rakta, pitta, kapha* or *vayu*. When *tejo dhatu* goes to the visual part with the *rakta*, the child may develop *raktaksha* (red eyes); if it goes with *pitta*, then *pingaksha* (yellow eyes); if with *kapha* then *shuklaksha* (white eyes); and if with *vata* then the eyes of the progeny would be *vikrutaksha* (deformed eye).¹⁰

During the *Upanishada* period, ocular anatomy was depicted in philosophical manner. In *Brihad Aranyaka Upanishada*, different structures of eyeball were said to have evolved from different Gods.¹¹

Muscles related to eyeball:

There are two *peshis* (muscles) which cover the eyeball. The surgeon must take an oblique incision over these muscles.¹²

Asthi related to eyeball:

While describing types of *asthi* (i.e. bone), *Sushruta* mentioned *tarunasthi* (cartilage) which is related with *akshikosha* (orbit).¹³

Parts of netra:

Sushruta has described that eyeball is made up of five mandals, six *sandhis* and six *patalas*.¹⁴

1) *Mandal* – means rounded or spherical in shape. The parts which appears to be circular or rounded are described as *mandal*.^{15,16}

- *Pakshma mandal* – eye lashes
- *Vartma mandal* – eye lids
- *Shweta mandal* – sclera
- *Krishna mandal* – cornea
- *Drushti mandal* – pupil

2) *Sandhi*- means joint. *Sushruta* has classified *sandhi* into two types. Those which can be counted and are between the bones and another type of joints are countless as these are the joints between *peshi* (muscles), *snayu* (tendons) and *sira* (vessels)¹⁷.

Latter type of junctions are present in *netra* and are described as *sandhi*. Joints between five mandalas forms six *sandhis* as follows:

- Kaninaka sandhi* – inner canthus
- Apanga sandhi* – outer canthus.
- Pakshma-varthma gata sandhi* – junction where eye lashes are attached to the eyelids.
- Vartma-shweta gata sandhi* – fornix- where palpebral conjunctiva meets bulbar conjunctiva.
- Shweta-krishna gata sandhi* – sclero – corneal junction.
- Krishna – drushti gata sandhi* – pupillary margins.¹⁸

Netragata patal:

In *Sushruta samhita*, there is a very crisp description about *patala*. He described six *patalas* related to *netra*, out of which two

patalas are *bahya*¹⁹ (i.e., externally situated), and remaining four *patalas* are *abhyantara* (i.e. internally situated).

These are as follows:

- i) *Urdhwa vartma* – upper eyelid
- ii) *Adho vartma* – lower eyelid these are *bahya patalas*.
- iii) *Tejojalashrit patal*
- iv) *Pishitashrit patal*
- v) *Medoshrit patal*
- vi) *Asthyashrit patal*

Sushruta has not described the shape, position, colours etc of *patalas* but he has given the symptoms of the diseases caused by affecting these *patalas*. By reviewing and comparing these symptoms with modern concepts of eye diseases, we can have some conclusions about these *abhyantara patalas*.

Concept of *drishti*

As *Timira* is one among the *Drishti gata roga*, it is quite necessary to know more about *drishti*.

Definition of *Drishti* (area of sight/vision)- The *drishti* is of the size of a cotyledon of the lentil, composed of the finest parts of *panchmahabhutas*, gleaming like a glow-worm or a spark which is covered by the external coat of the eye and appears like a hole.²⁰

The concept of *Drishti* by *Acharya Sushruta* is a bit different and all the description of *Drishti* given by him points to the pupil i.e.

- *Masura dala matra*
- *Prasada* of *Panchamahaboota*
- Covered by the external *Patala*
- Sparkle like a glow worm (*Khadyotavisfulingabha*)
- Constantly nourished by the cold aqueous

- Shape resembles a hole (*Vivirakritim*)
- Benefited with cold things

Sira (Veins, Arteries and Nerves)-

Acharya Dalhana describes *sira* as plural word and it can be considered as the orbit having a single ophthalmic artery but two ophthalmic veins. *Sira* (Veins): *Acharya Susruta* has described both the eyes have 38 *siras*.²¹ *vata* is carried in eight *sira*, *pitta*, *rakta* and *kapha* are carried in ten *sira* each. *Acharya vagbhatta* has explained total number of 56 *siras* present in the both eyes. Among them two *siras* each are responsible for lid movement (*nimesha-unmesha*) and six *siras* should not be opened during *sira vyadha*.

Dhamani (Arteries): The two *dhamanis* helps in visual perception and two are for the flow of tears.²²

Kandara (tendons and ligaments) of the Eyeball: it can be considered as trochlea of superior oblique and suspensory ligament of eyeball.

Snyau, Peshi: There is a *Prithu snayu* in the eyes. Two *peshi* are situated in both eyes and which are circular (*Mandala*) in shape. *Meda* and *Sleshma Bandana* (Orbital fat) of Eyeball: The *Meda* and *Sleshma Bandana* can be considered as orbital fat of both eyelids.

Marma (Vulnerable Area): three *marma* are described in relation to eye i.e. *Apanga*, *Aavarta* and *Shringataka*. The two *apanga marma* are situated on the outer side of the orbit, below the lateral end the of the eye-brows. The injury of *apanga* and *avarta marma* them cause blindness or diminished vision. The *apanga marma* and *avarta marma* is a type of *shira marma* and half *angula* in size. The *Avarta marma* is above

the lateral end of the eyebrows. The *Sringataka marma* is the merging of vessels providing nutrition to sense organs like nose, ear, eye and tongue. It is a *sira marma* and four *angula* in size and injury to this can also results in immediate death.²³

Daivakruta chidra:

Sushrutacharya has mentioned about surgical interventions of eye in ancient era. The anatomy of eye explained in classical texts is useful in understanding the surgical procedures adopted by *Sushrutacharya*. While *Daivakruta Chhidra* is not mentioned in the process of describing the *Netra Sharir*, the exact location is not mentioned. However, its importance in Cataract surgery is mentioned.²⁴

The *Marma sthanani* is quoted by *Sushrutacharya*, which needs to be protected during surgical procedures.²⁵ Apart from this, some points such as *Daivakruta chhidrani* are mentioned, which should be used as site of incision during operative procedures of eye and ear.

About the *Daivakruta chhidra* in relation to eye, it is said that while doing *Linganash Shastra Karma*, the surgeon leaving two parts of white circle from the black one towards the outer canthus, should open his eyes properly, free from vascular network and then with a barley tipped rod like instrument held firmly in hand with middle, index and thumb fingers should puncture the natural hole like point with effort and confidence, not below, above or in sides. The left eye has to be punctured with right hand and vice versa. when punctured accurately, a drop of fluid comes out along with some typical sound. This is the only reference of *Daivakruta chidra* present in *Netra* by *Sushrutacharya*.²⁴

As mentioned before as well, while doing *Linganash Shastra Karma*, the surgeon

leaves half parts of *angul* of white circle from the black one towards the one fourth of outer canthus, while opening his eyes properly free from vascular network and then with a tipped rod like instrument held firmly in hand with middle, index and thumb fingers should puncture the natural hole like point (not much behind or above) with effort and confidence.²⁶

On the basis of above references of *Daivakruta chidra* and its application in surgical intervention, this site can be compared with sclero-corneal junction. But the same needs to be studied while making an attempt for clinical research on cataract surgery performed in today's era.

Discussion:

Netra Sharir mentioned in Ayurveda texts can be correlated with modern anatomy of eyeball, with a very few exceptions. Though this information is very vague while comparing to the current knowledge of eye, we must understand that *Maharshi Sushruta* has never explained only anatomical view of situations but also described each and every subpart of eyeball in utmost detail. In Ayurvedic classics, all the anatomical structures are described with its physiological aspects. *He* first ever described the anatomy of eye in relation to their shape, size of various anatomical components while elaborating seventy-six different kinds of eye diseases and their treatment in *uttara tantra*. While *Netra* execute both physiological functions of *roopagrahana* and *buddhigrahana* as it is the seat of *Alochaka pitta*, with its predominance of *tejo mahabhuta*, there is always a threat of *kapha* to eye.

The shape of *netra* is like *svrittam* which means spherical from all sides and *gostanakara* means shaped like that teat of the cow (oval shape). *Acharya Sushruta* described the anatomical parts of the eye consists of *mandals* are five in number and *sandhi* and *patala* are six in number.

Sandhi is the junction between two *Mandalas* and are 6 in number. *Acharya sushruta* has described the importance of *patala* in *netra sharir*. The first *patala* is the seat of *tejas* and *jala* and it can be taken as cornea and aqueous humour; the second *patala* is the seat of *mamsa* and it can be taken as iris and ciliary body. The third *patala* is the seat of *medo* and it can be taken as vitreous humour, it is a jelly like structure which resembles *medas*. The fourth *patala* is the seat of *asthi* and it can be taken as lens and retina, as it is the seat for *linganasha*.

These are the parts where *doshas* get localized and lead to various types of *netra rogas*. When *doshas* invade gradually deeper in the *patala*, it causes *timira*, *Kacha* and *Linganasa*. *Netra* also consists of *Akshi bandhana*, *sira*, *pesi*, *dhamani*, *marma*, *snayu* and other accessory parts. Thus, whole of *patala*, *Mandala*, *Sandhi*, *Akshi bandhana*, *sira*, *pesi*, *dhamani*, *marma* and *snayu* completes the *netra sharira*. It can be said that *Patala* were described by *Acharyas* in order to show the severity of the diseases when they involve deeper tissues and no single structure can be correlated with specific *Patala* accurately. *Patala* can be taken as different structures in different contexts.

Based on the physiological anatomy of eyeball, he further mentioned different forms of treatment, do's and don'ts to restore eye health. In eye surgery, *Sushruta* mentioned 'the God created hole' (*daivakruta chhidra*) which is bloodless and an easy approach towards lens. There is a need of further clinical and surgical research in the field of *Ayurvedic netrasharir* to explore the concept of *Sushruta* mentioned.

Conclusion :

Netra Sharir explained by *Sushrutacharya* is surgically important.

Daivakruta Chidra mentioned in *Linganash shastrakarma* is considered as important structure while performing various ocular interventions in today's time.

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