

Annals of Ophthalmology and Eye Disorders

Review Article

fundus photography in the Management of dry eye disease among elderly patients with vision loss

Russo E^{1*}, Ferrari D²and Colombo M³

¹Department of Vision Science, Snake Research Center for Vision Science, Greece

²Department of Clinical Ophthalmology, Neva Institute for Advanced Ophthalmology, Italy

³Department of Vision Science, Godavari Institute for Advanced Vision Science, Portugal

*Address for Correspondence: Elena Russo, Department of Vision Science, Snake Research Center for Vision Science, Greece; E-mail: elena.russo@snake.edu

Received: 25 October 2025; Accepted: 26 January 2026; Published: 25 April 2026.

Citation of this article: Russo E, Ferrari D, Colombo M (2026) fundus photography in the Management of dry eye disease among elderly patients with vision loss. Ann Ophthalmol Eye Disord, 8(1): 01-06. DOI: [10.5281/zenodo.22812237](https://doi.org/10.5281/zenodo.22812237)

Copyright: © 2026 Elena Russo, et al. This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Dry eye disease prevalence rises with age to roughly 15% in the oldest cohorts, coexisting with the posterior segment diseases driving most irreversible vision loss [1,12].

Objective: To examine dry eye management in elderly patients and how fundus photography and surface imaging support efficient assessment.

Methods: Narrative synthesis of TFOS DEWS II reports, Cochrane reviews, cohorts, and fundus-photography screening literature.

Findings: Meibography documents evaporative dry eye [8], and non-mydratic fundus photography now screens for retinopathy in the same visit [29,31].

Conclusions: Visual complaints should not be attributed to the ocular surface without a fundus photograph confirming posterior segment health [10,11].

Keywords: dry eye disease; fundus photography; meibography; elderly; vision loss

1. Introduction

Dry eye disease is one of the most common reasons an older adult presents to an eye clinic, and its prevalence rises steadily with age. Large cohort studies of women and men place prevalence in the range of 7-15% among adults over 65, climbing further in the oldest patients [1,2,3]. The Beaver Dam Eye Study's longitudinal wave showed meaningful new incidence in older cohorts followed over a decade, so clinicians are managing a moving target rather than a fixed baseline [4]. The TFOS DEWS II reports consolidated this evidence into a coherent framework, defining dry eye disease as a multifactorial disorder of the ocular surface characterized by loss of tear film homeostasis [5,6,7].

Dry eye disease rarely occurs in isolation in older patients. Age-related meibomian gland dropout, reduced blink rate, polypharmacy, and a cumulative burden of ocular surgery converge on the same population that also carries the highest incidence of age-related macular degeneration, diabetic retinopathy, and glaucoma [8,9]. Vision loss in an elderly patient with dry eye symptoms is therefore rarely attributable to the ocular surface alone, and a clinician evaluating blur or fluctuating vision must hold two possibilities in mind: a tear film disorder degrading the anterior optical surface, and a posterior segment disease progressing quietly behind it. Fundus photography, whether via a dilated camera or an office-based non-mydratic device, is the practical tool that lets a clinician document the posterior pole efficiently and screen for the diseases that actually threaten irreversible vision loss, freeing the remaining visit time for the tear film and meibographic assessment dry eye disease itself requires [10,11,12]. This article reviews current evidence on managing dry eye disease in elderly patients with concurrent vision loss, focusing on how fundus photography and ocular surface imaging fit into a single, efficient care pathway.

2. Methods

We conducted a narrative synthesis of the peer-reviewed literature on dry eye disease epidemiology and management in older adults, ocular surface and meibomian gland imaging, and fundus photography for screening posterior segment disease in elderly populations with visual complaints. Sources were identified through the TFOS DEWS II reports and their cited primary literature, Cochrane reviews of dry eye interventions, landmark epidemiological cohorts, and retinopathy and macular degeneration screening studies evaluating fundus photography and automated grading, with reference lists hand-searched for further relevant studies. Because the direct intersection of fundus photography and dry eye management is not a large discrete literature, this review draws on adjacent bodies of evidence and synthesizes them into a single clinically coherent account rather than a formal systematic review with quantitative pooling.

3. Results

Epidemiology and burden of dry eye disease in the elderly

Every major population-based study of dry eye disease reports the same age gradient. In the Women's Health Study, prevalence of clinically diagnosed dry eye syndrome rose from under 6% in women under 50 to nearly 15% in women over 80 [1], with a comparable if somewhat lower trajectory in men from the Physicians' Health Studies [2]. The Beaver Dam Eye Study's cross-sectional wave identified similar risk gradients tied to age, female sex, and vitamin A deficiency [3], and its follow-up wave showed substantial new incidence over ten years among initially asymptomatic older adults [4]. The UK TwinsUK cohort corroborated the same age and sex pattern in a genetically informative sample, implicating heritable as well as environmental drivers [13] (Table 1). The consistent female predominance reflects sex hormone influences on lacrimal and meibomian gland function that intensify around menopause, detailed in the TFOS DEWS II Sex, Gender, and Hormones Report, and

helps explain why elderly women present so frequently with evaporative disease superimposed on other age-related ocular pathology [14].

Dry eye disease also carries a measurable functional and economic burden felt disproportionately by older patients whose visual reserve is already limited. Miljanovic and colleagues showed decrements in vision-related quality of life comparable in magnitude to moderate cataract, affecting reading, driving, and screen-based tasks central to independence in old age [15]. Yu and colleagues' decision-tree analysis of the economic burden of dry eye disease in the United States found direct and indirect costs that scale with severity, a burden borne by health systems serving aging populations before the cost of coexisting posterior segment disease is even added [16].

Pathophysiology, diagnosis, and ocular surface imaging in older patients

The TFOS DEWS II pathophysiology report frames dry eye disease as a self-amplifying cycle in which tear hyperosmolarity and instability drive ocular surface inflammation, which in turn worsens both, a cycle that aqueous-deficient and evaporative subtypes feed into from different starting points [7]. Evaporative dry eye from meibomian gland dysfunction is disproportionately common in older patients, and noncontact infrared meibography can document the underlying glandular dropout directly; Arita and colleagues used this technique to show progressive, quantifiable meibomian gland atrophy across the adult lifespan, establishing meibography as a practical way to visualize a process clinical lid examination alone underestimates [8]. The International Workshop on Meibomian Gland Dysfunction's executive summary explicitly recommended meibomian gland imaging as part of a structured diagnostic approach, particularly when evaporative loss is not obvious on slit-lamp examination alone [9].

Diagnostic testing benefits from the same multimodal

logic. The TFOS DEWS II Diagnostic Methodology Report recommends tear film osmolarity as one of several objective markers of ocular surface homeostasis alongside tear break-up time, ocular surface staining, and meibomian gland assessment, since no single test captures the full disease [17]. Sullivan and colleagues showed osmolarity correlates with disease severity, supporting its use as a quantitative monitoring endpoint [18], and Lemp and colleagues' multicenter study confirmed its discriminating ability between normal and dry eye states [19]. A persistent complication is the well-documented dissociation between symptoms and signs: Nichols and colleagues found only weak correlation between patient-reported symptoms and staining or tear break-up time, a mismatch especially important in elderly patients who may under-report symptoms or attribute blur to known retinal disease rather than the ocular surface [20]. The Ocular Surface Disease Index, validated by Schiffman and colleagues, remains the most widely used instrument for tracking this symptom burden over time [21]. Baudouin and colleagues proposed a practical severity algorithm integrating symptoms, signs, and inflammatory markers to guide staged treatment [22], and Bron and colleagues emphasized individualizing diagnostic thresholds rather than applying a single cutoff across a heterogeneous, aging patient population [23].

Table 1: Complementary diagnostic modalities used when evaluating an elderly patient with dry eye symptoms and visual complaints [17,8,18,29].			
Modality	Target structure	Primary clinical question	Relevance in elderly patients
Tear break-up time / osmolarity	Tear film	Tear film stability and homeostasis	Objective marker less dependent on symptom reporting
Non-contact meibography	Meibomian glands	Structural gland dropout/atrophy	Documents age-related evaporative disease directly

Modality	Target structure	Primary clinical question	Relevance in elderly patients
Ocular Surface Disease Index	Patient-reported symptoms	Symptom burden and treatment response	May under-report in cognitively impaired patients
Fundus photography (mydriatic or non-mydriatic)	Macula, optic disc, retinal vasculature	Posterior segment disease ruling in/out	Screens for AMD, diabetic retinopathy, glaucomatous disc change causing the same visual complaint

Management strategies for dry eye disease in older adults

TFOS DEWS II's Management and Therapy Report organizes treatment into a staged algorithm beginning with education, environmental modification, and lid hygiene, progressing through tear supplementation, anti-inflammatory therapy, and punctal occlusion, and reserving surgical or biologic interventions for the most refractory cases [24]. Artificial tear supplementation remains first-line at every severity level; the Cochrane review by Pucker and colleagues found modest but consistent symptomatic benefit across over-the-counter formulations with no clear superiority of one over another, supporting a pragmatic trial-and-error approach in older patients who may face tolerability or dexterity constraints with dropper bottles [25]. Punctal occlusion, reviewed by Ervin and colleagues, showed benefit for aqueous-deficient dry eye refractory to lubrication alone, though the evidence base remains limited by small trials, a caveat worth conveying when counseling elderly patients about this minor procedure [26].

For evaporative disease from meibomian gland dysfunction, which predominates in the elderly, gland-directed physical treatments have accumulated a growing evidence base. Craig and colleagues' prospective trial of intense pulsed light therapy demonstrated measurable improvement in tear film stability and

symptom scores, an office-based option that does not depend on home-regimen adherence, an advantage in patients with memory impairment or limited caregiver support [27]. Fraunfelder and colleagues' review of medication-induced dry eye is particularly relevant to a polypharmacy-burdened geriatric population, cataloguing systemic antihistamines, diuretics, and topical glaucoma medications, agents an elderly glaucoma patient is likely already using, as common iatrogenic contributors that clinicians should review before escalating dry eye therapy [28]. This evidence favors beginning with medication review and gland-directed therapy before moving to more invasive interventions in elderly patients.

Vision loss in elderly dry eye patients and the role of fundus photography

The diseases that actually cause irreversible vision loss in older adults, age-related macular degeneration, diabetic retinopathy, and glaucoma, are posterior segment conditions that dry eye disease does not cause but frequently coexists with and can mimic early on (Figure 1). Congdon and colleagues' analysis of global causes of visual impairment placed these conditions among the leading causes of vision loss worldwide, concentrated in the same older age bracket most affected by dry eye disease [10]. Wong and colleagues projected a sharp rise in age-related macular degeneration burden through 2040 as populations age, and the Global Burden of Disease analysis by Bourne and colleagues confirmed that vision impairment from macular degeneration, glaucoma, and diabetic retinopathy remains heavily concentrated in patients over 60, exactly where dry eye prevalence also peaks [11,12].

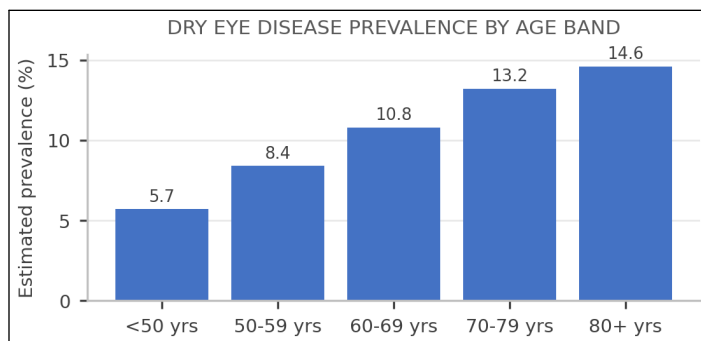


Figure 1: Estimated prevalence of dry eye disease by age band in population-based cohorts of women and men, showing a steady rise across the decades in which age-related macular degeneration, diabetic retinopathy, and glaucoma also become more prevalent [1,2,4].

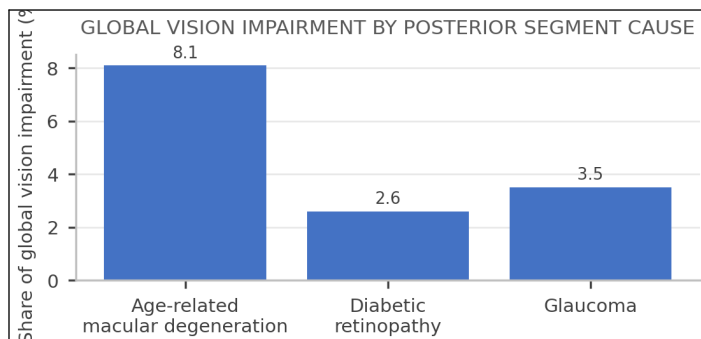


Figure 2: Approximate share of global vision impairment and blindness attributable to age-related macular degeneration, diabetic retinopathy, and glaucoma, the posterior segment causes a fundus photograph obtained during a dry-eye-focused visit is intended to detect or exclude [10,12].

Fundus photography is central to distinguishing these two categories of disease at the point of care. A patient with blurred or fluctuating vision and ocular surface symptoms cannot be assumed, on symptoms alone, to have dry eye disease as the sole explanation; a fundus photograph at the same visit, via a traditional dilated camera or a non-mydratic device suited to frail elderly patients, documents the macula, disc, and vasculature efficiently enough to rule a posterior segment cause in or out without a separate visit (Table 1). Silva and colleagues showed non-mydratic ultrawide-field imaging performs comparably to dilated examination for detecting diabetic retinopathy, valuable for patients who find dilation uncomfortable [29]. Scanlon's account of the English National Screening Programme showed a fundus-photography pathway read by trained graders can

deliver population-level retinopathy screening at scale, a model extended to community settings where many elderly dry eye patients are also managed [30]. Automated grading validated by Abramoff and colleagues has improved this screening step's throughput, making a fundus photograph more feasible within a standard dry-eye visit without subspecialist input at every encounter [31] (Figure 2). In practice, the soundest pathway for an elderly patient with visual complaints and dry eye symptoms is concurrent assessment, ocular surface diagnostics alongside a same-visit fundus photograph, so posterior segment disease is neither missed nor allowed to masquerade as refractory dry eye.

4. Discussion

The evidence reviewed here supports a straightforward but frequently under-implemented principle: dry eye disease management in elderly patients cannot be separated from screening for the posterior segment diseases that share its age distribution. Dry eye disease is common in this population, well characterized by the TFOS DEWS II framework, and manageable through a staged algorithm most patients tolerate [6,24]. But the same demographic burden driving dry eye prevalence also drives macular degeneration, diabetic retinopathy, and glaucoma, and a clinician who treats visual symptoms as dry-eye-attributable without a fundus photograph risks delaying diagnosis of a condition where delay carries far higher stakes [11,12].

Several practical implications follow. Meibography and tear film diagnostics complement rather than substitute for fundus imaging; each answers a different clinical question [8,29]. Because non-mydratic cameras and automated grading have matured, adding a fundus photograph to a standard dry eye visit is now logistically realistic even without on-site retinal subspecialists [30,31]. The symptom-sign dissociation documented in dry eye disease, compounded in elderly patients by under-reporting and comorbid visual disease, means

objective imaging of both the ocular surface and posterior pole carries proportionally more diagnostic weight in this population [20]. Finally, medication review deserves emphasis: an elderly patient on topical glaucoma therapy and systemic anticholinergic or diuretic medication may have iatrogenic dry eye compounding baseline disease, and untangling that contribution before escalating treatment avoids unnecessary intervention [28].

Few studies directly examine fundus photography as an intervention within dry eye management pathways specifically; most supporting evidence is drawn from adjacent literatures that this review has synthesized rather than from trials designed around the combined pathway itself. Prospective studies quantifying how often a same-visit fundus photograph changes management would strengthen the practical case made here.

5. Conclusion

Dry eye disease in elderly patients is common, well characterized diagnostically through tear film osmolarity, meibography, and validated symptom instruments, and manageable through a staged treatment algorithm that most patients tolerate. But because the same aging population carries the highest burden of age-related macular degeneration, diabetic retinopathy, and glaucoma, visual complaints in this group should never be attributed to the ocular surface without first documenting the posterior pole. Fundus photography, made increasingly efficient by non-mydriatic devices and automated grading, offers a practical, well-tolerated way to rule out these vision-threatening conditions within the same visit used to evaluate and manage dry eye disease, ensuring that ocular surface therapy proceeds on a foundation of confirmed, rather than assumed, retinal health.

6. References

1. Schaumberg, D.A., Sullivan, D.A., Buring, J.E., Dana, M.R. (2003) Prevalence of dry eye syndrome among US women. *American Journal of Ophthalmology*, 136(2): 318-326. DOI: [10.1016/S0002-9394\(03\)00218-6](https://doi.org/10.1016/S0002-9394(03)00218-6)
2. Schaumberg, D.A., Dana, R., Buring, J.E., Sullivan, D.A. (2009) Prevalence of dry eye disease among US men: estimates from the Physicians' Health Studies. *Archives of Ophthalmology*, 127(6): 763-768. DOI: [10.1001/archophthalmol.2009.103](https://doi.org/10.1001/archophthalmol.2009.103)
3. Moss, S.E., Klein, R., Klein, B.E.K. (2000) Prevalence of and risk factors for dry eye syndrome. *Archives of Ophthalmology*, 118(9): 1264-1268. DOI: [10.1001/archophth.118.9.1264](https://doi.org/10.1001/archophth.118.9.1264)
4. Moss, S.E., Klein, R., Klein, B.E.K. (2008) Long-term incidence of dry eye in an older population. *Optometry and Vision Science*, 85(8): 668-674. DOI: [10.1097/OPX.0b013e318181a947](https://doi.org/10.1097/OPX.0b013e318181a947)
5. Craig, J.P., Nichols, K.K., Akpek, E.K., Caffery, B., Dua, H.S., Joo, C.K., et al. (2017) TFOS DEWS II Definition and Classification Report. *The Ocular Surface*, 15(3): 276-283. DOI: [10.1016/j.jtos.2017.05.008](https://doi.org/10.1016/j.jtos.2017.05.008)
6. Stapleton, F., Alves, M., Bunya, V.Y., Jalbert, I., Lekhanont, K., Malet, F., et al. (2017) TFOS DEWS II Epidemiology Report. *The Ocular Surface*, 15(3): 334-365. DOI: [10.1016/j.jtos.2017.05.003](https://doi.org/10.1016/j.jtos.2017.05.003)
7. Bron, A.J., de Paiva, C.S., Chauhan, S.K., Bonini, S., Gabison, E.E., Jain, S., et al. (2017) TFOS DEWS II Pathophysiology Report. *The Ocular Surface*, 15(3): 438-510. DOI: [10.1016/j.jtos.2017.05.011](https://doi.org/10.1016/j.jtos.2017.05.011)
8. Arita, R., Itoh, K., Inoue, K., Amano, S. (2008) Noncontact infrared meibography to document age-related changes of the meibomian glands in a normal population. *Ophthalmology*, 115(5): 911-915. DOI: [10.1016/j.ophtha.2007.06.031](https://doi.org/10.1016/j.ophtha.2007.06.031)
9. Nichols, K.K., Foulks, G.N., Bron, A.J., Glasgow, B.J., Dogru, M., Tsubota, K., et al. (2011) The International Workshop on Meibomian Gland Dysfunction: executive summary. *Investigative Ophthalmology & Visual Science*, 52(4): 1922-1929. DOI: [10.1167/iovs.10-6997a](https://doi.org/10.1167/iovs.10-6997a)

Citation: Russo E, Ferrari D, Colombo M (2026) fundus photography in the Management of dry eye disease among elderly patients with vision loss. *Ann Ophthalmol Eye Disord*, 8(1): 01-06.

10. Congdon, N.G., Friedman, D.S., Lietman, T. (2003) Important causes of visual impairment in the world today. *JAMA*, 290(15): 2057-2060. DOI: [10.1001/jama.290.15.2057](https://doi.org/10.1001/jama.290.15.2057)
11. Wong, W.L., Su, X., Li, X., Cheung, C.M.G., Klein, R., Cheng, C.Y., et al. (2014) Global prevalence of age-related macular degeneration and disease burden projection for 2020 and 2040. *The Lancet Global Health*, 2(2): e106-e116. DOI: [10.1016/S2214-109X\(13\)70145-1](https://doi.org/10.1016/S2214-109X(13)70145-1)
12. Bourne, R.R.A., Steinmetz, J.D., Saylan, M., Mersha, A.M., Weldemariam, A.T., Wondmeneh, T.G., et al. (2021) Causes of blindness and vision impairment in 2020 and trends over 30 years, and prevalence projections for 2050. *The Lancet Global Health*, 9(2): e130-e143. DOI: [10.1016/S2214-109X\(20\)30425-3](https://doi.org/10.1016/S2214-109X(20)30425-3)
13. Vehof, J., Kozareva, D., Hysi, P.G., Hammond, C.J. (2014) Prevalence and risk factors of dry eye disease in a British female cohort. *British Journal of Ophthalmology*, 98(12): 1712-1717. DOI: [10.1136/bjophthalmol-2014-305201](https://doi.org/10.1136/bjophthalmol-2014-305201)
14. Sullivan, D.A., Rocha, E.M., Aragona, P., Clayton, J.A., Ding, J., Golebiowski, B., et al. (2017) TFOS DEWS II Sex, Gender, and Hormones Report. *The Ocular Surface*, 15(3): 284-333. DOI: [10.1016/j.jtos.2017.04.001](https://doi.org/10.1016/j.jtos.2017.04.001)
15. Miljanovic, B., Dana, R., Sullivan, D.A., Schaumberg, D.A. (2007) Impact of dry eye syndrome on vision-related quality of life. *American Journal of Ophthalmology*, 143(3): 409-415. DOI: [10.1016/j.ajo.2006.11.060](https://doi.org/10.1016/j.ajo.2006.11.060)
16. Yu, J., Asche, C.V., Fairchild, C.J. (2011) The economic burden of dry eye disease in the United States: a decision tree analysis. *Cornea*, 30(4): 379-387. DOI: [10.1097/ICO.0b013e3181f7f363](https://doi.org/10.1097/ICO.0b013e3181f7f363)
17. Wolffsohn, J.S., Arita, R., Chalmers, R., Djalilian, A., Dogru, M., Dumbleton, K., et al. (2017) TFOS DEWS II Diagnostic Methodology Report. *The Ocular Surface*, 15(3): 539-574. DOI: [10.1016/j.jtos.2017.05.001](https://doi.org/10.1016/j.jtos.2017.05.001)
18. Sullivan, B.D., Whitmer, D., Nichols, K.K., Tomlinson, A., Foulks, G.N., Geerling, G., et al. (2010) An objective approach to dry eye disease severity. *Investigative Ophthalmology & Visual Science*, 51(12): 6125-6130. DOI: [10.1167/iovs.10-5390](https://doi.org/10.1167/iovs.10-5390)
19. Lemp, M.A., Bron, A.J., Baudouin, C., Benitez Del Castillo, J.M., Geffen, D., Tauber, J., et al. (2011) Tear osmolarity in the diagnosis and management of dry eye disease. *American Journal of Ophthalmology*, 151(5): 792-798. DOI: [10.1016/j.ajo.2010.10.032](https://doi.org/10.1016/j.ajo.2010.10.032)
20. Nichols, K.K., Nichols, J.J., Mitchell, G.L. (2004) The lack of association between signs and symptoms in patients with dry eye disease. *Cornea*, 23(8): 762-770. DOI: [10.1097/01.ico.0000133997.07144.9e](https://doi.org/10.1097/01.ico.0000133997.07144.9e)
21. Schiffman, R.M., Christianson, M.D., Jacobsen, G., Hirsch, J.D., Reis, B.L. (2000) Reliability and validity of the Ocular Surface Disease Index. *Archives of Ophthalmology*, 118(5): 615-621. DOI: [10.1001/archopht.118.5.615](https://doi.org/10.1001/archopht.118.5.615)
22. Baudouin, C., Aragona, P., Van Setten, G., Rolando, M., Irkec, M., Benitez del Castillo, J., et al. (2014) Diagnosing the severity of dry eye: a clear and practical algorithm. *British Journal of Ophthalmology*, 98(9): 1168-1176. DOI: [10.1136/bjophthalmol-2013-304619](https://doi.org/10.1136/bjophthalmol-2013-304619)
23. Bron, A.J., Tomlinson, A., Foulks, G.N., Pepose, J.S., Baudouin, C., Geerling, G., et al. (2014) Rethinking dry eye disease: a perspective on clinical implications. *The Ocular Surface*, 12(2 Suppl): S1-S31. DOI: [10.1016/j.jtos.2014.02.002](https://doi.org/10.1016/j.jtos.2014.02.002)
24. Jones, L., Downie, L.E., Korb, D., Benitez-del-Castillo, J.M., Dana, R., Deng, S.X., et al. (2017) TFOS DEWS II Management and Therapy Report. *The Ocular Surface*, 15(3): 575-628. DOI: [10.1016/j.jtos.2017.05.006](https://doi.org/10.1016/j.jtos.2017.05.006)
25. Pucker, A.D., Ng, S.M., Nichols, J.J. (2016) Over the counter (OTC) artificial tear drops for dry eye syndrome. *Cochrane Database of Systematic Reviews*, 2: CD009729. DOI: [10.1002/14651858.CD009729.pub2](https://doi.org/10.1002/14651858.CD009729.pub2)
26. Ervin, A.M., Law, A., Pucker, A.D. (2017) Punctal occlusion for dry eye syndrome. *Cochrane Database of Systematic*

Citation: Russo E, Ferrari D, Colombo M (2026) fundus photography in the Management of dry eye disease among elderly patients with vision loss. *Ann Ophthalmol Eye Disord*, 8(1): 01-06.

Reviews, 6: CD006775. DOI:
[10.1002/14651858.CD006775.pub3](https://doi.org/10.1002/14651858.CD006775.pub3)

27. Craig, J.P., Chen, Y.H., Turnbull, P.R. (2015) Prospective trial of intense pulsed light for the treatment of meibomian gland dysfunction. *Investigative Ophthalmology & Visual Science*, 56(3): 1965-1970. DOI: [10.1167/iovs.14-15764](https://doi.org/10.1167/iovs.14-15764)
28. Fraunfelder, F.W., Sciubba, J.J., Mathers, W.D. (2012) The role of medications in causing dry eye. *Journal of Ophthalmology*, 2012: 285851. DOI: [10.1155/2012/285851](https://doi.org/10.1155/2012/285851)
29. Silva, P.S., Cavallerano, J.D., Sun, J.K., Soliman, A.Z., Aiello, L.M., Aiello, L.P. (2012) Nonmydriatic ultrawide field retinal imaging compared with dilated fundus examination for detection of diabetic retinopathy. *American Journal of Ophthalmology*, 154(3): 549-559. DOI: [10.1016/j.ajo.2012.03.019](https://doi.org/10.1016/j.ajo.2012.03.019)
30. Scanlon, P.H. (2017) The English National Screening Programme for diabetic retinopathy 2003-2016. *Acta Diabetologica*, 54(6): 515-525. DOI: [10.1007/s00592-017-0974-1](https://doi.org/10.1007/s00592-017-0974-1)
31. Abramoff, M.D., Lou, Y., Erginay, A., Clarida, W., Amelon, R., Folk, J.C., et al. (2016) Improved automated detection of diabetic retinopathy on a publicly available dataset through integration of deep learning. *Investigative Ophthalmology & Visual Science*, 57(13): 5200-5206. DOI: [10.1167/iovs.16-19964](https://doi.org/10.1167/iovs.16-19964)