

Dry eye disease in patients with rheumatoid arthritis: A hospital-based cross-sectional study of prevalence, clinical characteristics, and treatment outcomes from South India

Shagufta Aamena*, Anand G. Gannur, Madhu A. Gannur, Chaitra C. Kulkarni and Azeem Nazeer

Department of Ophthalmology, Al Ameen Medical College and Hospital, Athani Road, Vijayapura-586108, Karnataka, India

Received: 17th July 2026; **Accepted:** 18th September 2026; **Published:** 01st October 2026

Abstract: *Background:* Dry eye disease (DED) is a common ocular complication of rheumatoid arthritis (RA), arising from immune-mediated damage to the lacrimal functional unit, yet remains under diagnosed in routine rheumatological practice. *Objectives:* To determine the prevalence and clinical characteristics of DED among RA patients and its association with demographic and disease-duration factors. *Methods:* 150 RA patients aged 30–50 years were evaluated in this hospital-based cross-sectional study using TBUT, Schirmer's Test I, fluorescein and Rose Bengal staining. DED was diagnosed when ≥ 2 of subjective symptoms, TBUT <10 s, or Schirmer's <10 mm/5 min were present. *Results:* DED was diagnosed in 52/150 patients, more often with longer RA duration. Schirmer's, TBUT and Rose Bengal scores differed significantly from DED-negative patients. Multi-modal treatment improved symptoms and quality of life, while a few remained refractory. *Conclusion:* DED affects more than one-third of RA patients with a duration-dependent severity gradient. Routine ophthalmic screening should be integrated into standard RA care.

Keywords: Rheumatoid arthritis, Dry eye disease, Keratoconjunctivitis sicca, Tear film break-up time, Schirmer's test.

Introduction

Rheumatoid arthritis (RA) is a chronic, systemic autoimmune disorder characterised by symmetric erosive synovitis, driven by genetic predisposition, environmental triggers and dysregulated immunity that gives rise to autoantibodies such as rheumatoid factor (RF) and anti-citrullinated protein antibodies (ACPA) [1]. Beyond the joints, RA frequently involves the cardiovascular, pulmonary, integumentary and ocular systems. Ocular involvement ranges from common conditions such as dry eye disease (DED) and episcleritis to rarer, sight-threatening complications including scleritis and peripheral ulcerative keratitis [2-7]. Of these, DED - also known as keratoconjunctivitis sicca is by far the most prevalent, causing chronic discomfort, visual fatigue and impaired quality of life.

The pathogenesis of DED in RA reflects a systemic inflammatory process acting on the lacrimal functional unit, comprising the cornea,

conjunctiva, lacrimal glands and their neural connections. Pro-inflammatory cytokines principally TNF- α , IL-1 β , IL-6 and IL-17 infiltrate and damage the lacrimal gland, reducing aqueous tear production, while promoting conjunctival goblet cell apoptosis, mucin deficiency and corneal epithelial injury [8]. This cascade destabilises the tear film, raises tear osmolarity and perpetuates a self-sustaining cycle of ocular surface inflammation that can persist independently of systemic disease control.

Global and Indian studies have consistently identified RA as an independent risk factor for DED, with reported prevalence ranging from approximately 31% to 56% depending on diagnostic criteria and population studied [8-11]. Despite this well-documented burden, ocular surface assessment is rarely incorporated into routine rheumatological evaluation, and patients often present with

moderate-to-severe disease before receiving ophthalmic care. Given the paucity of comprehensive, multiparameter data from Indian RA cohorts within a defined age range, this study was undertaken to determine the prevalence of DED among RA patients, characterise its clinical and objective features, and examine its association with demographic and disease-duration variables, alongside treatment response.

Material and Methods

Study design and setting: This hospital-based, cross-sectional observational study was conducted in the Department of Ophthalmology, in collaboration with the Departments of Medicine and Orthopaedics, at Al-Ameen Medical College Hospital, Vijayapura, over a period of two years.

Study population and sample size: Patients with a confirmed diagnosis of RA (RF-positive or fulfilling ACR/EULAR criteria), aged 30–50 years, attending the collaborating outpatient departments were screened for eligibility. The minimum sample size, calculated from an expected DED prevalence of 30% ($Z=1.96$, precision 8%), was 138; this was rounded to 150 to account for dropouts and enhance statistical robustness. Patients were enrolled by consecutive sampling. Exclusion criteria included prior ocular surgery within six months, active ocular infection unrelated to RA, pre-existing severe dry-eye-causing conditions (e.g. Stevens–Johnson syndrome, ocular cicatricial pemphigoid), use of topical ocular medication or contact lenses, pregnancy or lactation, and inability to comprehend study procedures. Institutional ethics committee clearance and written informed consent were obtained from all participants.

Clinical evaluation: A structured proforma recorded demographic data, RA history (duration, treatment, systemic manifestations) and ocular symptoms. All patients underwent visual acuity testing (Snellen's chart) and slit-lamp biomicroscopy of the lids, conjunctiva, cornea, anterior chamber and tear meniscus. Dry eye testing was performed in sequence:

- Tear Film Break-Up Time (TBUT): time to first dry spot after fluorescein instillation; <10 seconds considered abnormal.

- Schirmer's Test I (without anaesthesia): wetting <10 mm/5 minutes considered abnormal.
- Fluorescein staining, graded using the Oxford scale, to assess corneal epithelial damage.
- Rose Bengal staining, graded using the van Bijsterveld system, to assess conjunctival/corneal devitalisation.

DED was diagnosed when at least two of the following were present: subjective symptoms, TBUT <10 seconds, or Schirmer's value <10 mm/5 minutes [12–14].

Statistical analysis: Data were analysed using SPSS version 26.0. Continuous variables are presented as mean $\pm$ SD and categorical variables as frequency (%). The chi-square test (or Fisher's exact test) was used for categorical associations, and the independent-samples t-test for continuous comparisons between DED-positive and DED-negative groups. A p -value <0.05 was considered statistically significant.

Results

A total of 150 patients diagnosed with RA were enrolled, aged 30–50 years (mean 41.6 ± 6.2 years). The cohort comprised 114 females (76%) and 36 males (24%), consistent with the known female preponderance of RA (Table 1).

Table-1: Demographic profile of the study population (n = 150)			
Variable	Category	n	%
Age (years)	30–35	15	10.0
	36–40	42	28.0
	41–45	69	46.0
	46–50	24	16.0
Sex	Male	36	24.0
	Female	114	76.0
Duration of RA	<5 years	57	38.0
	5–10 years	63	42.0
	>10 years	30	20.0

Of the 150 patients evaluated, 52 (34.7%) fulfilled diagnostic criteria for DED ($p < 0.001$), confirming DED as a common and

statistically significant ocular manifestation of RA in this cohort (Table 2).

Table-2: Prevalence and severity of dry eye disease among RA patients			
Parameter	n	%	p-value
DED present (of 150)	52	34.7	<0.001
DED absent (of 150)	98	65.3	—
Mild DED (of 52 DED+)	22	42.3	0.155
Moderate DED (of 52 DED+)	19	36.5	—
Severe DED (of 52 DED+)	11	21.2	—

DED prevalence was similar between females (39/114, 34.2%) and males (13/36, 36.1%; $\chi^2=0.04$, $p=0.83$), indicating no significant sex-based difference in this cohort, whereas prevalence rose progressively with RA duration, reaching statistical significance ($p=0.041$), consistent with cumulative immune-mediated damage to the lacrimal functional unit over time. The most frequent symptoms among DED-

positive patients were foreign body sensation (78.8%), burning sensation (71.2%), dryness (69.2%) and blurring of vision (51.9%).

Objective testing (Table 3) showed markedly reduced Schirmer's values, shortened TBUT and elevated Rose Bengal scores in DED-positive versus DED-negative patients (all $p<0.001$). Fluorescein corneal staining (Oxford scale) was present in 46 of 52 DED-positive patients (88.5%; $p=0.013$): Grade 0 in 11.5%, Grade I in 26.9%, Grade II in 34.6%, Grade III in 19.2% and Grade IV in 7.8%. Slit-lamp examination additionally showed conjunctival congestion (63.5%), reduced tear meniscus height (59.6%), punctate epithelial erosions (46.2%), conjunctival dryness/loss of sheen (55.8%), lid margin irregularity (40.4%), meibomian gland dysfunction features (36.5%) and filamentary keratitis (11.5%).

Table-3: Objective dry eye test results — DED-positive vs DED-negative patients				
Test	DED present (mean $\pm$ SD)	DED absent (mean $\pm$ SD)	t value	p-value
Schirmer's I (mm/5 min)	6.4 $\pm$ 2.1	14.8 $\pm$ 3.2	18.52	<0.001
TBUT (seconds)	6.9 $\pm$ 2.4	12.5 $\pm$ 3.1	12.36	<0.001
Rose Bengal score (van Bijsterveld)	4.3 $\pm$ 1.6	1.2 $\pm$ 0.8	15.21	<0.001

Following multi-modal treatment (Table 4), most patients reported improved subjective visual comfort (75.0%), reduced visual fluctuation during daily activities (67.3%) and improved performance of functional vision tasks (65.4%). A treatment-refractory subgroup of 11 patients

(21.2%) showed no appreciable improvement in either ocular findings or quality of life ($p<0.001$), likely representing patients with the longest disease duration and most advanced structural damage.

Table-4: Treatment modalities and clinical outcomes in DED-positive patients (n = 52)			
Treatment / Outcome	n	%	p-value
Preservative-free artificial tears	52	100.0	<0.001
Combined therapy (≥ 2 modalities)	41	78.8	<0.001
Lubricating gels / ointments	38	73.1	<0.001
Topical anti-inflammatory agents	32	61.5	0.097
Short-term topical corticosteroids	18	34.6	0.028
Punctal occlusion	5	9.6	<0.001
Symptomatic improvement	41	78.8	<0.001
TBUT improvement	36	69.2	0.006
Reduction in ocular surface staining	33	63.5	0.052
Schirmer's improvement	31	59.6	0.165
Overall quality-of-life improvement	40	76.9	<0.001
No significant improvement	11	21.2	<0.001

Discussion

This study demonstrates a DED prevalence of 34.7% among RA patients aged 30–50 years, closely matching the pooled global estimate of 32.8% reported by Turk et al. in a meta-analysis of over 18,000 RA patients [11], and falling within the range of Indian studies (31–56%) [9, 15-18]. The lower figure relative to some Indian cohorts likely reflects the restriction of this study to a younger age band, which excludes older patients in whom DED prevalence is known to rise further.

Patients with longer RA duration were significantly more likely to develop DED, consistent with findings from Fujita et al., Abd-Allah et al. and Gandhi et al. [16, 19-21] although no significant sex-based difference in DED prevalence was observed in the present cohort. The duration-dependent gradient is consistent with a model of cumulative, immune-mediated damage to the lacrimal gland: continuous lymphocytic infiltration progressively destroys acinar tissue, while cytokine-driven goblet cell apoptosis depletes the mucin layer, a process histologically analogous to secondary Sjögren's syndrome [22-23].

Objective testing provided strong, internally consistent evidence of ocular surface compromise, together with corneal epithelial staining in the large majority of affected patients. These findings corroborate a pathophysiological model in which reduced aqueous secretion, unstable tear film and consequent hyperosmolar stress activate MAPK/NF- κ B signalling in surface epithelial cells, perpetuating inflammation and epithelial damage even when systemic RA activity is controlled [24-25].

Treatment with multi-modal therapy produced symptomatic and quality-of-life improvement in over three-quarters of patients, consistent with reports by Ren et al. and Villani & Nucci favouring combined, rather than single-agent,

management [26-27]. Functional measures such as TBUT and symptom scores improved more consistently than Schirmer's values, suggesting that tear film instability is more therapeutically modifiable than structural lacrimal gland damage. The 21.2% of patients who remained refractory likely represent a subgroup with the most advanced glandular damage, possibly including undiagnosed secondary Sjögren's syndrome, and may benefit from more advanced interventions such as scleral lenses or targeted anti-inflammatory therapy [12,23,27].

Limitations include the cross-sectional design, which precludes causal inference; the absence of systemic disease-activity measures (DAS28, ESR, CRP, RF/ACPA titres); restriction to the 30–50-year age band, limiting generalisability to older patients; and the relatively modest DED-positive subgroup (n=52), which constrained power for some subgroup comparisons. Formal testing for secondary Sjögren's syndrome (anti-Ro/SSA, anti-La/SSB) was not performed and would refine future phenotyping of treatment-refractory patients [3].

Conclusion

DED affects more than one in three RA patients in this cohort and shows a clear, duration-dependent gradient of prevalence and severity. Routine ophthalmic screening, supported by closer collaboration between rheumatologists and ophthalmologists, would enable earlier diagnosis and more effective, individualised management of this common but frequently overlooked extra-articular manifestation of RA.

Acknowledgement

The authors thank the Departments of Medicine and Orthopaedics, Al-Ameen Medical College and Hospital, Vijayapura, for patient referral and cooperation during this study.

Financial Support and sponsorship: Nil

Conflicts of interest: There are no conflicts of interest.

References

1. Punjabi OS, Adyanthaya RS, Mhatre AD, Jehangir RP. Rheumatoid arthritis is a risk factor for dry eye in the Indian population. *Ophthalmic Epidemiol.* 2006; 13(6):379-384.

2. Shan H, Liu W, Li Y, Pang K. The autoimmune rheumatic disease related dry eye and its association with retinopathy. *Biomolecules*. 2023;13(5):724.
3. Islam MM, Hossain MS, Islam MS, Mahfujullah A, Rahman S. Assessment of ocular surface diseases in systemic autoimmune conditions. *Int J Res Med Sci*. 2024; 12(11):4198-4203.
4. Schwartz T, Keenan R, Daluvoy M. Ocular involvement in rheumatoid arthritis [Internet]. *San Francisco: American Academy of Ophthalmology*. 2016 Oct 29 [cited 2026 Jul 18]. Available from: <https://www.aao.org/eyenet/article/ocular-involvement-in-rheumatoid-arthritis>
5. Ellis ME. How does rheumatoid arthritis affect the eyes? [Internet]. *Healthline*. 2020 Dec 10 [cited 2026 Jul 18]. Available from: <https://www.healthline.com/health/rheumatoid-arthritis-eyes>
6. Lewsley J. Rheumatoid arthritis and the eyes [Internet]. *Medical News Today*. 2022 Apr 29 [cited 2026 Jul 18]. Available from: <https://www.medicalnewstoday.com/articles/rheumatoid-arthritis-eyes>
7. Arthritis Foundation. Dry eyes and arthritis [Internet]. 2020 Apr 16 [cited 2026 Jul 18]. Available from: <https://www.arthritis.org/health-wellness/about-arthritis/related-conditions/physical-effects/dry-eyes-and-arthritis>
8. Usuba FS, De Medeiros-Ribeiro AC, Novaes P, Aikawa NE, Bonfiglioli K, Santo RM et al. Dry eye in rheumatoid arthritis patients under TNF-inhibitors: conjunctival goblet cell as an early ocular biomarker. *Sci Rep*. 2020; 10(1):14054.
9. Huda R, Waris SAN, Raj SVS, Rajendran CP. Rheumatoid arthritis is a risk factor for dry eye in south Indian population. *IP Int J Ocul Oncol Oculoplasty*. 2019; 5(1):31-33.
10. Ma W, Wang G, Li X, Wu H, Liu Z, Dong N et al. Study of factors influencing dry eye in rheumatoid arthritis. *J Ophthalmol*. 2020; 2020:1-8.
11. Turk MA, Hayworth JL, Nevskaya T, Pope JE. Ocular manifestations in rheumatoid arthritis, connective tissue disease, and vasculitis: a systematic review and meta-analysis. *J Rheumatol*. 2020; 48(1):25-34.
12. Wylęgała A. Modern diagnostics for dry eye disease: implications for rheumatology. *Reumatologia*. 2025; 63(4):213-215.
13. Pena-Verdeal H, Garcia-Queiruga J, Sabucedo-Villamarin B, Garcia-Resua C, Giraldez MJ, Yebra-Pimentel E. Association between dry eye disease subtypes and rheumatoid arthritis. *Egypt Rheumatol*. 2024; 46(4):161-165.
14. Perez VL, Chen W, Craig JP, Dogru M, Jones L, Stapleton F et al. TFOS DEWS III: executive summary. *Am J Ophthalmol*. 2025; 282:135-145.
15. CK L, Hiremath SG, Pujar C. Dry eye in rheumatoid arthritis patients: correlation with disease activity. *Indian J Clin Exp Ophthalmol*. 2019; 5(2):227-231.
16. Gandhi PA, Samar AK, Kathuria N, Mishra A, Chhabra HS. Prevalence of dry eye disease in rheumatoid arthritis patients and its correlation with duration of rheumatoid arthritis. *Pan-Am J Ophthalmol*. 2024; 6(3):118.
17. Abd-Allah NM, Hassan AA, Omar G, Hamdy M, Abdelaziz STA, Hamid WMAE et al. Dry eye in rheumatoid arthritis: relation to disease activity. *Immunol Med*. 2020; 43(2):92-97.
18. Bhagyajyothi BK, Beniwal S, Goyal D, Mangoli M, Bubanale S, Smitha KS et al. Incidence of dry eye in rheumatoid arthritis and associated macular toxicity due to drug. *Int J Health Sci*. 2022; 6(S8):5339-5347.
19. Fujita M, Igarashi T, Kurai T, Sakane M, Yoshino S, Takahashi H. Correlation between dry eye and rheumatoid arthritis activity. *Am J Ophthalmol*. 2005; 140(5):808-813.
20. Lai S, Wang C, Wu Y, Dai Y, Chen T, Wu H et al. Rheumatoid arthritis associated with dry eye disease and corneal surface damage: a nationwide matched cohort study. *Int J Environ Res Public Health*. 2023; 20(2):1584.
21. Khalil SA, Shafeek MA, Elmihi NMB, Hussein SH, Abdel-Zaher A. The relation between rheumatoid arthritis activity and dry eye disease. *Egypt Rheumatol*. 2025; 47(3):117-121.
22. Gehlen ML, Skare TL, Silva MB, Antero DC, Miyazaki F, Parra AGM. Olho seco e Sjögren secundário na artrite reumatóide. *Rev Bras Oftalmol*. 2012; 71(1):36-39.
23. Ruiz-Lozano RE, Prida-Españillat LA, Moll-Auais RA, Ramos-Dávila EM, Quiroga-Garza ME, Zhao A et al. Ocular inflammatory manifestations in patients with rheumatoid arthritis. *Reumatol Clin (Engl Ed)*. 2025; 21(5):501891.
24. Liu Y, Wu M, Ren Y, Feng J, Shi W, Kang H et al. Evaluation of dry eye severity and ocular surface inflammation in patients with autoimmune rheumatic diseases. *Ocul Immunol Inflamm*. 2024; 32(9):2018-2030.
25. Pandian VP, Srinivasan R. Ocular manifestations of rheumatoid arthritis and their correlation with anti-cyclic citrullinated peptide antibodies. *Clin Ophthalmol*. 2015; 9:393.
26. Villani E, Nucci P. Dry eye in rheumatoid arthritis. *Cornea*. 2015; 34(3):e6.
27. Ren Y, Tian J, Shi W, Feng J, Liu Y, Kang H et al. Evaluation and correlation analysis of ocular surface disorders and quality of life in autoimmune rheumatic diseases: a cross-sectional study. *BMC Ophthalmol*. 2023; 23(1):229.

Cite this article as: Shagufta A, Gannur AG, Gannur MA, Kulkarni CC and Azeem N. Dry eye disease in patients with rheumatoid arthritis: A hospital-based cross-sectional study of prevalence, clinical characteristics, and treatment outcomes from South India. *Al Ameen J Med Sci* 2026; 19(4): 305-309.

This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial (CC BY-NC 4.0) License, which allows others to remix, adapt and build upon this work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

*All correspondences to: Dr. Shagufta Aamena, Junior Resident, Department of Ophthalmology, Al Ameen Medical College and Hospital, Athani Road, Vijayapura-586108, Karnataka, India. Email: shaguftapq@gmail.com