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Integrative Management of Dry Eye Syndrome (*Sushkakshipaka*): Bridging Ayurvedic Netra *Kriya Kalpa* with Modern Ophthalmology

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Abstract: Background: Dry eye syndrome (DES) has an incidence of 5-50 percent of the global population and is characterized by instability and inflammation of the tear film. Modern therapies include artificial tears, cyclosporine, lifitegrast, and device therapies, although many patients still experience symptoms. Ayurveda conceptualizes DES as Sushkakshipaka, which is controlled by Netra Kriya Kalpa, topical eye treatment procedures such as Tarpana, Aschyotana, Seka, and Nasya. **Objective**: To synthesize the pathophysiological basis and therapeutic evidence of the integration of Ayurvedic Kriya Kalpa with modern ophthalmology. **Methods**: Narrative literature review of literature (2000225) in PubMed, Scopus, Ayushdhara, and classical texts. **Results**: TFOS DEWS II diagnostic pathway involves the use of OSDI, TBUT (<10 s), osmolarity (≥308imOsm/L) and staining. NF κB, IL 1 0 IL 6, TNF 0, and MMP 9 are the inflammatory pathways. Level of evidence- Level 1-2- Anti inflammatory and device-based therapies. Netra Tarpana including Triphala Ghrita is significant in the improvement of the Schirmer test, TBUT and symptoms ($p<0.05$). Aschyotana is delivered directly into the eye, and Nasya is used to treat supraclavicular pathology. **Conclusion**: A hybrid severity-based algorithm that combines Kriya Kalpa with current therapies can provide the best results. Prospective randomized trials and standardized protocols are needed.

Keywords: Dry eye syndrome, Sushkakshipaka, Netra Kriya Kalpa, meibomian gland dysfunction, integrative ophthalmology, Ayurveda

1. Introduction

Dry eye disease (DED) is a multifactorial disease of the tears and ocular surface that leads to symptoms of discomfort, visual disturbance, tear film instability, and possible epithelial damage [1]. The Tear Film and Ocular Surface Society (TFOS) estimates that 5 percent to 50 percent of the general population has the disease (the prevalence ranges widely based on age, geography, and diagnostic criteria) [12]. In a global study (2025) with more than 5,000 participants, almost half of the patients experienced daily symptoms, but one-third of the patients were unaware of the exact type of DED [13]. Well known risk factors are female gender, ageing, autoimmune diseases (e.g. Sjogren's syndrome), prolonged use of digital screens, and environmental factors (low humidity and pollution) [2,14].

The traditional classification of DED can be divided into aqueous tear deficient (with or without Sjögren syndrome) and evaporative forms, with meibomian gland dysfunction (MGD) contributing up to 86% of evaporative cases [15,16]. Modern management involves artificial tear substitutes, anti-inflammatory agents (cyclosporine, lifitegrast, corticosteroids), secretagogues, nutritional supplements (omega 3 fatty acids), physical therapies (warm compresses, intense pulsed light, thermal pulsation), punctal occlusion, and surgery [7,17]. Nonetheless, these methods are not equally effective; a significant number of patients complain of chronic symptoms or dissatisfaction with treatment, and long-term compliance is also not the easiest task [2,18].

Classical works, including the Sushruta Samhita and Ashtanga Hridaya [3,19], describe a condition similar to DED, called Sushkakshipaka in Ayurveda, the traditional Indian system of medicine. The term literally means, dry eye affliction, and it is characterized by Rukshata (dry), Toda (pricking pain), Daha (burning sensation), Kandu (itching) and Guru Krichhronmeelana (difficulty in opening the eyes) [20]. Sushkakshipaka was a Vataja disorder, to Acharya Sushruta, and Vata-Pitta to Vagbhata; both agree that Rakta (blood tissue) plays a significant pathogenic role [19,21].

The classical armamentarium for the treatment of ocular diseases, collectively known as Netra Kriya Kalpa, includes Tarpana (retention of medicated ghee around the eye), Aschyotana (medicated eye drops), Seka (pouring of medicated liquids about closed eyes), Anjana (collyrium), Pindi, Vidalaka, and Putapaka [4,22]. These modalities are intended to circumvent systemic obstacles, attain high local drug concentrations, and provide long contact time with the ocular surface, which is consistent with current ideas of how to deliver drugs to the ocular surface [10,23]. In particular, Netra Tarpana has been demonstrated in modern clinical trials to produce a significant improvement in both subjective symptoms and objective parameters, such as the values of the Schirmer test and tear breakup time (TBUT), in patients with DED [9,24].

Although there is increasing interest in integrative approaches, a cohesive, evidence-based algorithm to seamlessly integrate Ayurvedic Kriya Kalpa into modern ophthalmology has eluded us. The purpose of this review is to fill this gap by (i) delineating the etiopathogenesis and diagnostic paradigms of DED in both modern and Ayurvedic approaches, (ii) critically appraising the therapeutic evidence of key Kriya Kalpa procedures in both modern and Ayurvedic perspectives, and (iii) proposing a structured integrative management algorithm based on clinical evidence and applicable to routine ophthalmic practice.

2. Methods

A thorough literature search was performed in PubMed, Scopus, Google Scholar, Ayushdhara, the Cochrane Library, and classical Ayurvedic electronic repositories (NIYI, AMAR). Search terms were: “dry eye disease”, “meibomian gland dysfunction, inflammation, pathophysiology, TFOS DEWS II, cyclosporine, lifitegrast, intense pulsed light, Sushkakshipaka, Netra Tarpana, Kriya Kalpa. The search was limited to peer-reviewed articles published between 2000 and 2025, with priority given to randomised controlled trials (RCTs), systematic reviews, meta-analyses, and high-quality observational studies. Inclusion criteria: human studies that assessed diagnostic procedures or interventions to treat DED/MGD and studies on Kriya Kalpa procedures. The exclusion criteria were as follows: animal/in vitro studies, abstracts of conferences without full text, and editorials. Data extraction and narrative synthesis were performed using standard methods. The levels of evidence were determined based on the Oxford Centre criteria. A consensus (two ophthalmologists and two Ayurvedic physicians) was reached to develop an integrative algorithm.

3.1. Pathophysiology of Dry Eye Disease and its Ayurvedic Correlates

3.1.1. Inflammatory Cascade in Modern Ophthalmology

TEAR hyperosmolarity, which occurs due to decreased aqueous secretion or excessive evaporation, is the central pathogenic mechanism of DED [6,32]. MAPK and NF κB pathways are activated by hyperosmotic stress. Desiccating and hyperosmolar stress upregulates pro-inflammatory cytokines (TNF-α, IL 1 2, IL 6) and MMP 9 [33,34]. This facilitates the maturation of antigen-presenting cells that migrate to the lymph nodes and activate Th1/Th17 cells. These T cells re-enter the ocular side, activating the NLRP3 inflammasome and releasing IL 18 and IL 1 [35,36]. This process results in tear film instability, epithelial apoptosis, and corneal barrier dysfunction [6,37].

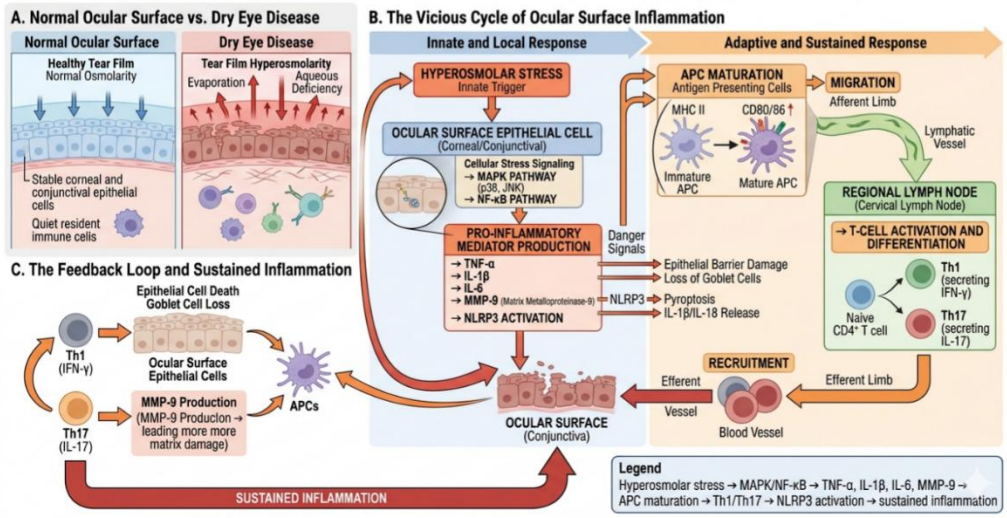

Figure 1. Immunoinflammatory response of the ocular surface in dry eye disease

3.1.2. Ayurvedic Perspective: Sushkakshipaka Samprapti

According to Ayurveda, Sushkakshipaka is a Tridoshaja disease with Vata and Pitta predominance and the presence of Rakta dhatu [19,38]. Acharya Sushruta defined it as Vataja Netra Roga, and Vagbhata as Vata Pita prevailing [3,21]. Nidana (causative factors) include excessive sunlight, dry environment, getting up at night, eating dry/pungent foods, and spending a lot of time on the screen [20,39]. Dosha Prakopana follows the Kriyakala phases [3,22]. Table 1 matches the modern DED subtypes with Ayurvedic phenotypes.

Table 1. Comparative taxonomy: Dry eye disease subtypes and Ayurvedic Sushkakshipaka phenotypes

Modern DED subtype	Ayurvedic phenotype	Key clinical correlates
Aqueous-tear deficient	*Vata* (with/without *Rakta*)	Dryness, pricking pain, difficulty opening eyes
Evaporative (MGD)	*Pitta* (with *Rakta*)	Burning, redness, lid margin inflammation
Mixed type	*Vata–Pitta*	Dryness, burning, gritty sensation
Sjögren's-associated	*Vata–Pitta–Rakta*	Severe dry mouth and eyes, systemic inflammation

3.2. Diagnostic Paradigms

3.2.1. TFOS DEWS II Algorithm

The TFOS DEWS II pathway involves the use of OSDI/DEQ 5 (OSDI ≥13 triggers testing), TBUT (<10 triggers testing), osmolarity (≥308 triggers testing mOsm/L), ocular surface staining, and meibomian gland evaluation [1,5,12,33]. As many as 40 percent of patients can be asymptomatic [2,14].

3.2.2. Ayurvedic Netra Pariksha

Ayurvedic examination includes Darshana (inspection), Sparshana (palpation), and Prashna (interrogation) to Rukshata, Raga, Shopha and validated symptom score to Garsha, Toda, Daha, Kandu, Harsha [843].

3.3. Modern Pharmacological and Device-Based Therapies

3.3.1. Anti-Inflammatory Agents

Topical cyclosporine A (0.05% emulsion, 0.1% water-free) suppresses T cell activation and inflammation of the conjunctiva. In reality, there is a 66.6 percent corneal staining clearance at 12 months [7,23]. Lifitegrast 5% inhibits LFA 1/ICAM 1, and patients individually prefer it [8]. Diquafosol 3% reduces tear IL 1BA, TNF A, IL 6, and IL 8 levels in 4 weeks [26].

3.3.2. Physical and Device-Based Modalities

Intense pulsed light (IPL) leads to increased TBUT +2.08 s and decreased SPEED scores, which is more effective than LipiFlow in a network meta-analysis [31,37]. LipiFlow improves TBUT (+0.67 s) and OSDI (−6.07) scores [17]. IPL with low levels of light therapy and combination IPL has subsequent metabolic effects [35].

3.3.3. Emerging Pharmacotherapies

Perfluorohexyloctane is a monolayer that prevents evaporation and was approved after phase III trials (n=1,218) [42]. Varenicline nasal spray (OC 01) induces a trigeminal parasympathetic reflex, resulting in corneal staining improvement without ocular irritation [27,28].

3.4. Ayurvedic Netra Kriya Kalpa

3.4.1. Netra Tarpana (Medicated Ghee Retention)

In RCTs ($p<0.05$), Netra Tarpana with Triphala Ghrita or Goghrita Manda has a significant effect on the Schirmer test (+6 -8 mm) and TBUT (+4 -6 ss). Goghrita Manda was better than these to provide instant relief to Garsha, Toda and Daha [9]. These effects last for at least 15 days after treatment [24]. A 2025 case study (n=30) indicated that 3 month symptom relief occurred following 7 sessions [39].

3.4.2. Aschyotana (Medicated Eye Drops)

Aschyotana containing Triphala kwatha provides anti-inflammatory phytochemicals, IL 6, and MMP 9 reduction in tears. It provides the same relief as artificial tears with high anti-inflammatory properties [10,42].

3.4.3. Nasya (Nasal Administration)

Nasya with *Anu Taila* improves TBUT (Δ +3–5 s) and Schirmer's test result (Δ +5 mm) via the trigeminal-parasympathetic reflex [11,40]. An RCT (n=60) demonstrated a significant OSDI reduction compared to the control [11].

Table 2. Summary of clinical evidence for key Netra Kriya Kalpa procedures in Sushkakshipaka

Procedure	Regimen	Key outcomes	Best evidence	Limitations
Netra Tarpana	7 days, 15-20 min retention	↑ Schirmer's (Δ+6-8 mm), ↑ TBUT (Δ+4-6 s)	RCT (n=60) [9]	No sham control
Aschyotana	2 drops 3-4×/day, 4 weeks	↓ OSDI, ↓ IL-6, ↓ MMP-9	Open (n=40) [10]	Small sample
Nasya	2 drops/nostril daily, 21 days	↑ TBUT (Δ+3-5 s), ↑ Schirmer's (Δ+5 mm)	RCT (n=60) [11]	No active comparator
Seka	5-10 min, 7 days	↓ Garsha, ↓ photophobia	Case series (n=20) [38]	No control

4. Discussion

Dry eye syndrome is an ideal paradigmatic condition for integrative medicine, whereby modern ophthalmology and Ayurvedic Kriya Kalpa can work together to address the core pathogenic cascade of tear hyperosmolarity into chronic inflammation [1,6,9]. The main stimulus is hyperosmolar stress, which activates the MAPK and NF κB signaling pathways, upregulating TNF α, IL 1 0, IL 6, and MMP 9 [33,34]. This triggers antigen-presenting cell maturation, recruitment of T cells (Th1/Th17), and NLRP3 inflammasome activation, which continues to damage the ocular surface [35,44]. According to Ayurveda, Sushkakshipaka describes Vata-Pitta-Rakta vitiation, with Vata representing dryness, Pitta the inflammatory burning (Daha), and Rakta the neovascular congestion [19,38]. This theoretical congruency offers a logical foundation for integrating therapies.

Pharmacotherapy has significantly developed in recent years. T cell activation and adhesion are reduced by topical cyclosporine (0.05% emulsion or 0.1% water free) and lifitegrast 5%, which have been demonstrated to have sustained corneal staining improvement in real-world studies [7,23,29]. Diquafosol 3% stimulates mucin secretion and reduces tear IL 1ba, TNF 4, IL 6, and IL 8 levels [26]. Network meta-analyses have verified TBUT gains of +2.08 31,37. LipiFlow thermal pulsation has these advantages [17]. Emerging drugs, such as perfluorohexyloctane (evaporation suppressant) and varenicline nasal spray (trigeminal parasympathetic agonist), provide new mechanisms for treatment [27,28,42].

With these options, a significant percentage of patients continue to experience symptoms, many report continuing to experience discomfort, and many are unable to cope with the indefinite daily eyedrop regimens [2,18]. Here, Netra Kriya Kalpa can offer a clear benefit: with episodic treatment courses (e.g., 7 day Tarpana), symptom relief has a lasting effect of weeks to months, which may contribute to higher adherence and quality of life [9,24].

The mechanistic explanation of Kriya Kalpa is increasingly recognized. Netra Tarpana with Triphala Ghrita delivers high concentrations of gallic acid, chebulagic acid and ascorbic acid directly to the ocular surface in 15-20 minutes, by far surpassing the residence time of the conventional drops [9,10]. These phytochemicals prevent NF κB and MAPK in vitro, and warm ghee restores the tear lipid layer and promotes secretion from the meibomian glands [24,39]. Aschyotana and Seka induce a lavage effect, eliminating proinflammatory mediators, and have been shown to be superior to artificial tears in reducing IL 6 and MMP 9 [10,38]. Nasya with Anu Taila operates through a process similar to that of varenicline, and clinical trials have shown significant improvements in TBUT and Schirmer values [11,40,41]. The safety information regarding these operations is encouraging, and no significant adverse events have been reported in the literature [41].

The suggested integrative algorithm (detailed in plain text) stratifies patients based on DED severity and Dosha phenotype. In the case of mild disease (OSDI 1322, TBUT 510s), first-line management includes lifestyle modifications, artificial tears, warm compresses, and either Aschyotana or Nasya [10,11,20]. In moderate disease (OSDI 2332, TBUT less than 5 s), topical cyclosporine or lifitegrast is administered along with a 7 day Netra Tarpana course [7,9,23]. Indicated include IPL or LipiFlow, short term corticosteroids and high dose omega 3 (233,46). Patients with Vata preponderance respond well to Goghrita Manda Tarpana, and patients with Pitta predominance are well treated with cooling Aschyotana formulations [9,39].

However, several implementation issues remain. Most ophthalmologists have not been trained in Kriya Kalpa, standardized GMP-grade ghee preparations do not widely exist, and prospective outcome monitoring using OSDI, TBUT, and staining has not always been performed [4,22,25]. Comparative effectiveness trials should be conducted head-to-head and urgently [6,31,33].

In conclusion, Ayurvedic Netra Kriya Kalpa and modern ophthalmology can be integrated to offer a safe, effective, and patient-centered approach to DED. The pathophysiological explanation is sound, and evidence supports the use of Tarpana, Aschyotana, and Nasya in combination with conventional therapies [9-11,24]. This strategy could be a mainstream choice with rigorous research and standardization [3,19,38].

Conclusion

A safe, effective, patient-centered approach to dry eye syndrome is through integrative management combining Ayurvedic Netra Kriya Kalpa and modern ophthalmology. The proposed algorithm prioritizes patients based on the severity of the disease and Dosha phenotype by combining lifestyle changes, artificial tears, Kriya Kalpa procedures, topical immunomodulators, device-based therapies, as omega 3 supplementation. To achieve successful implementation, training of ophthalmologists in Kriya Kalpa, standardization of GMP-grade formulations, and prospective outcome surveillance are imperative. There is an urgent need to conduct rigorous comparative effectiveness trials and mechanistic studies. This integrative approach can become a standard choice with further research and standardization.

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