Avens Publishing Group
J Ocular Biol
August 2026 Volume 10, Issue 1

Expert Perspectives and Preferences in the Diagnosis and Management of Dry Eye Disease and Ocular Lubricant use: A Questionnaire-Based Survey Among Indian Ophthalmologists

Keywords: DED; CMC 1.0% Eye Drops; Artificial Tears; Ophthalmologists; Ocular Surface Disorders; Clinical Practice.

Abstract

Objective: To assess the perspectives and preferences of Indian ophthalmologists in the diagnosis and management of dry eye disease (DED), including diagnostic approaches, ocular lubricant preferences, safety monitoring, and the perceived clinical effectiveness of carboxymethylcellulose (CMC) 1.0% eye drops.

Methods: A cross-sectional survey was conducted among ophthalmologists across India using a structured questionnaire to assess routine clinical practices in the diagnosis and management of DED. Responses related to diagnostic approaches, ocular lubricant preferences, safety monitoring, adverse effects, and clinical outcomes were analyzed descriptively and presented as frequencies and percentages using Microsoft Excel.

Results: A total of 49 ophthalmologists participated in the survey. Nearly 65% of respondents reported that DED was most commonly diagnosed among individuals aged 30-45 years in routine clinical practice. Among the participating ophthalmologists, 63.27% reported mixed dry eye as the DED subtype they most frequently encountered in routine clinical practice, while 73% observed that DED was more common among patients belonging to the upper-middle socioeconomic group. More than half of the respondents (55.10%) preferred CMC 1.0% eye drops as the lubricant of choice for patients with allergic conjunctivitis, and 65% preferred the same formulation for the management of acute infectious conjunctivitis. A substantial proportion of ophthalmologists (81.63%) reported prescribing CMC 1.0% eye drops following superficial corneal foreign body removal. Approximately 67% of respondents regularly monitored patients for treatment-related adverse effects and medication-related complications, while 71% reported moderate improvement in clinical outcomes with CMC 1.0% eye drops.

Conclusion: The survey demonstrates that mixed dry eye is the most commonly encountered subtype of DED in routine clinical practice, with CMC 1.0% eye drops being the preferred ocular lubricant for several ocular surface conditions. Regular safety monitoring and favorable clinician-reported outcomes support its continued use as an effective and well-accepted therapeutic option in routine ophthalmic practice.

Open Access **Research Article**

Journal of
Ocular Biology

Manjula S[1*] and Krishna Kumar M[2]

[1]*Department of Medical Services, Micro Labs Limited, Bangalore, Karnataka, India*
[2]*Department of Medical Services, Micro Labs Limited, Bangalore, Karnataka, India*

***Address for Correspondence**
Dr Manjula S, Department of Medical Services, Micro Labs Limited, Bangalore, Karnataka, India. Email Id: drmanjulas@gmail.com

Submission: 07 July, 2026
Accepted: 19 August, 2026
Published: 22 August, 2026

Introduction

Dry eye disease (DED) is a multifactorial disorder of the ocular surface characterized by the loss of tear film homeostasis, accompanied by ocular symptoms such as dryness, irritation, discomfort, and fluctuating visual disturbance. A recent systematic review estimated the global pooled prevalence of DED at 34.6% (95% CI: 30.2%–39.4%). Moreover, prevalence estimates varied considerably depending on the diagnostic criteria employed, ranging from 6.9% using ICD-9-based definitions to 53.8% when an Ocular Surface Disease Index (OSDI) score of ≥13 was used.[1] In India, a recent study from North India reported a DED prevalence of 32%, with 81% of affected individuals experiencing severe disease based on symptom assessment.[2,3]

Artificial tear substitutes remain the cornerstone of DED management, with CMC being one of the most extensively used ocular lubricants. CMC is a high-molecular-weight, anionic cellulose derivative that exerts its therapeutic effect through multiple mechanisms beyond simple lubrication. Its mucoadhesive properties enhance tear film stability and prolong tear retention on the ocular surface, thereby improving hydration, reducing friction during blinking, and promoting corneal epithelial repair. By restoring tear film integrity and reducing tear hyperosmolarity, CMC also contributes to improved ocular surface homeostasis and symptomatic relief in patients with DED.[4]

In addition to its established role in DED, CMC 1.0% eye drops are widely used as supportive lubricant therapy in patients with acute infections, particularly viral conjunctivitis. They provide symptomatic relief by reducing ocular irritation, dryness, foreign-body sensation, and discomfort while improving tear film stability during the healing process. Clinical studies have demonstrated that CMC-based artificial tears effectively alleviate symptoms and improve ocular surface comfort, although they serve as adjunctive therapy and do not replace antimicrobial treatment when bacterial conjunctivitis is present [4-6].

ISSN: 2334-2838

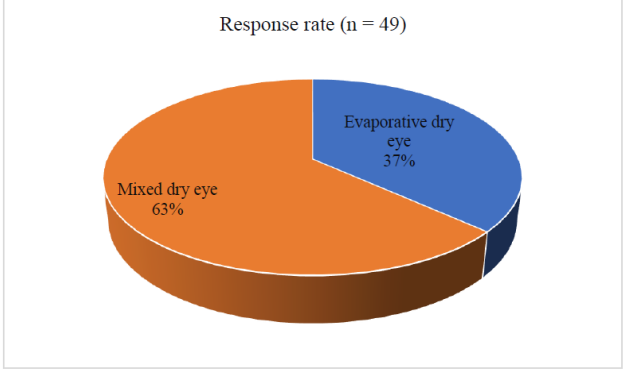

Figure 1: Distribution of responses on type of DED most commonly diagnosed in clinical practice.

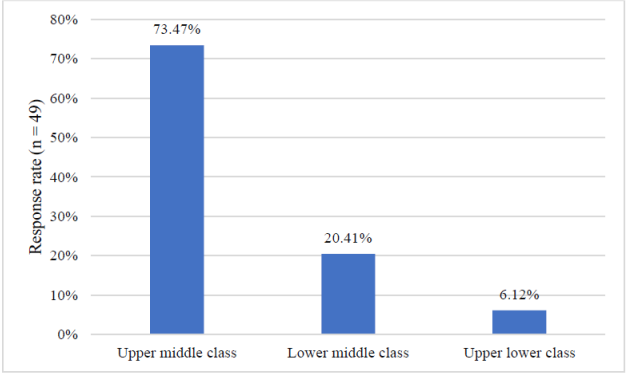

Figure 2: Distribution of responses on patients belonging socioeconomic group most frequently diagnosed with DED in clinical practice.

Despite the widespread use of ocular lubricants in routine ophthalmic practice, limited evidence is available regarding the diagnostic and therapeutic preferences of Indian ophthalmologists, particularly concerning the use of CMC 1.0% eye drops across different ocular surface disorders. Therefore, the present survey assessed clinicians' diagnostic approaches, ocular lubricant preferences, safety monitoring practices, and perceptions of the clinical effectiveness of CMC 1.0% eye drops in routine ophthalmic practice.

Methodology

A cross-sectional study was carried out among Ophthalmologists specialized in managing DED in the major Indian cities from June 2025 to December 2025. The study was performed in accordance with Bangalore Ethics, an Independent Ethics Committee (ECR/355/Indt/KA/2022), which was recognized by the Indian Regulatory Authority, the Drug Controller General of India.

Questionnaire

The questionnaire booklet titled HYDRA (Expert Perspectives on Hydration, Dry eye Disease and role of Lubricants) study was sent to Ophthalmologists who were interested in participating in the study. A 23-item structured, multiple-response questionnaire aimed to assess clinicians' routine approaches to the diagnosis and management of DED. It captured information on the estimated proportion of DED attributable to digital eye strain/computer vision syndrome, the age group and socioeconomic status most commonly affected, the predominant DED subtype, and commonly used diagnostic methods, including patient history, symptom assessment, Schirmer test, tear film break-up time (TBUT), ocular surface fluorescein staining, and slit-lamp examination.

The survey also explored clinicians preferred ocular lubricants for various ocular surface conditions, including allergic conjunctivitis, acute infectious conjunctivitis, viral keratitis, corneal ulcers, traumatic corneal abrasions, digital eye strain/computer vision syndrome, superficial corneal foreign body removal, cataract surgery, pterygium surgery, corneal tear repair/globe rupture repair, and chemical injury. In addition, it evaluated perceptions of the comparative effectiveness of CMC 1.0% eye drops versus polyethylene glycol + propylene glycol, sodium hyaluronate, and hydroxypropyl methylcellulose formulations. Further questions addressed the safety of CMC 1.0% eye drops in contact lens users, commonly encountered adverse effects, the frequency of safety monitoring, and overall treatment effectiveness using a 5-point Global Improvement Scale.

Participants

A convenient sampling technique was used, and an invitation was sent to Ophthalmologists across India based on their expertise and experience in treating DED in the month of March 2025 for participation in this Indian survey. About 49 clinicians from major cities of all Indian states, representing the geographical distribution, shared their willingness to participate and provide necessary data. Clinicians were instructed to complete the questionnaire independently without consulting colleagues. Written informed consent was obtained from each participant before the study began.

Statistical analysis

The data were analyzed using descriptive statistics. Categorical variables were presented as percentages to clearly illustrate their distribution. As an exploratory perception-based survey, the analysis was limited to descriptive statistics. The frequency of occurrence and corresponding percentages were employed to represent the distribution of each variable. Graphs were created to visualize the distribution of the categorical variables, using Microsoft Excel (version 16.0.18025.20030).

Table 1: Distribution of responses on age group most commonly diagnosed with DED in clinical practice.

Age group (years)	Response rate (n = 49)
15-30	10.2%
30-45	65.31%
45-60	16.33%
60-75	8.16%

ISSN: 2334-2838

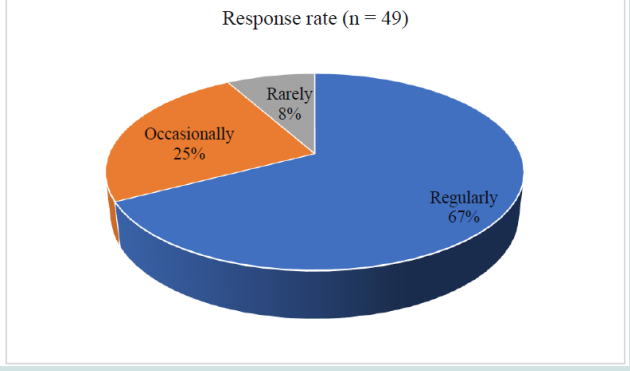

Figure 3: Distribution of responses on frequency of monitoring patients for potential side effects or complications of medications.

Results

A total of 49 ophthalmologists participated in the survey. Approximately 35% of respondents reported that 45–60% of patients with DED in routine practice had digital eye strain/computer vision syndrome. Nearly 65% of clinicians stated that DED was most commonly diagnosed among individuals aged 30–45 years (Table 1). Among the participating ophthalmologists, 63.27% reported mixed dry eye as the DED subtype they most frequently encountered in routine clinical practice (Figure 1). Approximately 73% of ophthalmologists observed that DED was more commonly diagnosed among patients belonging to the upper-middle socioeconomic group (Figure 2).

The majority (85.71%) reported using a comprehensive diagnostic approach incorporating patient history, symptom assessment, Schirmer test, TBUT, fluorescein staining, and slit-lamp examination for DED diagnosis. More than half (55.10%) of the participants preferred CMC 1.0% eye drops as the lubricant of choice for patients with allergic conjunctivitis (Table 2). Similarly, 65% of clinicians preferred CMC 1.0% for patients with acute infectious conjunctivitis (Table 3).

About 39% of participants preferred CMC 1.0% eye drops as the ocular lubricant for patients with viral keratitis, while 55% preferred the same formulation for patients with corneal ulcers. Similarly, 39% preferred CMC 1.0% eye drops for patients with traumatic corneal abrasions or epithelial defects. Approximately 39% favored polyethylene glycol + propylene glycol eye drops for patients with digital eye strain/computer vision syndrome. A majority of respondents (82%) reported prescribing CMC 1.0% eye drops following superficial corneal foreign body removal (Table 4).

Approximately 39% of participants preferred sodium hyaluronate eye drops following cataract surgery, while 37% preferred the same formulation after pterygium surgery. About 40% prescribed CMC 1.0% eye drops following corneal tear repair or globe rupture repair. Nearly 29% preferred the same formulation for patients with chemical injuries. About 43% of participants reported that the formulation was not more effective than polyethylene glycol + propylene glycol eye drops in the treatment of DED based on their clinical experience. Similarly, 67% reported that it was not more effective than sodium hyaluronate eye drops, whereas 41% considered the formulation to be more effective than hydroxypropyl methylcellulose eye drops/gel for the treatment of DED.

According to 71% of clinicians, CMC 1.0% eye drops are well-tolerated for use with contact lenses based on their clinical experience. Approximately 67% of respondents reported regularly monitoring patients for treatment-related adverse effects and medication-related complications (Figure 3). Less than half of the clinicians (32.65%) identified irritation as the most commonly encountered adverse effect associated with CMC 1.0% eye drops. Based on the 5-point Global Improvement Scale, 71% of respondents reported moderate improvement in clinical outcomes with CMC 1.0% eye drops (Figure 4).

Discussion

Most clinicians in the present survey reported that DED was most commonly diagnosed among individuals aged 30–45 years, representing the economically active population with high occupational exposure to digital screens and visual display terminals. This finding is consistent with the hospital-based study by Titiyal et al., which reported a significantly higher risk of DED among individuals aged 21-40 years, primarily attributed to desk-based occupations and prolonged visual display terminal (VDT) use.[2] Similarly, Donthineni et al. identified professional occupation and higher socioeconomic status as important risk factors for DED, suggesting that the predominance of DED in the 30-45-year age group may reflect the increasing use of digital devices among working professionals.[3]

In the present survey, mixed dry eye was identified by most ophthalmologists as the most commonly diagnosed subtype of DED in routine clinical practice. For the purpose of this perception-based survey, mixed dry eye was considered to represent the coexistence of aqueous tear deficiency and excessive tear evaporation. Respondents were asked to identify the DED subtype most commonly encountered in their routine clinical practice based on their usual clinical assessment; no standardized diagnostic algorithm or prespecified objective criteria were imposed by the survey.

Table 2: Distribution of responses on preferred lubricant in patients with allergic conjunctivitis in clinical practice.

Preference	Response rate (n = 49)
Carboxymethylcellulose eye drops 1.0%	55.1%
Polyethylene glycol + propylene glycol eye drops	10.2%
Sodium gyaluronate eye drops	28.57%
Hydroxypropyl methylcellulose eye drops/gel	6.12%

ISSN: 2334-2838

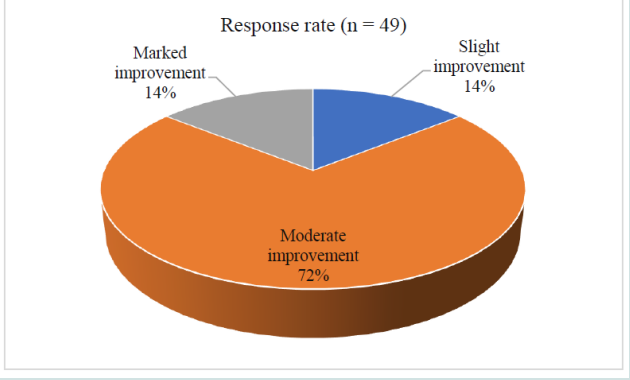

Figure 4: Distribution of responses on rating the outcomes with CMC 1% eye drops in patients with DED on a 5-point scale [global improvement scale] based on clinical experience.

Mixed dry eye is characterized by the coexistence of aqueous tear deficiency and excessive tear evaporation, reflecting the multifactorial nature of DED in which multiple pathogenic mechanisms frequently overlap. This finding is consistent with the large electronic medical record-based study by Donthineni et al., which reported mixed dry eye as the predominant subtype, accounting for 39.9% of all DED cases, followed by evaporative dry eye (35.5%) and aqueous-deficient dry eye (20.6%). The authors suggested that multiple etiological factors frequently coexist in patients with DED, resulting in mixed disease presentations.[3] In contrast, Bhatt et al. reported evaporative dry eye (39.6%) as the most common subtype, followed by aqueous-deficient dry eye (34.7%) and mixed dry eye (25.7%).[7]

In the present survey, most ophthalmologists reported that DED was more commonly diagnosed among patients from the upper-middle socioeconomic group. This observation is consistent with the findings of Donthineni et al., who identified higher socioeconomic status, urban residence, and professional occupations as significant risk factors for DED.[3] Similarly, Titiyal et al. reported a higher prevalence of DED among individuals engaged in desk-based occupations and prolonged visual display terminal use. The predominance of DED in the upper-middle socioeconomic group may therefore reflect greater exposure to digital devices, prolonged indoor work, and better access to ophthalmic care, leading to increased recognition and diagnosis of the disease.[2]

In the present survey, more than half of the ophthalmologists preferred CMC 1.0% eye drops as the lubricant of choice for patients with allergic conjunctivitis. Similarly, many clinicians preferred the same formulation for acute infectious conjunctivitis, consistent with published evidence supporting the use of ocular lubricants as adjunctive therapy to dilute allergens, improve tear film stability, and relieve ocular surface irritation. Although comparative studies specifically evaluating CMC in allergic conjunctivitis are limited, lubricating eye drops are widely recommended as adjunctive therapy to dilute allergens, improve tear film stability, and relieve ocular surface irritation. CMC-based artificial tears have demonstrated favorable efficacy and safety in improving ocular surface symptoms and tear film stability in patients with DED, making them a suitable supportive treatment in allergic conjunctivitis.[8,9] Honkila et al. demonstrated that preservative-free CMC 1.0% eye drops provided symptomatic relief, with both the moxifloxacin and CMC groups showing faster clinical recovery than no treatment, suggesting that lubricating eye drops can offer meaningful symptomatic benefit even in the absence of antibiotics.[5]

The finding that many participants prescribed CMC 1.0% eye drops following superficial corneal foreign body removal. Guier and Stokkermans recommend topical lubricants such as CMC after superficial corneal foreign body removal to promote corneal epithelial healing, maintain ocular surface integrity, reduce irritation, improve patient comfort, and facilitate the removal of residual debris.[10] Likewise, Tripathy et al. recommend lubricating eye drops as part of standard post-removal management, alongside topical antibiotics and close follow-up until complete epithelial healing, with continued lubricant use if symptoms persist.[11]

The finding that the majority of ophthalmologists regularly monitored patients for treatment-related adverse effects and medication-related complications is supported by published evidence. Cohen et al. monitored patients throughout a 42-day study and reported infrequent ocular adverse events, such as eye irritation, foreign body sensation, eyelid crusting, and eye pain, with no treatment-related serious adverse events, confirming the favorable safety profile of CMC 1.0%.[12] Similarly, Aragona et al. performed safety assessments at every follow-up visit and found that treatment-related adverse events were generally mild (approximately 10% of participants), with no serious treatment-related events.[13] Yao et al. also conducted scheduled follow-up examinations and reported that adverse events were uncommon, comparable between

Table 3: Distribution of responses on preferred lubricant in patients with acute infectious conjunctivitis in clinical practice.

Preference	Response rate (n = 49)
Carboxymethylcellulose eye drops 1.0%	65.31%
Polyethylene glycol + propylene glycol eye drops	20.41%
Sodium hyaluronate eye drops	12.24%
Hydroxypropyl methylcellulose eye drops/gel	2.04%

Table 4: Distribution of responses on preferred lubricant following superficial corneal foreign body removal in clinical practice.

Preferred lubricant	Response rate (n = 49)
Carboxymethylcellulose eye drops 1.0%	81.63%
Polyethylene glycol + propylene glycol eye drops	10.2%
Sodium hyaluronate eye drops	4.08%
Hydroxypropyl methylcellulose eye drops/ gel	4.08%

ISSN: 2334-2838

treatment groups, and associated with no significant safety concerns, supporting the importance of routine safety monitoring during CMC 1.0% therapy.[14]

Based on the 5-point Global Improvement Scale, most respondents reported moderate improvement in clinical outcomes with CMC 1.0% eye drops. This observation is consistent with published clinical evidence. Labetoulle et al. (2017) demonstrated that CMC-containing lubricant eye drops significantly improved the Global Ocular Staining Score (GOSS), OSDI, tear break-up time (TBUT), and ocular symptoms, with efficacy comparable to hyaluronic acid and superior relief of burning, grittiness, and ocular discomfort. [15] Similarly, Aragona et al. reported significant improvements in OSDI, TBUT, ocular surface staining, and symptom scores after 3 months of treatment, highlighting the clinically meaningful efficacy and excellent tolerability of the CMC formulation.[13] Bruix et al. further showed that CMC significantly reduced subjective symptoms, improved tear film stability, and enhanced objective ocular surface parameters compared with controls, supporting its moderate clinical benefit in patients with mild-to-moderate DED.[16]

This survey highlights current practices among Indian ophthalmologists and demonstrates broad clinical acceptance of CMC 1.0% eye drops for diverse ocular surface conditions. The study highlights current preferences in the management of DED, allergic conjunctivitis, acute infectious conjunctivitis, and post–corneal foreign body removal care. However, several limitations should be considered. The relatively small sample size (n = 49) may restrict the generalizability of the study findings. The cross-sectional survey design precludes assessment of causal relationships, and responses may be influenced by recall or reporting bias. The questionnaire was structured specifically for this exploratory survey; however, formal psychometric validation and/or pilot testing of the questionnaire was not undertaken, which may limit assessment of its measurement validity. Larger multicentre studies incorporating patient-reported outcomes and objective clinical assessments are warranted to further validate these observations.

Conclusion

CMC 1.0% eye drops are widely preferred by ophthalmologists as a lubricant therapy for the management of DED and various ocular surface conditions, including allergic conjunctivitis, acute infectious conjunctivitis, and post-procedural ocular surface care. Most respondents report favorable clinical outcomes, with moderate improvement in symptoms and regular monitoring for treatment-related adverse effects. These findings reflect current clinical practice and support the broad utility of CMC 1.0% eye drops as an effective and well-accepted ocular lubricant.

Acknowledgement

We would like to thank all the clinicians who participated in this study.

Conflict of Interest

Both authors are employees of Micro Labs Limited. The study was designed and conducted as part of a scientific initiative. The authors declare that no undue influence was exerted on data collection, analysis, or interpretation.

Funding

This study was funded by Micro Labs Limited. The sponsor had a role in study conceptualization and questionnaire development but did not influence the interpretation of results.

References

1. Xiao K, Li L, Zhang X, Ye Y, Yao Y, Liu Y, et al. (2025) Global prevalence of dry eye: A systematic review and meta-analysis. Exp Eye Res. 249: 110627.
2. Titiyal JS, Falera RC, Kaur M, Sharma V, Sharma N (2018) Prevalence and risk factors of dry eye disease in North India: Ocular surface disease index-based cross-sectional hospital study. Indian J Ophthalmol 66: 207-211.
3. Donthineni PR, Kammari P, Shanbhag SS, Singh V, Das AV, Basu S (2019) Incidence, demographics, types and risk factors of dry eye disease in India: Electronic medical records driven big data analytics report I. Ocul Surf 17: 250-256.
4. Ballesteros-Sánchez A, Sánchez-González JM, Tedesco GR, Rocha-De-Lossada C, Murano G, Spinelli A, et al. (2023) Assessing the effects of 0.3% carboxymethylcellulose tear substitute treatment on symptoms and signs of dry eye disease in elderly population: a prospective longitudinal study. J Clin Med 12: 7364.
5. Honkila M, Koskela U, Kontiokari T, Mattila ML, Kristo A, Valtonen R, et al. (2022) Effect of topical antibiotics on duration of acute infective conjunctivitis in children: a randomized clinical trial and a systematic review and meta-analysis. JAMA Netw Open 5: e2234459.
6. Azari AA, Barney NP (2013) Conjunctivitis: a systematic review of diagnosis and treatment. JAMA. 2013 Oct 23;310(16):1721-1729.
7. Bhatt K, Singh S, Singh K, Kumar S, Dwivedi K (2023) Prevalence of dry eye, its categorization (Dry Eye Workshop II), and pathological correlation: A tertiary care study. Indian J Ophthalmol 71: 1454-1458.
8. Lievens C, Berdy G, Douglass D, Montaquila S, Lin H, Simmons P, et al. (2019) Evaluation of an enhanced viscosity artificial tear for moderate to severe dry eye disease: a multicenter, double-masked, randomized 30-day study. Contact Lens Anterior Eye. 42: 443-449.
9. Semp DA, Beeson D, Sheppard AL, Dutta D, Wolffsohn JS (2023) Artificial Tears: A Systematic Review. Clin Optom (Auckl) 15: 9-27.
10. Guier CP, Stokkermans TJ (2026) Corneal foreign body removal. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 [cited 2026 Jul 12].
11. Tripathy K, Ichlangod AM, Sridhar U, Vaghela M (2023) A red and watering eye. BMJ. 383: e076442.
12. Cohen S, Martin A, Sall K (2014) Evaluation of clinical outcomes in patients with dry eye disease using lubricant eye drops containing polyethylene glycol or carboxymethylcellulose. Clin Ophthalmol 8: 157-164.
13. Aragona P, Benítez-Del-Castillo JM, Coroneo MT, Mukherji S, Tan J, Vandewalle E, et al. (2020) Safety and efficacy of a preservative-free artificial tear containing carboxymethylcellulose and hyaluronic acid for dry eye disease: a randomized, controlled, multicenter 3-month study. Clin Ophthalmol 14: 2951-2963.
14. Yao K, Bao Y, Ye J, Lu Y, Bi H, Tang X, et al. (2015) Efficacy of 1%

ISSN: 2334-2838

carboxymethylcellulose sodium for treating dry eye after phacoemulsification: results from a multicenter, open-label, randomized, controlled study. BMC Ophthalmol 15: 28.

15. Labetoulle M, Chiambaretta F, Shirlaw A, Leaback R, Baudouin C (2017) Osmoprotectants, carboxymethylcellulose and hyaluronic acid multi-ingredient eye drop: a randomised controlled trial in moderate to severe dry eye. Eye (Lond) 31: 1409-1416.

16. Bruix A, Adán A, Casaroli-Marano RP (2006) Eficacia de la carboximetilcelulosa sódica para el tratamiento del síndrome del ojo seco [Efficacy of sodium carboxymethylcellulose in the treatment of dry eye syndrome]. Arch Soc Esp Oftalmol 81: 85-92.