



Review Article

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A REVIEW ON KRIYAKALPA: THE MODERN APPROACH TO AYURVEDIC OCULAR THERAPEUTICS

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ABSTRACT

Ophthalmology in Ayurvedic literature comprises of major part of Shalakyatantra, branch of Ashtang Ayurved. This fact is evidenced by the vivid and systemic presentation of the subject matter, description of ocular trauma (Nayanabhigata) and ocular therapeutics i.e. Kriyakalpa. Kriyakalpa literally means the treatment; but is in vague for ocular therapeutics. Kriyakalpa means the procedures in which various drugs are applied in and around the eye ball as a treatment modality. Tarpanadi procedures are included in Kriyakalpas. It will not be an exaggeration to say that Kriyakalpa is the only field of Ayurvedic Ophthalmology which has the potential to contribute to the suffering humanity. Kriyakalpa procedures need a modern scientific base to develop the branch of Ophthalmology. This review article is a sincere effort to compile and correlate Ayurvedic ocular therapeutics with the modern pharmacokinetics. The concentration of drug is an important factor to act in the Kriyakalpa procedures along with other factors explained.

Keywords: Kriyakalpa, Ocular Therapeutics, Route of drug administration.

INTRODUCTION

Ophthalmology in Ayurvedic literature comprises of major part of Shalakyatantra, branch of Ashtang Ayurved¹. This fact is evidenced by the vivid and systemic presentation of the subject matter, description of ocular trauma (Nayanabhigata) and ocular therapeutics i.e. Kriyakalpa. Kriyakalpa literally means the treatment; but is in vague for ocular therapeutics. Kriya means the procedures to be done on various eye diseases while the Kalpa means the various drugs and modes used to treat the eye diseases. Kriyakalpa means the procedures in which various drugs are applied in and around the eye ball as a treatment modality². Acharya Sushruta mentioned five types of Kriyakalpa include Tarpana, Putapaka, Seka, Anjana and Aschyotana³. While Sharangdhara explained Pindi and Bidalaka additional to Sushruta's five Kriyakalpa⁴. In the medieval age, Sharangdhara developed these treatment modalities and named them as Netra Prasadana Karma⁵ (Treatment modalities helpful to eyes without harm). Kriyakalpa aims to treat eye diseases and also is known as Bahyaparimarjan Chikitsa (External body purification process).

Eyes are the only organ in the body which receives separate treatment modality like Kriyakalpa as a Bahyaparimarjan Chikitsa and no other organs are individually receives the treatment modalities like Kriyakalpa on eyes. However Panchakarma are the Sarvadehik treatment procedures and stated as Antahparimarjan Chikitsa⁶ (Internal body purification process).

Kriyakalpa procedures need a modern scientific base to develop the branch of Ophthalmology. The application of Ayurvedic ocular therapeutics seems crude in the light of modern Ophthalmology. Despite the available evidence regarding the mode of action, the foremost query about the absorption and therapeutic effect of these measures is obvious. Two views are held in this regards:

- The potency of the locally administered drug by virtue of its action relieves the disease.
- Locally applied medication reaches conjunctival sac, fornices, inner and outer canthi, nasal cavity and blood vessels and alleviates both locally as well as systemically⁷.

An honest effort is made to compile the effect of local treatment modality like Kriyakalpa on eyes through modern ocular therapeutics (Route of drug administration) in this article.

Kriyakalpa

Kriyakalpa procedures are administered through Poorvakarma (Pre treatment), Pradhankarma (Main treatment course) and Paschat Karma (Post treatment). Poorvakarma includes the Panchakarma on body to remove vitiated Doshas and after that Kriyakalpa procedures applied to eliminate remaining Dosha as a Bahyaparimarjan Chikitsa. Pradhankarma includes the actual Kriyakalpa procedures while Paschatkarma is the Parihar Kala to follow Sansarjan Krama (Dietary regime).

Seka

Seka procedure is indicated in acute condition of eye diseases. Medicine is poured on closed eyes continuously from four Angul heights for a specific time, according to Doshas⁸. There are three types of Seka as⁹:

Table 1

Types of Seka	Dosha Predominant Diseases	Kala
Snehan	In Vataj diseases	400 Matra
Ropana	In Pitta and Raktaj diseases	600 Matra
Lekhana	In Kaphaj diseases	300/200 Matra

Samyak Seka Lakshana are Rog Nivritti (Relieved from Disease), Swabhavik Varna (Getting natural colour), Vedana

Shanti (Relief from pain), etc¹⁰. Seka is used in Balwan Dosh Vyadhi¹¹.

Aschyotana

Instillation of few drops of medicines into the open eyes from the height of two Angul is called as Aschyotana¹². Aschyotana is the first line of treatment in all eye diseases¹³. There are three types of Aschyotana as¹⁴

Table 2

Types of Aschyotana	Dosha Predominant Diseases	Dose
Lekhana	In Kaphaj diseases	7-8 drops
Ropana	In Pitta and Raktaj diseases	12 drops
Snehan	In Vataj diseases	10 drops

Aschyotana can also be administered in Alpabalyadhi¹⁵. Aschyotana reduces painful conditions, irritation and foreign body sensation of eyes, itching of eyes, redness and features of inflammation, burning, excessive watering, etc¹⁶.

Modern aspect of Aschyotana

This is an application of liquid ocular drug in the form of drops in the conjunctival sac. The number of drops indicated varies from 5-12 drops in the conjunctiva as per the condition. Eye drops of modern era are meant only to be instilled one or two drops that may stay on the surface of the eyeball only for one or two seconds. But in Aschyotana the drug in the form of an aqueous solution falls on the cornea and conjunctiva from a safe height of 3" or 4" continuously for about 10 minutes. Here our drug will have an access of entering the conjunctival blood vessels about more than 100 times than that of modern eye drops which are of very weak concentration dropped from very less height (1/2") and is of very small quantity (1 drop). It may be true that more than one drop will not stay on conjunctiva, but when they are dropped from a little more height, continuously for a longer time and with little more temperature of the solution they will get absorbed more effectively. As we know that action of most of the topical instillation or application of drugs in the eyes limited to ocular surface i.e conjunctiva and corneal epithelium. These instillations in some instances can influence the action of ciliary muscles e.g mydriatics, cycloplegics and IOP lowering drug. Similarly other Kriyakalpa therapies can also influence the action of ciliary muscles or accommodation.

Pindi

Pindi is the modified procedure of Bidalaka. Instead of direct application of drug paste on eyes, it is kept in cotton or Doshaghna leaves and is kept tightly over the eyelids¹⁷. Pindi relieves the symptoms of Netrabhishyanda, Adhimantha, Shotha, Netrakandu, Kaphaja Netraroga, etc¹⁸.

Bidalaka

Bidalaka is the application of medicated paste on the outer surface of eye i.e. eye lids¹⁹. Bidalaka are of three types according to thickness of paste as Uttama (the best), Madhyama (moderate), and Heena (minimal)²⁰. Bidalaka relieves burning, discharge, excessive tears, swelling, redness, itching, etc of eyes²¹.

Tarpana

This is one of the Kriyakalpa which gives nourishment to the eyes and cures Vata-Pitta predominant diseases²². In this

procedure the unctuous (Oily) substance (Medicated Ghee-Vasa, Majja, Ghrita Manda) is kept in the eye for a specific time by special arrangement made around eyes with white lentil dough (Mashpali) or Tarpana goggle²³.

There are different Aushadh Dharana Kala explained as per diseased part as²⁴

Table 3

Diseased Part/ Dosha	Aushadh Dharana Kala
Sandhigata Roga	300 Matra
Vartmagata Roga	100 Matra
Shuklagata Roga	500 Matra
Krishanagata Roga	700 Matra
Drishtigata Roga	800 or 1000 Matra
Sarvagata Roga	1000 Matra
Vataj Roga	1000 Matra: Kala for one day
Pittaj Roga	800 Matra : Kala for three days
Kaphaj Roga	500 Matra : Kala for five days.

Prakash Kshamata (Tolerance to light), Swasthyam (Health), Netralaghav (Lightness in eyes), normal complexion of the parts of eyes, Laghutva in Nimesh-Unmesh (Easiness in closing and opening of eyes) are the Samyaka Lakshana of Tarpana procedure²⁵. By virtue of Sanskaranuvariti Guna of Ghrita and its supremacy in Snehavarga, Ghrita is effective in Vata-Pittaj diseases and improves Dhatubala²⁶.

Putapaka

The indications and procedure of Putapaka is like Tarpana but the medicine preparation is specific i.e. the medicine is (Swarasa) extracted by Putapaka Vidhi²⁷. The Putapaka is of three types as Snehana, Ropana, and Lekhana Putapaka²⁸. Vagbhata mentioned Prasadana Putapaka instead of Ropana Putapaka²⁹.

Anjana

Application of medicine to the internal surface of lid margin from Kaninika Sandhi to Apanga Sandhi with Anjana Shalaka is called as Anjana³⁰. Types of Anjana according to action of drugs are as³¹:

- Lekhanjana:- Used in Kapha predominant diseases of eyes
 - In Vata predominant diseases:- Amla- Lavana Rasa
 - In Pitta Predominant diseases:- Tikta-Kashay Rasa
 - In Rakta Predominant diseases:- Kashaya- Tikta Rasa
- Ropananjana:- Ropananjana drug is oily and it gives strength and complexion to the eyes.
- Prasadanjana:- It is prepared with Madhur and Snigdha medicines .

In Vata predominant diseases application of Anjana should be done at evening, in Pitta predominant diseases at night and in Kapha predominant diseases Anjana application should be done in morning³². Anjana procedure is contraindicated in Samavastha of netrarog. If done it will cause complications like Strava (Watering), Shoola (pain), Shoth (odema), Timira (low vision) and difficulty in opening and closing of eyelids³³. Anjana has direct action on Ocular tissues especially on Conjunctiva. It removes debris and unwanted tissue due to its Lekhan property.

Ocular Pharmacology

Ocular therapeutics includes ointments, gels, eye drops, and emulsions. These modes can be used via topical route of drug

administration. The other forms of route of drug administration in eyes are periocular injections, intraocular or intracameral route or intravitreal route and systemic administration. Eye drops are most popular and convenient method of topical drug administration.

The pharmacology of Kriyakalpa can be explained on the following principles of modern pharmacology^{34,35}:

- Route of drug administration
- Solubility and Bioavailability
- Absorbing surface
- Vascularity of the absorbing surface
- Physical state of the drug
- Compliance
- Excretion or disposal

Route of drug administration

Mainly mucosal and cutaneous routes are used. Drugs are applied to the conjunctival sac as drops and ointment which is thin disc of gelatin as in Aschyotan, Seka and Anjana. Mucous membranes are good absorbing surfaces. Drugs applied in mucous membrane of conjunctiva, nasopharynx, oropharynx, etc are readily absorbed. Subconjunctival injections can be employed to introduce a wide range of substances; for sclera allows free and indiscriminate passage of molecules of big size. Perhaps ointments and ocular inserts (Anjana or application of collyrium) act in the same way. The systemic route has limitation because of blood- aqueous barrier. Large sized molecules cannot cross this barrier and do not enter the eye. Many collyrium contains the large sized molecules which are administered topically. This proves the awareness of ancient Acharyas about blood aqueous barrier. Few drugs rapidly penetrate the intact skin. Absorption of these drugs is proportional to their lipid solubility since epidermis behaves as a lipid barrier. The dermis is freely permeable to many solutes which form the basis for application of Bidalaka and Pindika on the skin surrounding the eyeball.

Solubility and bioavailability

Bioavailability: Absorption depends on solubility of drugs and local condition at the site of absorption. Drugs to be absorbed through mucous membrane should be water and lipid soluble. The main forms of drugs instilled into the eyes are aqueous solutions (medicated solution), aqueous suspensions (medicated ghee and oils), ocular inserts and ointments (different Anjana preparations). Each has different influence on drug bioavailability. In solution drug is totally dissolved (and therefore available) but tissue contact time is short as in Aschyotan and Seka. Ointment increases bioavailability of drug by increasing the tissue contact time and by preventing dilution and drainage of active ingredients as in different collyria. In suspension the drug is present as small particles kept suspended in an aqueous medium by a dispersing agent (Medicated Ghee and oils). Particles do not leave the eye as quickly as the solutions which increase the tissue contact time as in Tarpana and Putapaka.

Absorbing surface

Conjunctiva and cornea are main absorbing surfaces. Conjunctival membrane readily absorbs the drug. Absorption through cornea involves transformation of drugs through its different layers. The corneal epithelium and endothelium have 100 times more lipid contents than in the stroma and fat soluble drugs readily penetrates the epithelium and endothelium.

However only water soluble drugs can penetrate the stroma, therefore a drug should be amphipathic i.e have both lipophilic and hydrophilic characters to penetrates all the layers of cornea. The drug contact time has an effect upon the absorption and penetration of drugs. So specific duration of contact time has been mentioned by our Acharyas for specific diseases e.g. Tarpana in Vata predominant diseases are done for a longer duration as compared to Pittaj and Kaphaj predominant diseases.

Vascularity of absorbing surface

The drug absorption is directly proportional to the vascularity of absorbing surface. Increased blood flow is brought about by massage or local application of heat enhances absorption of drug. Snehana, Swedana done in some of Kriyakalpa procedures as a Poorvakarma increases the blood flow to that part.

Two types of absorption mechanism:

- a) Vascular and b) Corneal

Water soluble drugs easily absorbed through the vessel wall i.e. permeability and vascularity. So in diseases where blood vessels especially external eye are not involved, medicines in the watery form is better. Therefore modes of application modulated watery preparation are Aschyotan and Seka. Especially in the anterior segment of eye Aschyotan and Seka are the procedures for medications. Fat soluble factors easily get absorbed through cornea. So in Vata Pitta predominant diseases Ghrita is perfect for Tarpana and Aschyotan. Honey has both vascular as well as corneal absorption and Kapha Shamaka so used in Kapha predominant diseases.

Physical state of drug

Colloids are more slowly absorbed than crystalloids. Fat soluble substances reach the circulation more slowly than water soluble drug. This is the reason that in Tarpana and Putapaka, rich in fat soluble substances, are kept for longer duration than Seka and Aschyotana which contains surplus of water soluble substances. Concentrated solutions are more rapidly absorbed. Besides lipids and water solubility, ability of a drug to penetrate the cell membrane also depends upon its molecular size, structure and ionic charge.

Molecular size and structure: According to Richardson, substance with molecular weight less than 100 can pass readily through cell membranes and those of more than 500 do not. To overcome this limitation in molecular size, some ophthalmic drugs are prepared in high concentration. So that by the law of mass action, a small percentage will reach the anterior chamber and an effect will be obtained. In Tarpana and Putapaka the medicated Ghee or oil is used in the eye and absorption of the drug is on the basis of law of mass action.

Herbal compounds given in the form of infusion and decoctions contain varying amount of saponins which increase the permeability of epithelium by reducing the surface tension.

Compliance

The peak serum level time of the drug is the criteria of its dosage schedule which should be maintained by repeating the drug at that interval. Non compliance of this dosage schedule leads to drug resistance by the causative organisms. So to avoid non compliance certain dosage interval mentioned by Acharyas in each kriyakalpa. e.g. In Tarpana daily in Vatavikara, alternately in Pittavikara, interval of 2-3 days in Kaphaj Vikara.

Excretion or disposal

Topically applied solutions or eye drops, as in Aschyotan and Seka; mostly overflows and also gets excreted through the nasolacrimal duct. Whatever is absorbed entered the blood circulation and excreted through the main route of excretion. Cell membrane is lipid globular protein mosaic with lipid soluble portion or non polar group towards inferior of the membrane.

Ionic water soluble or polar groups are oriented at the two surfaces of membranes embedded within this phospholipids are globular proteins which are hydrophilic portion of the membrane; therefore the cell membrane has some sites for water soluble drugs.

DISCUSSION

Kriyakalpa forms the basis of ocular therapeutics in Ayurveda. The aim of Kriyakalpa procedures mentioned by ancient Acharyas are seems to be tissue oriented where the therapeutic concentration of the drug can be achieved by concentration of the drug, tissue contact time, molecular weight of drug, absorption of drug, bio-availability of drug. In Kriyakalpa, various drugs can be selected as per vitiated Dosha and the types of diseases for the procedures. The procedures of medications are modulated to ensure maximum absorption of drug.

CONCLUSION

This review article is a sincere effort to compile the ocular pharmacology explained by ancient Acharya in the form of Kriyakalpa. Kriyakalpas are the boon to Ayurvedic ophthalmology which can be studied through the route of drug administration, absorption, physical state of drug, solubility and bio-availability of drug, compliance and excretion of drug. With the help of new technology Ayurvedic scholars can study Kriyakalpa and certainly Ayurvedic ophthalmology will get the global platform in the suffering humanity.

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