

NETRA KRIYAKALPA AS A TARGETED OCULAR DRUG DELIVERY SYSTEM: A MODERN PHARMACOLOGICAL PERSPECTIVE**Chirag Parmar*¹, Pallavi Jagtap²**¹PG Scholar, Department of Shalakya Tantra.²Professor & HOD, Department of Shalakya Tantra Dr. D. Y. Patil College of Ayurved and Research Centre, Dr. D.Y. Patil Vidyapeeth (Deemed to be a University) Pune. Maharashtra, India.

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ABSTRACT

Netra Kriyakalpa constitutes a set of classical Ayurvedic ocular procedures described in the Shalakya Tantra tradition for the prevention and management of Netra Roga (ocular disorders). Despite the growing interest in targeted drug delivery systems for eye diseases, there is still a lack of combined research across different fields. This examination situates Netra Kriyakalpa within the context of contemporary ocular pharmacology, exploring the ways in which traditional practices—specifically Tarpana, Putapaka, Anjana, Aschyotana, and Seka—exemplify principles of localized drug administration, sustained drug retention, enhanced permeation, and targeted therapeutic effects. Furthermore, this research correlates these techniques with contemporary drug delivery

systems that are topical in nature, facilitate sustained drug release, and augment tissue penetration.

This suggests a conceptual basis for future research that aims to apply these ideas in practice.

1. INTRODUCTION

The human eye poses distinctive obstacles to effective drug treatment, stemming from its anatomical and physiological characteristics, such as the tear film, rapid tear turnover, corneal epithelial tight junctions, and nasolacrimal drainage.

These factors result in low bioavailability (typically <5%) of conventional topical instillations for anterior segment diseases. In modern drug delivery, approaches such as viscosity enhancement, permeation enhancers, inserts, and nanoparticles are employed to increase residence time and tissue uptake.

In Ayurveda, Netra Kriyakalpa encompasses a suite of localized therapeutic procedures intended to deliver medicaments directly to ocular tissues, optimize tissue contact, and alleviate dosha imbalances. Classical texts characterize these practices as nourishment (Brihmana), detoxification (Shodhana), and rejuvenation (Rasayana), thereby highlighting their dual functions in both prevention and treatment.

2. Classical Netra Kriyakalpa Procedures

2.1 Tarpana

Tarpana entails the retention of medicated ghee atop the eyes, enclosed within a dough barrier, for a prescribed period. This procedure is prescribed for ocular fatigue, dryness, and degenerative eye ailments, facilitating prolonged contact with the ocular surface. In contemporary practice, Tarpana is analogous to prolonged-contact formulations, such as gels and inserts, which aim to extend pre-corneal residence time and augment drug permeation.

2.2 Putapaka

Putapaka involves using medicated extracts that are heated in a controlled way after Tarpana. This process is believed to remove leftover doshic imbalances and help the eyes work properly.

A modern comparison is that thermal processing can change how drugs dissolve and how easily they penetrate, similar to how drug reservoirs are activated or how diffusion-based delivery is improved.

2.3 Anjana

Anjana involves putting medicated pastes or powders on the conjunctival surface or eyelids. This method is traditionally used to treat long-lasting inflammation and chronic dryness.

Modern parallel: Comparable to ointments or mucoadhesive suspensions, these methods enhance contact duration and localized therapeutic impact.

2.4 Aschyotana and Seka

Aschyotana (instillation) and Seka (irrigation) techniques administer aqueous medicated decoctions to the ocular surface, facilitating cleansing and the management of inflammation.

Modern parallel: These procedures are akin to antiseptic washes and irrigations, albeit with tailored medicament compositions.

3. Mechanistic Alignment with Modern Ocular Pharmacokinetics

The barriers to ocular drug absorption necessitate strategies that prolong residence time and enhance permeability. In modern ophthalmology, precorneal clearance refers to the rapid elimination of drugs, which limits their exposure.

- Corneal Barrier: Tight junctions impede hydrophilic drug entry.
- Blood-ocular barriers: Restrict systemic to ocular drug penetration.

Netra Kriyakalpa, by leveraging lipid-rich Ghrita and prolonged contact (Tarpana), can conceptually enhance lipophilic drug partitioning across corneal epithelia, akin to formulations designed with permeation enhancers or prodrugs in modern ophthalmic therapy.

4. Clinical Applicability and Evidence

Classical reviews and case reports underscore Kriyakalpa's efficacy in mitigating diverse ocular manifestations and enhancing visual ease. Despite the limited availability of high-caliber randomized controlled trials that adhere to WoS standards, these empirical observations provide initial support for its clinical significance.

5. Integrative Potential and Future Research

A growing imperative exists for:

- Pharmacokinetic characterization of Ayurvedic formulations employed in Kriyakalpa.

Standardized clinical trials designed to compare the therapeutic outcomes of Ayurvedic and contemporary medical approaches.

Formulation science can be employed to transform traditional media, such as Ghrita and Taila, into standardized delivery systems containing specific active ingredients. This interdisciplinary approach has the potential to integrate established therapeutic practices within evidence-based methodologies, thereby facilitating the development of innovative drug-delivery systems.

CONCLUSION

Netra Kriyakalpa exemplifies inherent principles of targeted ocular drug delivery, encompassing localized treatment, prolonged contact, and customized medications, which are relevant to current issues in ophthalmic pharmacotherapy. Consequently, translational research that connects Ayurvedic practices with contemporary pharmaceutical science could expand therapeutic possibilities for diseases affecting both the anterior and posterior segments of the eye.

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