ISSN: 2322 - 0902 (P)
ISSN: 2322 - 0910 (O)

International Journal of Ayurveda and Pharma Research

Review Article

EXPLORING THE MODE OF ACTION OF *SHUNTHYADI ASCHYOTANA* (EYE DROP) IN DRY EYE DISEASE: AN AYURVEDIC AND MODERN LITERATURE REVIEW

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Article info

Article History:
Received: 14-09-2026
Accepted: 10-10-2026
Published: 17-11-2026

KEYWORDS:
Aschyotana, Dry Eye Disease, *Kriyakalpa, Shushkakshipaka, Shunthyadi Aschyotana*.

ABSTRACT

Dry Eye Disease (DED) is a multifactorial disorder of the ocular surface characterized by tear film instability, hyperosmolarity, inflammation, and neurosensory abnormalities, resulting in ocular discomfort and impaired visual function. The conventional management of Dry Eye Disease includes lubricating tear substitutes, topical anti-inflammatory agents, anti-allergic medications, and, in selected cases, surgical interventions such as punctal plug insertion. In Ayurveda, DED can be correlated with *Shushkakshipaka*, a condition predominantly involving vitiated *Vata* and *Pitta doshas*. Among the various *Kriyakalpa* procedures, *Aschyotana* is considered an important topical ocular therapy. *Shunthyadi Aschyotana* has demonstrated promising therapeutic efficacy in the management of Dry Eye Disease, with significant improvement in both subjective symptoms and objective clinical parameters, but its probable mechanism of action has not been comprehensively reviewed. **Aim and Objective:** To review the probable mode of action of *Shunthyadi Aschyotana* in the management of Dry Eye Disease by correlating Ayurvedic principles with modern pharmacological concepts. **Results:** The review suggests that the therapeutic effects of *Shunthyadi Aschyotana* may be attributed to its multitarget pharmacological actions. From an Ayurvedic perspective, the formulation may remove *Kapha Avarodha*, provide *Snehana*, and promote *Ropana* and *Chakshushya* effects, thereby restoring ocular homeostasis. **Conclusion:** *Shunthyadi Aschyotana* appears to have a plausible therapeutic role in the management of Dry Eye Disease through complementary Ayurvedic and modern pharmacological mechanisms. Nevertheless, its proposed mode of action remains hypothetical and requires validation through well-designed experimental studies and randomized controlled clinical trials to establish its efficacy and scientific basis.

INTRODUCTION

Dry eye is not a disease entity, but a symptom complex occurring as a sequela to deficiency or abnormalities of the tear film.[1] Symptoms suggestive of dry eye include irritation, foreign body (sandy) sensation, feeling of dryness, itching, nonspecific ocular discomfort and chronically sore eyes not responding to a variety of drops instilled earlier. Complications of dry eye disease can be vision threatening and include epithelial breakdown, corneal ulceration, melting and even perforation.[2]

Access this article online

Quick Response Code

https://doi.org/10.47070/ijapr.v14i10.4448

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In Ayurveda, on the basis of signs and symptoms it can be considered under *Shushkakshipaka*. *Shushkaakshipaka* classified as *Sarvagata Netraroga* among all the 76 *Netrarogas* by *Acharya Sushruta* and mentioned it as *Vata* predominant *Vyadhi* characterized by *Kunita Vartma* (narrowing of palpebral aperture*), Daruna Ruksha Vartma* (hardness and dryness at lid margin and cilia), *Aviladarshana* (blurring of vision), *Sudarunam Yat Pratibodhane* (difficulty to open the eyes/ photophobia).

Increased global prevalence, chronic and recurrent nature, economic burden and life-long dependency to topical drugs and complications make us think about the sustainable, cost-effective, time-effective treatment of such disease. This has created scope for exploring traditional formulations such as

Shunthyadi Aschyotana in Dry Eye Disease management.

AIM AND OBJECTIVES

To review the probable mode of action of *Shunthyadi Aschyotana* in the management of dry eye disease by correlating Ayurvedic principles with modern pharmacological concepts.

MATERIALS AND METHODS

Review of literature: A detailed study of dry eye disease (*Shushkakshipaka*) has been done from the literature available both Ayurveda and modern point of view.

Drug review: A detailed study of *Shunthyadi Aschyotana* (eye drop) has been done.

Review of Literature

Modern Review

Definition: Tear Film and Ocular Surface Society Dry Eye Workshop II (TFOS DEWS II) in 2017 has redefined dry eye as: "Dry eye is a multifactorial disease of the ocular surface characterized by loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles."[3]

Synonym: Kerato-Conjunctivitis Sicca

Prevalence - In epidemiological studies performed globally, the prevalence of dry eye disease (DED) ranges from 5 to 50 percent.[4] A study from north India reported 32% prevalence of dry eye disease, and based on symptoms 81% were severe DED. Another study from south India reported 1.46% DED incidence.[5]

Symptoms suggestive of dry eye include irritation, foreign body (sandy) sensation, feeling of dryness, itching, nonspecific ocular discomfort and chronically sore eyes not responding to a variety of drops instilled earlier. Complications of dry eye disease can be vision threatening and include epithelial breakdown, corneal ulceration, melting and even perforation.[6]

Treatment comprises tear substitutes, anti-inflammatory agents, secretagogues, mucolytics, in severe cases surgeries like punctal occlusion, tarsorraphy.

Ayurvedic Review

Dry Eye Disease can be considered under *Shushkakshipaka* in Ayurveda. *Shushkakshipaka* comes under *Sarvagata Roga* of *Netra Rogas. Acharya Sushruta* depicted *Shushkakshipaka* as *Vata* predominant disease[7], whereas *Acharya Vaghbhatta* as *Vata-Pitta*[8] and *Acharya Sharangdhara* as *Vata-Rakta.*

- ***Nirukti:*** The word '*Shushkakshipaka*' means eye where in *Ashru* has depleted or dried resulting in inflammation of the eye. In other words, inflammation in the eye due to decreased/depleted or dried *Ashru*[9] or *Ashru* has depleted due to inflammation in the eye.

Roopa

- ***Sushruta Samhita[10]:*** *Kunita-Vartma* (Narrowing of palpebral aperture), *Daruna-Ruksha Vartma* (Hard and rough lids), *Aavila Darshana* (Blurred vision), *Sudarunam Yat Pratibodhane* (Difficulty in opening the lids).
- ***Ashtanga Hridaya[11]:*** *Gharsha-Toda-Bheda-Upadehavat* (gritty sensation, pricking pain, tearing pain, stickiness in eyes), *Ruksha-Daruna Vartma* (rough and hard lids), *Kricchronmeela-Nimeelanam* (difficulty in opening and closing the lids), *Vikunana* (narrowing of palpebral apperature), *Vishushkatva* (dryness of eyes), *Shitechha* (liking for cold), *Shoola-Pakavat* (pain and inflammation in eyes).

Chikitsa: *Chikitsa* of *Shushkakshipaka* includes different *Kriyakalpas* like- *Anjana, Aschyotana, Parisheka, Tarpana Karma.*

Drug Review

Although the term "*Shunthyadi Aschyotana*" is not explicitly described as an independent formulation in the classical Ayurvedic texts. The procedure of *Aschyotana* as an important *Kriyakalpa* for the management of ocular diseases. The currently used *Shunthyadi Aschyotana* has been formulated by integrating ingredients from these classical references.

Acharya Sushruta has stated that *Shunthi* rubbed over a stone-slab with *Goghrita* and *Stanya* is recommended as *Anjana* in *Shushkakshipaka.*[12] *Acharya Sushruta* also quoted that *Vasa* of aquatic animals mixed with little quantity of powdered *Shunthi* and *Saindhava Lavana* should be applied to the eyes as an *Anjana* in *Shushkakshipaka.*[13] According to *Acharya Charaka,* if eye is affected with *Vata* an external application of *Bidalaka* can be prepared by making paste of *Shunthi* and *Saindhava* with *Goghrita* is useful.[14]

Therefore, it represents a classical formulation developed through textual compilation and pharmaceutical adaptation, consistent with Ayurvedic principles.

Table 1: Ingredients of *Shunthyadi Aschyotana*

S.No	Name of Drug	*Rasa*	*Guna*	*Virya*	*Doshaghnata*
1	*Goghrita/ Goghrita Manda* (cow ghee)	*Madhura*	*Guru, Snigdha, Mridu*	*Sheeta*	*Vata-Pitta Shamaka*
2	*Shunthi (Zingiber officinale* Roscoe)	*Katu*	*Laghu, Snigdha*	*Ushna*	*Vata-Kapha Shamaka*
3	*Saindhava Lavana* (rock salt)	*Lavana*	*Laghu, Snigdha*	*Sheeta*	*Tridoshahara*

It has been prepared by *Ghrita Paka Vidhi* till achievement of *Sneha Siddhi Lakshana* mentioned by Acharya Sharangdhara.[15] After that it should be filtered and sterile packaging should be done.

RESULTS

Probable Mode of Action: *Shunthyadi Aschyotana* comes under *Snehana* type of *Aschyotana,* in which eye drop is instilled into *Kaninika Sandhi* (inner canthus) or *Akshi Madhye* (centre of the eye) from two *Angula* height into an open eye.

Ayurvedic view of mode of action[16]

- *Aschyotana* poured into *Netra Kosha* (*Kaninika Sandhi*)
- Spreads into *Netra Sandhis, Sirah-Ghrana-Mukha-Srotasa*
- Eliminates vitiated *Doshas* from *Urdhwa Jatru*

Shunthyadi Aschyotana opens up the obstruction of meibomian glands (*Shleshma-Avarodha*) and initiates tear production. As there is generalized inflammation in the dry eye, which is also known as Keratoconjunctivitis sicca.

Shunthi contains gingerol, zingeron which shows anti-inflammatory activity and reduces inflammation. These constituents also act as anti-oxidants and prevent further damage to the cells and helps in regeneration. It reduces dryness of *Vata* and maintains the viscosity of tear film and elasticity of blood vessels.

Saindhava Lavana may act as a permeation enhancer owing to its *Sukshma* property. *Goghrita* is having *Snigdha Guna*, *Rasayana, Chakshushya, Vata-Pitta Shamaka* properties which is helpful in strengthening the *Pradhama Patala* (cornea and conjunctiva) and reconstruct the *Ashru* (tear film) to provide tear film stability. It also works on *Dvitiya Patala* to give nourishment and strengthens the ciliary muscle.

Modern Mode of Action

Eye drops are the most popular and convenient method of topical drug administration. The pharmacology of eye drops can be explained on the following principles of modern pharmacology.[13,14]

1. Route of drug administration
2. Solubility and bioavailability
3. Absorbing surface
4. The physical state of the drug
5. Compliance
6. Excretion or disposal

- **Route of drug administration:** Drugs which are poured into the Conjunctival sac as drops is ocular route. The systemic route has limitations because of the blood-aqueous barrier. Large-sized molecules cannot cross this barrier and do not enter the eye. This proves the awareness of ancient *Acharyas* about the blood retinal barrier and given ocular therapies (*Kriyakalpa*).
- **Solubility and Bioavailability:** Absorption depends on the solubility of drugs and local conditions at the site of absorption. It depends on many factors like absorbing surface, dosages form, absorption, drug vehicles, tissue contact time, compliance, disposal, etc. Route of drug administration, solubility, and bio-availability of drugs, absorbing surface whether it is skin, conjunctiva, cornea, nasolacrimal duct or oral mucosa or all together, vascularity of the absorbing surface, the physical state of drug, patient compliance, excretion of the drug -influence the action of ocular administration. Drugs to be absorbed through the 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 *Go-Ghrita* and oils), ocular inserts, and ointments (different *Anjana* preparations). Each has a different influence on drug bioavailability. Particles do not leave the eye as quickly as the solutions which increase the tissue contact time as in *Snehana Aschyotana*, *Tarpana*, and *Putapaka*.
- **Absorption:** Conjunctiva and cornea are the main absorbing surfaces. The Conjunctival membrane readily absorbs the drug. Absorption through the cornea involves the 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 penetrate 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 the cornea. The drug

contact time affects the absorption and penetration of drugs.[17,18] So, *Snehana Aschyotana* like *Shunthyadi Aschyotana* having amphipathic nature, gets absorbed and give good results.

The precorneal tear film is a stagnant fluid layer that is spread over the corneal epithelium by a cover of mucin and is stabilized by the superficial oily layer formed by meibomian gland secretion.[19] *Shunthyadi Aschyotana* increases this tear film secretions by opening meibomian gland obstruction.

- **The physical state of the drug**

  According to Richardson, a substance with a 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 concentrations. So that by the law of mass action, a small percentage will reach the anterior chamber and an effect will be obtained. In *Aschyotana*, the medicated *Goghrita* is used in the eye, and absorption of the drug is based on the law of mass action. Herbal compounds given in the form of infusion and decoctions contain varying amounts 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 with this dosage schedule leads to drug resistance by the causative organisms. So, to avoid noncompliance certain dosage intervals are mentioned by *Acharyas* in each *Aschyotana*.
- **Excretion:** Topically applied solutions or eye drops, outflows or get excreted through the nasolacrimal duct. Whatever is absorbed entered the blood circulation and excreted through the main route of excretion. The cell membrane is a lipid globular protein mosaic with a lipid-soluble portion or non-polar group towards the interior of the membrane.
- Ionic water-soluble or polar groups are oriented at the two surfaces of membranes embedded within these phospholipids are globular proteins which are the hydrophilic portion of the membrane; therefore, the cell membrane has some sites for water-soluble drugs.
- *Go-Ghrita* act as a viscosity enhancer in *Shunthyadi Aschyotana.* Permeation enhancers improve corneal uptake by modifying the corneal integrity. In modern pharmacology, chelating agents, preservatives, surface-active agents, and bile salts were studied as possible permeation enhancers. Here, *Saindhava Lavana* may act as a permeation enhancer. (Figure: 1)

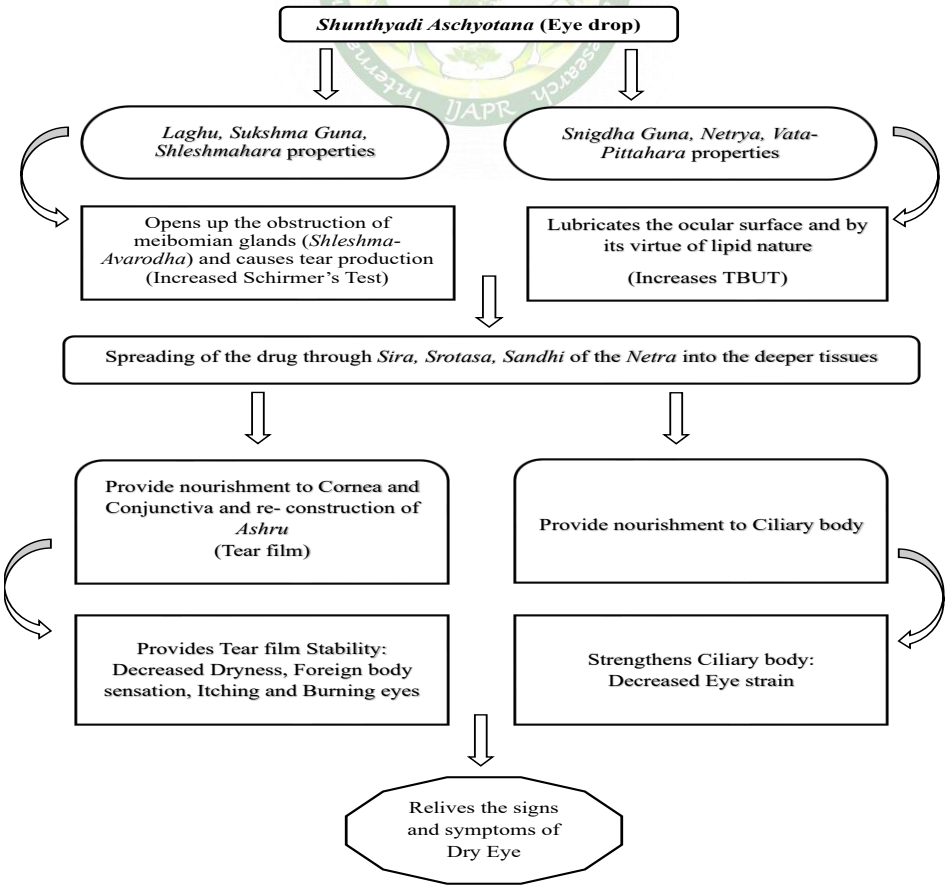


Figure: 1

DISCUSSION

Dry Eye Disease is characterized by tear film instability, ocular surface inflammation, hyperosmolarity, epithelial damage, and neurosensory abnormalities. In Ayurveda, *Shushkakshipaka* is predominantly a *Vata-Pitta* disorder manifested by ocular dryness (*Rukshata*), burning sensation (*Daha*), pain (*Toda*), foreign body sensation, and discomfort. The pathogenesis described in Ayurveda closely resembles the clinical features and inflammatory nature of dry eye disease.

Aschyotana is the first-line *Kriyakalpa* recommended for many ocular disorders because it delivers medicine directly to the ocular surface. Modern ophthalmology similarly recognizes topical administration as the preferred route for achieving higher local drug concentrations while minimizing systemic exposure. Thus, the classical concept of Aschyotana is consistent with current principles of topical ocular drug delivery.

Shunthyadi Aschyotana acts by mitigating *Kapha Avarodha*, the formulation may facilitate the unobstructed functioning of ocular channels (*Srotas*), while its *Snehana* property improves lubrication of the ocular surface. These combined effects may help restore tear film stability, reduce ocular discomfort, and alleviate the clinical manifestations of *Shushkakshipaka* (Dry Eye Disease).

Published literature specifically evaluating *Shunthyadi Aschyotana* remains limited. The available evidence primarily comprises pharmaceutical standardization studies, analytical evaluations, and a few clinical investigations assessing its therapeutic efficacy in the management of *Shushkakshipaka* (dry eye disease). These studies have reported improvements in clinical symptoms such as ocular dryness, burning sensation, foreign body sensation, and overall patient comfort. However, the majority of these investigations have focused on clinical outcomes rather than elucidating the underlying pharmacological or mechanistic basis of the formulation.

Despite these encouraging observations, the existing body of evidence has several limitations. Most published studies are characterized by small sample sizes, single-centre study designs, inadequate control groups, and a lack of detailed mechanistic investigations. Furthermore, standardized formulations, objective biomarker assessments, and long-term follow-up data are scarce. Therefore, while the available evidence supports the potential role of *Shunthyadi Aschyotana* in the management of dry eye disease, it remains insufficient to establish definitive conclusions regarding its efficacy and mode of action. Well-designed, randomized controlled trials and mechanistic studies are warranted to validate its therapeutic potential and strengthen the evidence base.

CONCLUSION

Based on the available Ayurvedic literature, pharmacological evidence of its constituent herbs, and the current understanding of dry eye disease pathophysiology, *Shunthyadi Aschyotana* appears to have a plausible multitarget therapeutic role. Nevertheless, its proposed mechanisms remain hypothesis-generating rather than conclusively proven, highlighting the need for robust experimental and clinical research to validate its efficacy and elucidate its mode of action.

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Cite this article as:
Meghna Motwani, Ganga R. Hadimani, Jyoti Khokhani. Exploring the Mode of Action of Shunthyadi Aschyotana (Eye Drop) in Dry Eye Disease: An Ayurvedic and Modern Literature Review. International Journal of Ayurveda and Pharma Research. 2026;14(10):107-112.
https://doi.org/10.47070/ijapr.v14i10.4448
Source of support: Nil, Conflict of interest: None Declared

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