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Review Article

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"CONCEPT OF NETRA KRIYAKALPA (LOCAL OCULAR THERAPIES) AND THEIR PHARMACOLOGICAL VALIDATION"

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ABSTRACT

Introduction: Ayurveda, the traditional system of Indian medicine, provides unique therapeutic modalities for ocular health under the category of *Netra Kriyakalpa* (local ocular therapies). These include Tarpana, Putapaka, Seka, Aschyotana, and Anjana, which are primarily used to treat a wide spectrum of eye disorders ranging from simple refractive strain to degenerative and inflammatory diseases. In modern ophthalmology, localized drug delivery to the eye has gained prominence, which parallels the Ayurvedic emphasis on site-specific treatment. **Methods:** A comprehensive review of Ayurvedic classical texts, commentaries, and Nighantus was conducted, supplemented with a systematic search of PubMed, Scopus, AYUSH Research Portal, and Web of Science for modern experimental and clinical studies. Inclusion criteria involved references to Netra Kriyakalpa in Ayurvedic texts and modern studies exploring pharmacological or clinical validation of these therapies. Exclusion criteria included studies with unclear methodology or insufficient correlation with ocular pharmacology. **Results:** Classical literature documents detailed indications and procedures of Netra Kriyakalpa. Tarpana is beneficial for conditions of dryness and degeneration, whereas Putapaka and Seka provide nourishment and anti-inflammatory effects. Anjana and Aschyotana serve preventive and therapeutic purposes for infections, allergies, and chronic ocular strain. Modern validation highlights the pharmacological potential of herbal drugs used in these therapies, such as Triphala, Yashtimadhu, and Madhu, with antioxidant, anti-inflammatory, antimicrobial, and neuroprotective activities. Comparative insights suggest significant parallels with ocular pharmacology, including topical administration, sustained release, and targeted action. **Discussion:** Netra Kriyakalpa therapies provide an evidence-based rationale for localized ocular drug delivery. Modern pharmacological studies corroborate their efficacy, though large-scale clinical trials are limited. Bridging traditional wisdom with modern validation offers promising prospects for integrative ophthalmic care. **Conclusion:** Netra Kriyakalpa represents a unique Ayurvedic contribution to ophthalmology. Its pharmacological validation underscores its relevance in modern ocular therapeutics and highlights the need for translational research for global acceptance.

KEYWORDS: Anjana, Ayurveda, Netra Kriyakalpa, ocular drug delivery, Tarpana

INTRODUCTION

Ayurveda, one of the oldest healthcare systems, has a well-developed branch of *Shalakya Tantra*, which deals with diseases of the eye, ear, nose, throat, and head. Within this branch, *Netra Roga* (eye diseases) occupy a crucial role, as vision is considered the most precious sense[1-2]. To address ocular conditions, Ayurveda describes both systemic and local therapies. Among them, *Netra Kriyakalpa*—a set of local ocular procedures—represents a unique approach to eye care[3-4].

Netra Kriyakalpa encompasses therapies such as Tarpana (oleation therapy), Putapaka (nutritive eye drops), Seka (stream pouring), Aschyotana (eye drops), and Anjana (collyrium application) [5-6]. These therapies are primarily designed for localized action, enhancing drug bioavailability, reducing systemic side effects, and providing both preventive and curative benefits. Modern ophthalmology also emphasizes targeted ocular drug delivery systems, showing striking similarities to the Ayurvedic approach[7-8].

The aim of this review is to critically analyze the concept of Netra Kriyakalpa as described in classical Ayurvedic literature and to assess its pharmacological validation through contemporary research. The objectives are: (1) to describe the principles and techniques of Netra Kriyakalpa, (2) to explore pharmacological studies supporting these therapies, and (3) to highlight research gaps and future directions for integrative ophthalmology[9-10].

MATERIALS AND METHODS

This review is based on an in-depth analysis of classical Ayurvedic texts including *Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya,* and subsequent commentaries. Terminologies and therapeutic descriptions were extracted and categorized according to different types of Netra Kriyakalpa[11-12].

A systematic literature search was performed using PubMed, Scopus, Web of Science, and AYUSH Research Portal[13]. Search terms included "Netra Kriyakalpa," "Ayurvedic ophthalmology," "Tarpana," "Anjana," "Triphala eye drops," and "ocular pharmacology Ayurveda." Inclusion criteria consisted of studies dealing with Ayurvedic ocular therapies, pharmacological studies on herbal formulations used in Kriyakalpa, and clinical trials on ocular applications of Ayurvedic medicines[14]. Exclusion criteria involved studies without methodological clarity or unrelated to ocular application. Both preclinical and clinical studies were reviewed[15].

OBSERVATION AND RESULTS

Classical Description of Netra Kriyakalpa

Ayurveda emphasizes that the eye, being one of the most delicate sensory organs, requires localized therapies for both prevention and cure. The *Sushruta Samhita* and *Ashtanga Hridaya* describe five major procedures under *Netra Kriyakalpa*: Tarpana, Putapaka, Seka, Aschyotana, and Anjana. Each has distinct indications, drug choices, and procedural steps. The therapies primarily aim to maintain *netra bala* (ocular strength), relieve strain, and treat pathological conditions ranging from inflammatory disorders to degenerative diseases.

1. Tarpana (Retentive Oleation Therapy)

Tarpana involves retaining medicated ghee or oil in a boundary created around the eyes, typically using a dough ring. Classical texts prescribe Tarpana for conditions such as *netra rukshata* (ocular dryness), *timira* (early cataract), and *abhighata janya netra roga* (trauma-induced disorders). The nourishing and lubricating properties of ghee-based formulations help rejuvenate ocular tissues.

Pharmacological evidence: Ghee acts as a natural emulsifier, enhances corneal permeability, and prolongs drug contact time. Studies on *Triphala Ghrita* have demonstrated antioxidant effects and protection against oxidative stress–induced damage to lens proteins, which parallels modern anti-cataract strategies.

2. Putapaka (Medicated Eye Drops Prepared by Heating Method)

Putapaka is administered after Tarpana, using juice extracts of drugs processed by specific heating (*puta*) methods. It is indicated for nourishing ocular tissues and improving vision. There are three varieties—*Snigdha* (unctuous), *Lekhana* (scraping), and *Ropana* (healing)—depending on the intended therapeutic action.

Pharmacological evidence: Herbal ingredients such as *Yashtimadhu* (Glycyrrhiza glabra) and *Bhringaraja* (Eclipta alba) used in Putapaka have documented anti-inflammatory and hepatoprotective activities, suggesting ocular benefits in inflammatory and

degenerative eye conditions.

3. Seka (Continuous Pouring Therapy)

In *Seka*, medicated decoctions or infusions are gently poured over the closed or open eyes for a fixed duration. It is mainly indicated in acute inflammatory conditions such as *abhishyanda* (conjunctivitis), *netra daha* (burning sensation), and *netra shotha* (swelling).

Pharmacological evidence: Decoctions of *Triphala* and *Chandana* (Santalum album) have cooling, anti-inflammatory, and antimicrobial effects. Clinical studies on Triphala eye wash have shown significant improvement in allergic conjunctivitis, reducing redness, itching, and discharge.

4. Aschyotana (Eye Drop Therapy)

Aschyotana, the simplest form of Netra Kriyakalpa, involves instillation of medicated liquids drop by drop. It is prescribed in almost all acute eye conditions and also as a preventive measure. The procedure is considered the first line of local therapy in Ayurveda.

Pharmacological evidence: Honey (*Madhu*) combined with herbal extracts in Aschyotana has been shown to have antibacterial and wound-healing properties, making it effective for corneal ulcers and bacterial infections. Experimental studies confirm that honey-based formulations accelerate epithelial healing and reduce microbial load.

5. Anjana (Collyrium Application)

Anjana involves the application of medicated paste or powder to the inner margin of the eyelids. It is categorized into *Lekhana* (scraping), *Ropana* (healing), and *Prasadana* (soothing) Anjana. The therapy is both preventive and therapeutic, recommended for routine use to maintain ocular hygiene and improve vision.

Pharmacological evidence: Collyria containing *Triphala* or *Saindhava Lavana* exhibit antimicrobial, antioxidant, and anti-inflammatory effects. Modern equivalents include medicated eye ointments and gels. Comparative studies indicate that Triphala-based Anjana reduces oxidative stress markers and supports retinal protection.

Pharmacological Validation of Netra Kriyakalpa

Pharmacological research has identified several mechanisms underlying the effectiveness of Netra Kriyakalpa therapies:

- **Antioxidant activity:** Triphala, Amalaki, and Yashtimadhu reduce oxidative damage to ocular tissues, particularly lens proteins and retinal neurons.
- **Anti-inflammatory action:** Herbs such as *Haridra* (Curcuma longa) and *Chandana* modulate inflammatory mediators, relevant in conjunctivitis and keratitis.
- **Antimicrobial effect:** Honey, Triphala, and Madhu-based formulations show activity against bacterial and fungal pathogens implicated in ocular infections.
- **Neuroprotection:** Yashtimadhu and Amalaki support retinal cell survival and delay degenerative changes, correlating with management of glaucoma and retinopathies.

Modern Parallels in Ocular Drug Delivery

Modern ophthalmology faces challenges in ocular drug delivery due to rapid tear turnover, low corneal permeability, and systemic side effects. Ayurveda's Netra Kriyakalpa offers solutions:

- Tarpana parallels sustained-release ocular drug reservoirs, prolonging contact time.
- Seka is comparable to ocular irrigation and lavage in acute conditions.
- Aschyotana mirrors topical instillation of eye drops, the cornerstone of ophthalmology.
- Anjana corresponds to medicated eye ointments and gels, offering prolonged retention.

Clinical Outcomes and Evidence

Several clinical studies have evaluated Ayurvedic ocular therapies:

- **Triphala eye drops** significantly improved symptoms of chronic conjunctivitis and blepharitis.
- **Madhu-based Aschyotana** accelerated healing in corneal ulcers compared with standard therapy.
- **Triphala Ghrita Tarpana** demonstrated benefits in computer vision syndrome and early cataract by reducing eye strain and oxidative stress markers.
- Case reports suggest that Putapaka and Anjana improve visual acuity in patients with ocular surface disorders.

Collectively, both classical references and modern evidence indicate that Netra Kriyakalpa offers a

holistic, site-specific, and pharmacologically plausible approach to ocular care.

DISCUSSION

Netra Kriyakalpa illustrates Ayurveda's foresight in developing localized ocular therapies long before modern pharmacology identified the need for targeted drug delivery systems. The principle of applying medicine directly to the eye ensures higher drug bioavailability, quicker action, and minimal systemic side effects, all of which align with contemporary ophthalmic practices[16].

Strengths of Netra Kriyakalpa: The therapies address both preventive and curative needs. For instance, Anjana and Aschyotana maintain ocular hygiene and prevent infections, while Tarpana and Putapaka nourish deeper ocular tissues and manage degenerative changes. This dual approach reflects Ayurveda's preventive emphasis (*Swasthasya Swasthya Rakshanam*) [17].

Pharmacological support: Modern research validates many herbs used in these therapies. Triphala's antioxidant and cytoprotective effects support its use in cataract and glaucoma. Honey's antimicrobial and wound-healing properties corroborate its role in corneal ulcers. Yashtimadhu's neuroprotective action explains its inclusion in formulations for retinal health. These findings provide a pharmacological basis for Ayurvedic claims[18].

Challenges: Despite encouraging results, several limitations persist. Standardization of formulations is inconsistent, with variability in raw material quality, preparation methods, and sterility. Most clinical studies are small-scale, lacking randomization and control groups. Regulatory acceptance is hindered by limited pharmacokinetic data, particularly regarding ocular absorption and retention of Ayurvedic preparations[19].

Comparative insights: Modern ophthalmology employs eye drops, ointments, and irrigation solutions similar in function to Aschyotana, Anjana, and Seka. However, unlike synthetic drugs, Ayurvedic preparations often contain multiple active phytochemicals, providing synergistic actions such as antioxidant, antimicrobial, and anti-inflammatory effects simultaneously. This holistic pharmacology distinguishes Ayurveda but also complicates mechanistic validation[19].

Future directions: Integration of Ayurvedic principles with modern technology offers promising prospects. Nanotechnology-based ocular formulations of Triphala or Madhu may enhance stability and sterility while preserving therapeutic effects. Large-scale randomized clinical trials are essential to establish efficacy and safety. Moreover, comparative studies of Ayurvedic therapies with standard treatments can position Netra Kriyakalpa as a complementary modality in global ophthalmology.

In summary, Netra Kriyakalpa represents a scientifically plausible, culturally rooted, and clinically relevant therapeutic system. Its strengths lie in holistic formulation and localized application, while its challenges revolve around standardization and evidence generation. Bridging these gaps can facilitate global acceptance of Ayurvedic ocular therapies[20].

CONCLUSION

Netra Kriyakalpa, the Ayurvedic system of localized ocular therapies, represents a unique contribution to preventive and therapeutic ophthalmology. Rooted in classical texts, these therapies—Tarpana, Putapaka, Seka, Aschyotana, and Anjana—address a spectrum of ocular disorders from infections to degenerative changes. Their emphasis on site-specific drug delivery anticipates modern pharmacological strategies, offering prolonged retention, targeted action, and reduced systemic side effects.

Pharmacological validation has provided strong support for these therapies. Triphala, Madhu, Yashtimadhu, and other herbal components demonstrate antioxidant, antimicrobial, anti-inflammatory, and neuroprotective activities relevant to conditions like conjunctivitis, cataract, and corneal ulcers. Clinical studies, though limited in scale, report encouraging outcomes in ocular surface disorders and early degenerative diseases.

However, significant challenges remain, including standardization of formulations, sterility, dosage consistency, and large-scale clinical validation. Addressing these gaps is essential for wider acceptance. The integration of Ayurvedic wisdom with modern ocular pharmacology and emerging technologies such as nanocarriers can enhance therapeutic efficacy and global relevance.

In conclusion, Netra Kriyakalpa embodies the Ayurveda principle of preventive and holistic care

while offering pharmacologically validated solutions for modern ophthalmology. With rigorous research and translational studies, these therapies hold potential to complement existing ophthalmic practices, ensuring broader accessibility and holistic eye health worldwide.

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