WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 10, 543-562. Review Article ISSN 2277–7105

PRACTICAL UTILITY AND PHARMACOKINETICS OF *NETRA KRIYAKALPA* IN EYE DISORDERS: A NARRATIVE REVIEW

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Article Received on 14 April 2026,
Article Revised on 04 May 2026,
Article Published on 16 May 2026,

https://doi.org/10.5281/zenodo.20201935

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How to cite this Article: *[1]Dr. Prabi K. P., [2]Prof. Dr. Shamsa Fiaz. (2026). Practical Utility And Pharmacokinetics Of *Netra Kriyakalpa* In Eye Disorders: A Narrative Review. World Journal of Pharmaceutical Research, 15(10), 543–562.

ABSTRACT

Background: *Netra Kriyakalpa* are specialized external therapeutic procedures described in Ayurveda for the prevention and management of ocular disorders. These procedures, including *Aschyotana, Seka, Tarpana, Putapaka, Anjana, and Bidalaka*, are designed to deliver medicaments directly to ocular structures. Their therapeutic effects are explained on the basis of *Dosha shamana, Srotoshodhana*, and nourishment of ocular tissues. Elucidation of their mode of action is essential for establishing their scientific rationale and clinical relevance. **Materials and Methods:** A conceptual review was conducted using classical Ayurvedic texts such as *Sushruta Samhita*, *Ashtanga Hridaya*, and relevant commentaries. Contemporary literature related to ocular drug delivery and pharmacodynamics was also reviewed to correlate traditional principles with modern physiological mechanisms.

Results: *Netra Kriyakalpa* primarily act by local pacification of *Pitta* and *Kapha Dosha*, reduction of ocular inflammation, and improvement of tissue metabolism. Procedures involving drug retention, such as *Tarpana* and *Putapaka*, provide sustained drug contact leading to deeper tissue action, whereas procedures like *Seka* and *Aschyotana* offer rapid relief by acting on superficial ocular tissues. The mode of action of *Kriyakalpa* can be attributed to prolonged drug contact time, enhanced transcorneal absorption, and stimulation of local microcirculation. From a contemporary perspective, these procedures facilitate improved bioavailability, anti-inflammatory effects, tear film stabilization, and neurovascular modulation, supporting their therapeutic outcomes. **Conclusion:** *Netra Kriyakalpa* exert

multifactorial therapeutic actions through localized *Dosha* regulation and enhanced ocular drug delivery. Integration of Ayurvedic principles with modern pharmacological concepts provides a scientific basis for their effective clinical application in ocular disorders.

KEYWORDS: *Netra Kriyakalpa*; Mode of Action; Ayurvedic Ophthalmology; Ocular Drug Delivery; *Dosha Shamana.*

INTRODUCTION

Netra Kriya Kalpa refers to a group of specialized external therapeutic procedures (*Bahi-parimarjana chikitsa*) specifically designed for the management of ocular disorders. Just as *Panchakarma* forms the cornerstone of *Kayachikitsa*, *Netra Kriya Kalpas* constitute the fundamental therapeutic approach in *Netra Chikitsa.* These procedures are carefully tailored according to the anatomical characteristics of the eye and the specific nature of ocular diseases. Each *Kriya Kalpa* is distinct in its application and therapeutic action, contributing uniquely to ocular health and disease management.

ETYMOLOGY & DEFINITION

क्रियाणां तर्पणपुटपाकादीनां कल्पनं करणं क्रियाकल्पः।(Susruta Uttara Tantra 18/2, Dalhaṇa)

Here, the word *Kriya* means the special therapeutic procedure and *Kalpa* means formulations like *Svarasa, Ghrita, Kashaya*, etc.

CLASSIFICATION OF NETRA KRIYAKALPA

Charaka Samhita describes three types of *Netra Kriyakalpas*. *Sushruta* and *Vagbhata* expanded this classification to five, while *Sharangadhara* further elaborated the concept by including two additional procedures, thereby describing a total of seven *Kriyakalpas*. This progressive classification reflects the evolution and refinement of ocular therapeutic procedures in Ayurveda.

Charaka Samhita	Sushruta & Vagbhata	Sharngadhara Samhita
1. Bidalaka	*1. Seka*	*1. Seka*
2. Aschyotana	*2. Aschyotana*	*2. Aschyotana*
3. Anjana	*3. Anjana*	*3. Anjana*
—	*4. Tarpana*	*4. Tarpana*
—	*5. Putapaka*	*5. Putapaka*
—	—	*6. Pindi*
—	—	*7. Bidalaka*

Rationale and Advantages of Topical Ocular Therapeutics (*Netra Kriyakalpa*) Over Oral Drug Administration

Topical ocular therapeutic interventions, collectively described as *Netra Kriyakalpa*. These procedures are specifically designed to deliver therapeutic agents directly to ocular tissues, thereby ensuring localized and targeted drug action.[1] In contrast, oral drug administration lacks direct ocular targeting and depends on systemic distribution to reach the eye.[1] Drugs administered through *Netra Kriyakalpa* bypass gastrointestinal digestion and first-pass hepatic metabolism, allowing greater preservation of pharmacological potency at the site of action.[2] Conversely, orally administered medications are subjected to systemic digestion and metabolism, which may substantially reduce their effective concentration within ocular tissues. An additional advantage of topical ocular administration is the ability to control and monitor the duration of drug–tissue contact, thereby optimizing therapeutic efficacy. Such precision is not achievable with oral drug delivery, where tissue exposure remains unpredictable. Due to direct ocular application, *Netra Kriyakalpa* facilitates improved drug penetration to target tissues. Oral medications must traverse physiological barriers, including the blood–aqueous, blood–vitreous, and blood–retinal barriers, which significantly restrict drug availability to ocular structures. Consequently, topical ocular therapies demonstrate superior bioavailability at the target site with minimal systemic exposure. In comparison, oral drug administration results in lower ocular bioavailability owing to systemic dilution and biological barriers.[2]

SAMHITA REVIEW

Acharya Sushruta devoted the eighteenth chapter of *Uttara Tantra* to the description of these procedures. In *Ashtanga Hridaya*, the twenty-third and twenty-fourth chapters are exclusively assigned to *Aschyotana–Anjana Vidhi* and *Tarpana–Putapaka Vidhi*, respectively, for elaborating *Netra Kriyakalpa*. Similarly, *Ashtanga Sangraha* has also dedicated two chapters to these procedures, following the same classification as mentioned in Ashtanga Hridaya. *Sharngadhara Samhita* describes seven types of *Netra Kriyakalpas* in Uttarakhand, Chapter 13, under the title *Netra Prasadana Karmani*. In contrast, *Charaka Samhita* mentions three *Netra Kriyakalpas* in *Chikitsa Sthana*, Chapter 26 (verses 2–31).

CONCEPTUAL VARIATIONS

Although procedures like *Bidalaka* and *Pindi* are not explicitly classified as *Kriyakalpas* in *Ashtanga Hridaya* and *Sushruta Samhita*, these procedures are discussed in various contexts

along with their combinations and specific indications. Additionally, techniques such as *Avagundana, Avachurnana, Gharshana, and Pratisarana* are also described in classical texts for the management of different eye disorders.

AMAVASTA AND *NIRAMAVASTHA* BASED SELECTION OF OCULAR THERAPY

The selection of *Netra Kriya-kalpa* should be stage-specific, with *Shodhana*-oriented procedures such as *Seka and Aschyotana, Pindi, Bidalaka,* preferred during the *Ama* phase, while nourishing and strengthening interventions including *Anjana, Tarpana and Putapaka* are best reserved for the *Nirama* stage after complete resolution of inflammation.

ASCHYOTANA

Aschyotana is a therapeutic ocular procedure in which a medicated liquid is administered dropwise into the open eye from a prescribed height of approximately two *Angulas,* allowing rapid local drug action and serving as an Ayurvedic equivalent of topical ocular therapy.

MODE OF ACTION OF *ASCHYOTANA*

***Dosha Shamaka* Action:** The therapeutic efficacy of *Aschyotana* is primarily attributed to *Dosha Shamaka* action. Selection of drugs possessing *Sheeta* or *Ushna Virya* pacifies aggravated *Pitta* or *Vata Dosha*, which are predominantly involved in inflammatory and painful eye conditions.[2] Drugs with *Tikta* and *Kashaya Rasa* exhibit *Shothahara* and *Raktaprasadana* actions, leading to reduction in ocular inflammation and congestion.[3] The presence of *Snigdha Guna* counteracts ocular dryness *(Rukshata*) and stabilizes *Vata* at the ocular surface, thereby improving lubrication and comfort.[4] These combined effects result in alleviation of *Daha* (burning), *Raga* (redness), *Shotha* (edema), and *Ashru Srava* (watering).

***Srotoshodhana* (Cleansing of Ocular Microchannels):** *Aschyotana* facilitates *Srotoshodhana* of *Netra Srotas* through continuous contact and gentle flushing of the ocular surface. This action helps in the removal of *Ama, Kapha Mala,* and inflammatory secretions, which are responsible for obstruction and chronicity of disease by clearing these microchannels, *Aschyotana* improves local circulation and tissue nutrition, restoring physiological balance in ocular tissues.[5]

Local *Agni Deepana* and *Dhatu Poshana*: Ayurvedic texts describe the importance of *Bhrajaka Pitta* in local metabolic activities. *Aschyotana* enhances *Bhrajaka Pitta*–like activity at the ocular surface, promoting local metabolism and tissue responsiveness.

Adequate nourishment of *Rasa* and *Rakta Dhatu* is achieved, which is essential for maintaining ocular tissue vitality. This results in improved epithelial repair, faster healing, and restoration of normal ocular function.

***Sthanika Karma* (Local Drug Action):** Direct instillation of medicated liquid ensures *Sthanika Karma*, allowing the drug to act precisely at the *Netra Adhishthana*. This localized administration bypasses systemic metabolism and enhances therapeutic efficacy. The immediate availability of the drug at the site of action explains the rapid relief of pain, burning, and redness commonly observed following *Aschyotana*.

OCULAR DRUG DELIVERY CORRELATION

From a modern pharmacological viewpoint, *Aschyotana* closely resembles topical ocular drug delivery systems. After instillation, the liquid mixes with the tear film and spreads uniformly over the ocular surface. The drug penetrates ocular tissues through the corneal epithelium and conjunctiva, depending on its physicochemical properties. This route achieves high local bioavailability with minimal systemic absorption, which is the fundamental principle of modern ophthalmic therapy.

Tear Film Modulation and Anti-inflammatory Action: *Aschyotana* contributes to dilution and washout of inflammatory mediators present in the tear film, thereby reducing ocular surface inflammation. Enhanced ocular surface hydration improves tear film stability and epithelial protection, which is essential for ocular surface homeostasis. These mechanisms explain the rapid symptomatic improvement seen in acute inflammatory eye conditions.

Antimicrobial and Antioxidant Effects: Several herbal drugs traditionally used in *Aschyotana* possess experimentally proven antimicrobial and antioxidant properties. These properties help reduce microbial load and oxidative stress on the ocular surface, supporting its traditional use in infective and inflammatory eye disorders.[6]

According to *Ayurveda* the instilled medicine will penetrate into the *Akshikosha Srotas, Shira Srotas, Ghrana Srotas*, and *Mukha Srotas* of the *Urdhvanga Bhaga* and remove the *Mala* present there.[7] The Ayurvedic concepts of *Dosha Shamaka, Srotoshodhana*, and *Dhatu Poshana* correlate well with modern mechanisms such as local drug delivery, anti-inflammatory action, tear film stabilization, and epithelial healing. Most of the ophthalmic medications are formulated to be applied topically. The classical pharmacokinetic theory

based on the studies of systemically administered drugs does not fully apply to all ophthalmic drugs. However, similar principles of absorption, distribution, metabolism, and excretion are applicable to the drug disposition in the eye.[3] Thus, *Aschyotana* can be regarded as the Ayurvedic equivalent of topical ocular pharmacotherapy, offering a holistic and multi-targeted approach with a favourable safety profile. *Aschyotana* exerts its therapeutic effects through local drug action, Dosha pacification, cleansing of ocular microchannels, and tissue nourishment, which closely align with contemporary principles of ocular pharmacology. This integrative understanding validates the continued clinical relevance of *Aschyotana* in present-day ophthalmic practice.

NETRA SEKA

Seka is an external ocular therapeutic procedure in which a fine, continuous stream of medicated liquid is gently poured over the closed eyes from a prescribed height, and it is also known by the term *Parisheka*.

MODE OF ACTION OF *NETRA PARISHEKA*

Local *Dosha* Pacification: The continuous pouring of a medicated liquid directly over the closed eyelids produces a cooling and soothing effect on inflamed tissues, helping reduce burning (*Daha*), redness (*Raga*), and irritation. This local application increases direct drug contact with the ocular tissues, enhancing local dosha pacification and symptom relief.[8]

***Srotoshodhana* (Cleansing of Micro Channels):** According to Ayurvedic physiological concepts, inflammation leads to *Srotorodha* (blockage of channels) due to accumulation of morbid doshas and exudates. The continuous flow of medicated fluid during *Parisheka* mechanically flushes stagnant secretions and accumulated doshas from the ocular surface and periocular micro-channels. This cleansing action restores local equilibrium, facilitating normalization of tissue fluids and promoting healing.

Action of Medicated Liquids: The herbal decoctions used in *Parisheka* are chosen for their traditional qualities such as cool potency (*Sheeta veerya)* and anti-inflammatory/soothing effects. These qualities are believed to pacify aggravated *Pitta* and *Rakta*, and the *laghu, sukshma* properties of the liquid enhance penetration and surface contact. The direct application supports classical Ayurvedic aims of reducing inflammation and supporting metabolic balance in the *Netra Mandala*.

Neuro-Sensory and Comfort Effects: Although not explicitly discussed as "pharmacological action" in classical texts, the gentle and continuous flow of medicated fluid produces a calming and relaxing effect on ocular nerves, reducing subjective discomfort such as burning, irritation, and foreign body sensation.

Contemporary (Modern) Mode of Action Correlation

Mechanical Irrigation and Debris Removal: In modern ophthalmic practice, ocular irrigation is widely used to flush away tears, inflammatory mediators, pollutants, and debris from the conjunctival sac and ocular surface. *Netra Parisheka's* continuous flow acts similarly by mechanically removing inflammatory mediators and surface irritants, which can help reduce symptoms such as burning, itching, and redness in ocular surface conditions.

Enhanced Drug Contact and Bioavailability: By maintaining a continuous stream of medicated solution over the closed eye, *Netra Parisheka* increases contact time between therapeutic agents and ocular tissues, unlike conventional eye drops that are rapidly cleared by blinking and tear turnover. This extended contact theoretically enhances the local bioavailability of pharmacologically active herbal constituents.[9]

Clinical Evidence in Dry Eye (*Shushkakshipaka):* A randomized clinical study comparing *Netra Parisheka* combined with Ayurvedic topical therapy (*Keshanjana)* versus standard artificial tears in *Shushkakshipaka* (dry eye syndrome) demonstrated symptom improvement across multiple parameters, including foreign body sensation, burning, dryness, and tear film stability, suggesting clinical effectiveness in ocular surface inflammatory disorders.

Cost-Effectiveness and Safety: In the aforementioned clinical trial, *Netra Parisheka* was shown to be a safe and cost-effective adjunctive treatment for dry eye syndrome with comparable efficacy to standard therapies in many subjective and objective outcomes, highlighting its potential application in integrative ophthalmic care.

Netra Parisheka's mode of action integrates Ayurvedic therapeutic principles (*dosha* pacification, *srotoshodhana*, and targeted local application) with contemporary biomedical analogues (mechanical irrigation, enhanced drug contact, and symptom modulation). Clinical evidence, supports its efficacy and safety as a complementary ocular surface therapy when combined with topical Ayurvedic agents, positioning it as a rational integrative approach in inflammatory and surface-related eye disorders.

BIDALAKA

Bidalaka is an external ocular procedure in which a medicated herbal paste is applied over the closed eyelids, carefully avoiding the eyelashes and lid margins, with the thickness of application comparable to that prescribed for *Mukhalepa.*

MODE OF ACTION OF *BIDALAKA*

Bidalaka is described as a *Bahya Netra Kriyakalpa* wherein a medicated herbal paste is applied externally over the closed eyelids, avoiding the eyelashes and lid margins. This procedure is primarily indicated in inflammatory ocular conditions and acts through local *Dosha Shamana*, predominantly targeting *Pitta* and *Rakta Dosha*, which are chiefly responsible for manifestations such as redness, burning, pain, and swelling of the eyes. The local application ensures site-specific action and minimizes systemic involvement, making *Bidalaka* an effective external therapeutic modality in Shalakya Tantra.[10]

Dosha Shamana (Pitta–Rakta Pradhana Karma): Most *Bidalaka* formulations are composed of drugs possessing *Sheeta, Madhura, Tikta,* and *Kashaya rasa,* which are classically indicated for *Pitta Shamana*. These *Rasa* and *Guna* attributes help in alleviating *Daha* (burning sensation), *Raga* (redness), *Shotha* (edema), and *Ruja* (pain) associated with inflammatory eye disorders. In addition, the *Rakta Shodhana* and *Rakta Prasadana* actions of these formulations contribute to symptomatic relief in conditions such as *Abhishyanda*, *Netra daha*, and *Vartma shotha*, which are described as *Pitta-Rakta* dominant disorders in Ayurvedic texts.[11]

***Sthanika Karma* (Local Therapeutic Action):** The application of *Bidalaka* over the eyelids facilitates direct action on *Vartma, Sandhi*, and *Netra Srotas,* thereby enhancing localized therapeutic efficacy. The eyelid skin is thin and highly vascular, which supports the Ayurvedic concept of *Sukshma bhava* penetration of drug principles. This localized approach ensures better bioavailability of active constituents at the site of pathology and explains the rapid relief observed in acute ocular inflammatory conditions.[12]

***Srotoshodhana* and *Shothahara* Action:** *Bidalaka* is also believed to exert *Srotoshodhana* action by clearing micro-obstructions in minute ocular channels (*sukshma srotas*), thereby improving local circulation and tissue nutrition. Drugs with *Lekhana* and *Shothahara* properties reduce lid congestion and edema, leading to visible reduction in swelling and

discomfort. Clinical observations from indexed Ayurvedic studies report significant improvement in lid edema, congestion, and pain following *Bidalaka* application.

***Daha-Shamana* and *Vedana-Sthapana* Effect:** The cooling (*Sheeta*) nature of Bidalaka formulations counteracts ocular heat and pacifies aggravated Pitta dosha, resulting in prompt *Daha-shamana* and *Vedana-sthapana* effects. Sustained contact of the medicated paste over the eyelids provides a soothing effect, contributing to early symptomatic relief in inflammatory eye conditions.[13]

Modern / Contemporary Perspective: From a contemporary viewpoint, *Bidalaka* can be understood as a topical transdermal drug delivery system for periocular tissues. The eyelid skin is among the thinnest in the human body, allowing enhanced percutaneous absorption of phytoconstituents. Experimental studies have demonstrated that eyelid skin offers lower barrier resistance compared to other dermal sites, facilitating better penetration of lipophilic and low-molecular-weight compounds into periocular tissues.[13] Many herbs used in *Bidalaka* formulations possess documented anti-inflammatory, antioxidant, and analgesic properties, which help in reducing inflammatory mediators, oxidative stress, and vascular permeability at the local level. These pharmacological actions correlate with the observed reduction in redness, edema, and pain following *Bidalaka* application.[14] Local application also produces a vasomodulatory and decongestant effect, reducing capillary dilatation and improving venous drainage from eyelid tissues. Additionally, the sustained cooling contact of the herbal paste produces a thermotherapy-like effect, aiding in local temperature regulation and alleviation of burning sensation and irritation.

Thus, *Bidalaka* acts through local pacification of Pitta and Rakta dosha, improvement of microcirculation, clearance of obstructed ocular srotas, and transdermal absorption of active herbal constituents through the thin eyelid skin. The combined Ayurvedic and contemporary mechanisms result in effective relief from pain, burning, redness, congestion, and swelling of the eyes, validating *Bidalaka* as an important external therapeutic procedure in ocular inflammatory disorders.

PINDI

Pindi is a modified form of *Bidalaka* in which a medicated herbal paste is enclosed within a cloth bolus and gently placed over the closed eyes for a prescribed duration; it is also referred to as *Kavalika.*

MODE OF ACTION OF PINDI

Local Dosha Shamana (Pacification): *Pindi* application directly contacts the peri-ocular tissues, allowing local pacification of vitiated *Pitta* and *Rakta* doshas involved in conditions such as *Abhishyanda* and *Anjananamika*.[15] Medicated pastes commonly contain herbs with anti-inflammatory and anti-oxidant properties (e.g., *Haridra, Triphala, Daruharidra*) that help reduce *Shotha* (swelling) and inflammation.

Transdermal Drug Absorption & Increased Contact Time: Pindi retains medicated paste over the eyelids longer than *Bidalaka* or liquid therapies, increasing drug contact time and absorption through the thin peri-ocular skin. The eyelid skin's thin and vascular nature facilitates transdermal absorption of both lipophilic and hydrophilic herbal phytoconstituents, reaching underlying tissues. This reflects a transdermal drug delivery mechanism, where extended exposure allows enhanced absorption compared with brief drop instillation.

Local Swedana & Microcirculatory Effects: When *Pindi* is applied warm, it induces a mild *Swedana* (fomentation) effect, increasing local vasodilation and microcirculation, which helps remove inflammatory mediators and metabolic wastes (*Ama*) from peri-ocular tissues. Enhanced superficial blood flow can accelerate resolution of inflammation and promote tissue healing.[16]

Clinical and Case Evidence-Case Report in External Hordeolum (Stye): A case study administering *Nimbadi Pindi* with *Patoladi Kashaya Parisheka* daily for 7 days in *Anjananamika (external hordeolum)* showed significant improvement in pain, foreign body sensation, congestion, tearing and photophobia. This supports the anti-inflammatory and soothing action of *Pindi* in acute suppurative eyelid conditions.[17]

Contemporary Pharmacological Correlations: Transdermal Pathways

Studies on *Pindi* emphasize two absorption pathways through the eyelid skin:Epidermal (transcellular and intercellular) and Appendageal (via hair follicles and glands) These pathways facilitate both lipophilic and hydrophilic drug uptake into periocular tissues. This is conceptually similar to modern skin permeation principles used in transdermal drug delivery.

Controlled Localized Drug Delivery: Compared to immediate drainage seen in eye drop administration, *Pindi's* longer exposure time enhances local drug bioavailability and may

sustain therapeutic effects.[18] Modern topical ophthalmic research also seeks prolonged contact formulations for better drug delivery, paralleling the rationale of *Pindi.*

TARPANA

Akshi Tarpana is an ocular therapeutic procedure in which medicated ghee is retained over the eyes within a specially prepared boundary for a prescribed duration, with the purpose of nourishing and strengthening the ocular tissues; it is also known as *Netra Basti.*

MODE OF ACTION OF *TARPANA*

Concept and Procedural Basis:*Tarpana* is indicated mainly in *Vata–Pitta* predominant *Netra Rogas* and is intended to nourish and strengthen ocular tissues through *Snehana* and *Brimhana Karma*.[19]

Dosha Shamana (Vata–Pitta Pradhana Karma): The *Snigdha, Guru,* and *Sheeta* properties of *Ghrita* effectively pacify aggravated Vata dosha, which is responsible for ocular dryness, pain, roughness, fatigue, and degenerative changes. The *Sheeta Guna* also helps in *Pitta Shamana,* thereby reducing burning sensation, irritation, and ocular discomfort. Restoration of *Alochaka Pitta* ensures proper visual function and clarity.[20]

***Sthanika Karma* (Local Therapeutic Action):** Retention of medicated *Sneha* over the eyes produces a strong *Sthanika Karma,* allowing the drug to act directly on *Netra Sandhi*, *Drishti Mandala,* and *Akshi Srotas*. Classical texts explain that *Sneh*a retained for adequate time penetrates *Sukshma Srotas*, removes obstruction, and exerts sustained therapeutic action at the site of pathology.[21]

Brimhana* and *Dhatu Poshana: *Tarpana* provides *Brimhana* to ocular tissues by nourishing *Rasa, Rakta*, and *Majja Dhatu*, thereby improving ocular strength, endurance, and resistance to degeneration. *Ghrita* is described as a superior *Yogavahi*, enhancing the therapeutic efficacy of drugs processed in it and supporting long-term ocular health.

***Rasayana* and Anti-degenerative Action:** Medicated ghrita used in *Tarpana* often possesses *Rasayana* properties, which help in delaying degenerative changes of ocular tissues, enhancing tissue regeneration, and maintaining visual acuity, particularly in chronic and age-related eye disorders.[22]

***Srotoshodhana* and *Netra Balya* Effect:** The Sneha medium facilitates *Srotoshodhana* by clearing micro-obstructions in *Akshi Srotas*, thereby improving local circulation and nutrient supply. This results in *Netra Balya* effect, reducing ocular fatigue and improving functional stability of the eye.

Modern / Contemporary Perspective

Sustained Ocular Drug Delivery: Tarpana can be understood as a sustained ocular drug-retention technique in which prolonged contact of a lipid-based medium with the ocular surface increases drug residence time, similar to controlled-release ophthalmic systems.

Enhanced Corneal and Conjunctival Permeability: Lipid-based media such as *Ghrita* enhance corneal and conjunctival permeability, allowing better penetration of lipophilic phytoconstituents into ocular tissues. Prolonged exposure further improves local bioavailability without systemic absorption.[23]

Lubrication and Tear Film Stabilization: The unctuous nature of *Ghrita* improves ocular surface lubrication, reduces tear film evaporation, and enhances tear film stability, thereby alleviating dryness, irritation, and eye strain.[24]

Anti-inflammatory and Antioxidant Effects: Many herbs used in medicated *Ghrita* possess documented anti-inflammatory and antioxidant properties, which reduce oxidative stress, inflammatory mediators, and cellular damage in ocular tissues.

Cytoprotective and Microcirculatory Effects: Improved ocular surface hydration and reduced inflammation support cellular integrity and microcirculation, facilitating tissue repair and functional recovery in chronic ocular conditions.

Tarpana acts by *Snehana, Brimhana, Rasayana*, and *Vata–Pitta shamana* at the Ayurvedic level, while at the modern level it functions as a lipid-based sustained ocular therapy improving lubrication, bioavailability, antioxidant defense, and tissue protection, thereby restoring ocular comfort and function.

PUTAPAKA

Putapaka is a *Netra Kriyakalpa* generally performed after *Akshi Tarpana*, in which medicated extract prepared through a specific heating process is administered to the eyes using a procedure similar to *Tarpana,* with variations in drug preparation, composition, and duration.

MODE OF ACTION OF PUTAPAKA

Concept and Procedural Basis: Classical texts describe *Putapaka* as a *Shodhana-anubandha Brimhana Karma*, primarily intended to remove excess *Sneha*, clear ocular channels, and restore normal physiological balance of the eye after nourishment therapy.[25]

Dosha Shamana (Kapha–Pitta Pradhana Karma): *Putapaka* predominantly pacifies *Kapha Dosha*, which tends to increase following *Tarpana* due to excessive *Sneha*. By removing excess unctuousness and secretions, *Putapaka* prevents symptoms such as heaviness, stickiness, blurred vision, and excessive lacrimation. It also helps in *Pitta Shamana*, thereby reducing burning sensation and irritation of the eyes.[26]

***Sthanika Shodhana* (Local Cleansing Action):** The primary action of *Putapaka* is *Sthanika Shodhana* of the eye. The medicated preparation cleanses *Netra sandhi*, *Drishti mandala*, and *Akshi Srotas*, eliminating residual *Sneha*, metabolic waste, and morbid doshas accumulated during *Tarpana*. Classical references emphasize that *Putapaka* restores clarity and lightness to the eye by re-establishing normal ocular physiology.[27]

Srotoshodhana* and *Indriya Prasadana: *Putapaka* facilitates *Srotoshodhana* by clearing micro-obstructions in ocular channels, thereby improving the flow of nutrients and sensory impulses. This results in *Indriya Prasadana*, manifested as improved clarity of vision, lightness of the eyes, and enhanced functional capacity of the visual apparatus.

***Netra Balya* and *Chakshushya* Effect:** Though primarily a cleansing procedure, *Putapaka* also exerts a *Netra Balya* effect by restoring equilibrium between nourishment and cleansing. The procedure supports *Chakshushya Karma*, helping to maintain visual acuity and ocular comfort, particularly in chronic eye disorders.

Modern / Contemporary Perspective

Removal of Excess Lipid Residue: From a modern standpoint, *Putapaka* acts as a post-retention ocular cleansing therapy. Following prolonged lipid exposure during *Tarpana*, *Putapaka* helps remove residual oily material from the ocular surface, thereby preventing tear film instability, blurred vision, and discomfort.

Restoration of Tear Film Dynamics: By clearing excess lipid and debris, *Putapaka* aids in restoring normal tear film composition and distribution, improving optical clarity and ocular

comfort. This correlates with stabilization of the tear film after intensive lubrication therapies.[28]

Anti-inflammatory and Mild Decongestant Effect: Medicinal substances used in *Putapaka* often possess anti-inflammatory and soothing properties, which help reduce mild congestion, irritation, and surface inflammation of the eye following *Tarpana*.

Enhancement of Ocular Surface Function: Clearing the ocular surface improves oxygen diffusion, epithelial metabolism, and microcirculation, thereby enhancing ocular surface health and functional recovery. This supports the traditional concept of *Indriya Prasadana* described in Ayurvedic texts.[29] *Putapaka* acts primarily as a local cleansing and balancing ocular therapy, removing excess *Sneha* and *Kapha* after *Tarpana*, restoring patency of ocular channels, improving tear film dynamics, and enhancing visual clarity. Through *Srotoshodhana*, *Kapha–Pitta Shamana*, and *Indriya Prasadana*, *Putapaka* complements *Tarpana* and ensures optimal functional restoration of the eye.

ANJANA

Anjana is a *Netra Kriyakalpa* in which a medicated collyrium is applied to the inner margin of the lower eyelid, extending from *Kaṇinika s*andhi to *Apaṅga sandhi*, using an *Anjana śalaka* or fingertip, for therapeutic as well as preventive management of ocular disorders.[30]

MODE OF ACTION OF *ANJANA*

***Dosha Shamana (Kapha–Pitta–Vata* Balancing):** In Ayurvedic pharmacodynamics, Anjana is formulated to pacify *Pitta* and *Kapha doshas* which manifest in the eye as redness, discharge, irritation, and excessive secretions. By striking a balance between doshas in ocular tissues, Anjana reduces symptoms such as burning (*Daha*), watering (*Ashru srava*), itching (*Kandu*), and discharge (*Pushti* disturbances).

***Sthanika Karma* (Local Targeting):** *Anjana's* medicated substances act locally on *Netra sandhi*, cul-de-sac, conjunctival and superficial ocular tissues. Classical texts describe that the active principles of *Anjana* penetrate through *Srotas a*nd surface layers, thereby clearing dosha obstructions and restoring balance. Several formulations of *Anjana* described in Bruhat Trayi emphasize its role as a site-specific therapy targeting ocular micro-channels.[31]

Netra Balya* and *Indriya Prasadana: By pacifying vitiated *Doshas* and removing obstructions in *Srotas*, *Anjana* helps in *Netra Balya* (strengthening eye structures) and *Indriya*

Prasadana (enhancing sensory clarity). Improved regulation of *Alochaka Pitta* and stabilization of ocular *Srotas* translates into better vision and reduced ocular discomfort.[32]

Modern / Contemporary Correlation

Enhanced Topical Drug Delivery and Retention: The *Shikha Sharma et al.* narrative review describes *Anjana Karma* as a topical, non-invasive drug delivery system in which medicated collyrium formulations — particularly those containing herbo-mineral and metallo-mineral *Bhasmas* — may aid in increased adhesion, penetration, and sustained drug release at the ocular surface, thereby improving local bioavailability.

Particle Size–Mediated Absorption: Metallo-mineral components in *Anjana* are often processed to nanometer-range particle sizes (~10–500 nm). Such fine particles can enhance ocular surface adhesion and penetration, potentially aiding passage across barriers like the conjunctiva and cornea, which is similar to modern nano-formulation strategies used in ophthalmic drug delivery.[33]

Tear Film Interaction and Ocular Surface Dynamics: *Anjana* remains in contact with the tear film and conjunctival sac longer than simple drops due to its semisolid form. This prolonged residence time reduces washout by tears and blinking, enhances localized activity, and may lead to more sustained therapeutic effects.

Symptom Relief and Biophysical Effects: Modern phytochemistry and nanoparticle science support that *Anjana* formulations — especially those with metallo-mineral ingredients — may exhibit adhesive, anti-inflammatory, antimicrobial, and sustained-release properties. These properties can help decrease ocular surface irritation, congestion, and inflammatory symptoms, aligning with traditional Ayurvedic outcomes described for *Anjana*.[34] *Anjana* acts in Ayurveda by balancing *Pitta* and *Kapha Doshas*, clearing obstructions in ocular *Srotas*, and enhancing *Netra Balya* and visual clarity through local targeting of diseased tissues. Modern reviews support that *Anjana*'s medicated collyrium formulations — especially those containing engineered metallo-mineral particles — may provide enhanced topical drug retention, penetration, and sustained bioavailability at the eye surface, helping relieve symptoms and improve ocular health.

AVAGUNTANA

Avaguṇṭana is a *Netra Kriyakalpa* procedure described in *Aṣṭhanga Hṛdaya* and *Aṣṭhanga Saṅgraha*, in which finely powdered medicinal drugs are wrapped in a clean cloth and applied over the eyes for the management of various ocular disorders.

MODE OF ACTION OF *AVAGUNTANA*

Concept and Procedural Basis: Classical texts imply this is a preparatory and cleansing therapy to soften and mobilize vitiated doshas in superficial ocular tissues, facilitating their movement toward elimination and improving ocular tissue responsivity.[35]

***Dosha Shamana (Kapha–Vata* Predominance):** In ocular conditions where *Kapha* and *Vata* doshas predominate (manifesting as heaviness, stiffness, dryness, itching, congestion), *Avaguntana's Ushna* (warm) and *Snigdha* (moist) heat effects help in *Kapha vilayana* (liquefying viscous secretions) and *Vata Anulomana* (normalizing flow), thus relieving symptoms of congestion and discomfort. The warmth "loosens" accumulated stagnant doshas around *Netra srotas*, allowing easier elimination.

***Srotoshodhana* (Channel Cleansing) and *Shothahara* (Decongestant):**Ayurvedic texts suggest that fomentation helps open microscopic *Srotas* (minute channels), improving flow and clearing obstructions. In *Avaguntana*, the moist heat penetrates superficial ocular tissues and supports evacuation of dosha-linked stagnations, reducing *Raga* (redness) and *Shotha* (swelling) in periocular regions.

***Netra Indriya Prasadana* and Functional Normalization:**By eliminating stagnation and balancing doshas locally, *Avaguntana* is said to restore the normal function of *Alochaka Pitta* and sensory pathways, resulting in improved ocular comfort, clarity of vision, and *Indriya Prasadana* (clarity of sensory experience).[36]

Modern / Contemporary Correlation

Localized Moist Heat Therapy: *Avaguntana*'s warm fomentation effect is analogous to modern moist heat therapy applied in ophthalmology (e.g., warm compresses), which is clinically recognized for increasing blood flow, softening secretions, and relieving ocular discomfort. Warm moist heat dilates superficial vessels and improves circulation in periocular tissues, helping in clearance of inflammatory metabolic by-products and congestion —

consistent with the Ayurvedic concept of *Dosha Vilayana* and *Shothahara*. (Modern moist heat therapy literature used in blepharitis and dry eye management supports this effect.)

Improvement of Tear Film and Meibomian Function: While *Avaguntana* is not identical to clinical warm compresses, the heat and humidity likely help in stabilizing the tear film and softening meibomian secretions. In dry, fatigued, or congested eyes, increasing surface temperature improves lipid fluidity and tear dynamics, which correlates with the Ayurvedic idea of alleviating *Vata-Kapha* stagnations on the ocular surface.[37]

Neuromuscular Relaxation and Analgesic Effects: Moist heat is known to reduce neuromuscular tension and may reduce surface nerve sensitization. These analgesic and relaxation effects help relieve symptoms such as irritation, itching, and discomfort — aligning with the Ayurvedic principle that Quenching local doshas also removes pain (*Vedana*) and discomfort.

Enhanced Tissue Oxygenation and Metabolism: Improved circulation due to warmth increases oxygen delivery and lymphatic drainage to superficial ocular tissues, supporting healing and functional recovery. This correlates with Ayurveda's explanation of *Srotoshodhana* (clearing channels) and local dhatu nourishment following dosha mobilization.[36]

Avaguntana works at the Ayurvedic level by producing localized *Swedana* (steam/sudation) that pacifies *Kapha–Vata Doshas*, liquefies stagnated secretions, and clears *Srotas*, thereby reducing redness, swelling, heaviness, and discomfort of the eyes and restoring *Indriya prasadana*. From a contemporary perspective, the procedure functions similarly to moist heat therapy, enhancing local blood flow, improving secretion fluidity, stabilizing tear film dynamics, reducing surface irritation, and supporting microcirculation and neuromuscular relaxation. These effects together explain symptomatic relief and functional improvement seen during *Avaguntana*.

CONCLUSION

Netra Kriyakalpa constitute a scientifically rational and therapeutically effective group of Ayurvedic ocular procedures that act through localized *Dosha* regulation, *Srotoshodhana*, *Dhatu Poshana*, and sustained ocular drug delivery. Their stage-specific application, targeted local action, and minimal systemic exposure make them particularly suitable for both acute

and chronic ocular disorders. Contemporary pharmacological correlations further substantiate their mechanisms in terms of enhanced bioavailability, anti-inflammatory action, tear film modulation, and tissue protection. An integrative understanding of *Netra Kriyakalpa* provides a strong foundation for their continued clinical use and future research in Ayurvedic and integrative ophthalmology.

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