

# Digital dry eye

milton m. hom  
eyemage@mminternet.com  
Azusa, CA

5:50

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## disclosures

last 12 months	last 12 months	last 12 months
allergan/abbvie bausch health novartis sun pharma kala pharma tarsus pharma hovione scientia	silk-tech sydnexis topcon eyenovia bio laboratoires Thea aurinia pharma eyeavance pharma	surface pharma nevakar, inc. visus therapeutics aperta biosciences astareal, inc. azura ophthalmics aldehyra therapeutics

# Digital dry eye

A= Age & demographics

B= Blue light

C= Convergence In.

D= Dry eye

## Computer Vision Syndrome (CVS)


Screen associated dry eye

Trigeminal dysphoria

Digital dry eye


A=Age and demographics

**Jane's Story**  
Jane noticed how dry her eyes were, especially on windy days. Now, with RESTASIS, Jane makes more of her own tears.




WATCH VIDEO

**Rachael's Story**  
Rachael, a contact lens wearer, has incorporated RESTASIS into her daily routine.




WATCH VIDEO

**Kat's Story**  
Kat, an engineer, was experiencing dryness and using artificial tears more often than he wanted to.




WATCH VIDEO

**Diana's Story**  
Diana was experiencing dryness, most notably in air conditioned environments. Her doctor recommended RESTASIS.



WATCH VIDEO

**Leslie's Story**  
When her doctor prescribed RESTASIS, Leslie was relieved to know that there was something that could help her dry eyes.



WATCH VIDEO

## Age

Den et al. 2006  
DEWS 2007  
Hykin and Bron 1992  
Schaumberg et al. 2003  
Sullivan et al. 2006

Schaumberg, Debra A. et al. "The International Workshop on Meibomian Gland Dysfunction: Report of the Subcommittee on the Epidemiology Of, and Associated Risk Factors For, MGD." Investigative Ophthalmology & Visual Science 52.4 (2011): 1094-2006. PMC. Web. 18 Jan. 2016.

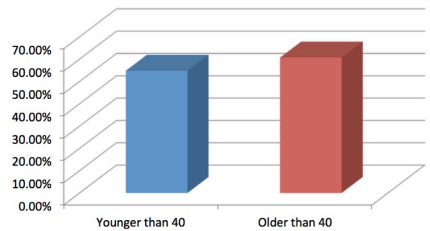
## Age

Under 40 vs Over 40  
Women  
MGD

Harthan J, Kwan J, Optiz D, Hom MM. Meibomian Gland Dysfunction in pre- and post-menopausal women. Optom Vis Sci 2015;92:E abstract 156066.

## Age

Figure 5: Presence of MGD in Females by Age



Harthan J, Kwan J, Opitz D, Hom MM. Meibomian Gland Dysfunction in pre- and post-menopausal women. *Optom Vis Sci* 2015;92:E-abstract 156088.

## Age

Den et al. 2006  
DEWS 2007  
Hykin and Bron 1992  
Schaumberg et al. 2003  
Sullivan et al. 2006

Schaumberg, Debra A. et al. "The International Workshop on Meibomian Gland Dysfunction: Report of the Subcommittee on the Epidemiology Of, and Associated Risk Factors For, MGD." *Investigative Ophthalmology & Visual Science* 52.4 (2011): 1994-2005. PMC. Web. 18 Jan. 2016.

## Digital device



June 29 2007 NYC



2:04

## COVID

## Screen time

"[During Covid] it is...usual routine for...children to spend most of the time (8–12 h per day) attending e-classes in front of a computer or mobile screens."

Bhattacharya S, Saleem SM, Singh A. Digital eye strain in the era of COVID-19 pandemic: An emerging public health threat. *Indian J Ophthalmol*. 2020;68(8):1709-1710. doi:10.4103/ijo.IJO\_1782\_20

## Screen time

"the increase in smart schooling/working exposes individuals to a higher use of...VDT...that is a well-known risk factor for DED"

Giannaccare G, Vaccaro S, Mancini A, Scorgia V. Dry eye in the COVID-19 era: how the measures for controlling pandemic might harm ocular surface. *Graefes Arch Clin Exp Ophthalmol*. 2020;258(11):2567-2568. doi:10.1007/s00417-020-04808-3

## Depression

"The pandemic and lockdown... were found to be associated with depressive symptomatology among both office workers and students"

Majumdar P, Biswas A, Sahu S. COVID-19 pandemic and lockdown: cause of sleep disruption, depression, somatic pain, and increased screen exposure of office workers and students of India. *Chronobiol Int*. 2020 Aug;37(8):1191-1200. doi: 10.1080/07420528.2020.1786107. Epub 2020 Jul 13. PMID: 32660352.

## Depression

"Depressive symptomatology increased from 1.97% to 14.77% among office workers...even more markedly, from 7.07% to 30.77%, among students"

Majumdar P, Biswas A, Sahu S. COVID-19 pandemic and lockdown: cause of sleep disruption, depression, somatic pain, and increased screen exposure of office workers and students of India. *Chronobiol Int*. 2020 Aug;37(8):1191-1200. doi: 10.1080/07420528.2020.1786107. Epub 2020 Jul 13. PMID: 32660352.



COVID

<https://www.youtube.com/watch?v=BzS3r73TQBY>
152

Depression

The COVID-19 pandemic has had a large and uneven impact on global mental health

Cases of mental disorders rose sharply during the pandemic

Cover in 2020

Major depressive disorder

Anxiety disorders

Additional cases due to COVID-19

76.2m

53.2m

193m

298m

Baseline cases

Younger people were hardest hit

Additional prevalence due to COVID-19, by age

Major depressive disorder

Anxiety disorders

Increases were higher among females than males

Additional cases due to COVID-19, by gender

Major depressive disorder

Anxiety disorders

35.5m

17.7m

51.8m

24.4m

Female

Male

Female

Male

Total

53.2m

Total

76.2m

Read the full paper: Santormasi D, Mantelli Hanna AM, Shadish J, et al. Global prevalence and burden of depressive and anxiety disorders in 2014 countries and territories in 2020 due to the COVID-19 pandemic. The Lancet. Published online October 6.

THE LANCET

THE UNIVERSITY OF QUEENSLAND

UQ

IHME

COVID

<https://www.youtube.com/watch?v=bHVxWtckVjk>
202

Depression

"Increased prevalence of depression has been found in patients with meibomian gland dysfunction (MGD)"

Wei Z, Liang J, Cao K, Wang L, Baudouin C, Labbé A, Liang Q. A multi-center study evaluating the correlation between meibomian gland dysfunction and depressive symptoms. Sci Rep. 2022 Jan 10;12(1):443. doi: 10.1038/s41598-021-04167-x. PMID: 35013413; PMCID: PMC8748897.

Depression

"Ocular Surface Disease Index score of the depression group was significantly higher than the control group"

Deng J, Zhou F, Hou W, Silver Z, Wong CY, Chang O, Huang E, Zuo QK. The prevalence of depression, anxiety, and sleep disturbances in COVID-19 patients: a meta-analysis. Ann N Y Acad Sci. 2021 Feb;1486(1):90-111. doi: 10.1111/nyas.14506. Epub 2020 Oct 2. PMID: 33009668; PMCID: PMC7675607.

Depression

"The characteristics of depression in the MGD group included: crying spells, sleep disturbance and depressed appetite"

Wei Z, Liang J, Cao K, Wang L, Baudouin C, Labbé A, Liang Q. A multi-center study evaluating the correlation between meibomian gland dysfunction and depressive symptoms. Sci Rep. 2022 Jan 10;12(1):443. doi: 10.1038/s41598-021-04167-x. PMID: 35013413; PMCID: PMC8748897.

Depression

"Antidepressants may have an impact on the course of eye dryness"

Koçer E, Koçer A, Özşütçü M, Dursun AE, Kırnar İ. Dry Eye Related to Commonly Used New Antidepressants. J Clin Psychopharmacol. 2015 Aug;35(4):411-3. doi: 10.1097/JCP.0000000000000356. PMID: 26075491.

Işık-Ulusoy S, Ulusoy MO. Influence of Different Antidepressants on Ocular Surface in Patients With Major Depressive Disorder. J Clin Psychopharmacol. 2021 Jan/Feb 01;41(1):49-52. doi: 10.1097/JCP.0000000000001325. PMID: 33347023.

Depression

"both SSRIs and serotonin-norepinephrine reuptake inhibitors increased the risk for eye dryness"

Koçer E, Koçer A, Özşütçü M, Dursun AE, Kırnar İ. Dry Eye Related to Commonly Used New Antidepressants. J Clin Psychopharmacol. 2015 Aug;35(4):411-3. doi: 10.1097/JCP.0000000000000356. PMID: 26075491.

Işık-Ulusoy S, Ulusoy MO. Influence of Different Antidepressants on Ocular Surface in Patients With Major Depressive Disorder. J Clin Psychopharmacol. 2021 Jan/Feb 01;41(1):49-52. doi: 10.1097/JCP.0000000000001325. PMID: 33347023.

## Depression

"a significant percentage of this population [millennials] take... antidepressants...that can be contributors to dry eye"

Hauswirth SG. Dry eye disease onset at a younger age. Optometry Times Journal, February digital edition 2022, Volume 14, Issue 2 <https://www.optometrytimes.com/view/dry-eye-disease-onset-at-a-younger-age>

1. Remeron (mirtazapine)
2. Lexapro (escitalopram)
3. Effexor (venlafaxine)
4. Zoloft (sertraline)
5. Celexa (citalopram)
6. Wellbutrin (bupropion)
7. Paxil (paroxetine)
8. Savella (milnacipran)
9. Prozac (fluoxetine)
10. Cymbalta (duloxetine)
11. Luvox (fluvoxamine)
12. Vestra (reboxetine)

B= Blue light

## Blue light

"LED lights and compact fluorescent lamps (CFLs)...emit a high level of blue light. CFLs contain about 25% of harmful blue light and LEDs contain about 35% of harmful blue light"

Mark Dunbar, OD, and Ronald Melton, OD. The Lowdown on Blue Light: Good vs. Bad, and Its Connection to AMD. Review of Optometry. February 2014

## Blue light

"the cooler the white LED, the higher the blue proportion. And by 2020, 90% of all of our light sources are estimated to be LED lighting."

Mark Dunbar, OD, and Ronald Melton, OD. The Lowdown on Blue Light: Good vs. Bad, and Its Connection to AMD. Review of Optometry. February 2014

## Blue light

"blue-enriched LED screen light clearly had an immediate effect on the nocturnal rise of melatonin secretion"

Stephanie van der Lely et. al. "Blue Blocker Glasses as a Countermeasure for Alerting Effects of Evening Light-Emitting Diode Screen Exposure in Male Teenagers." Journal of Adolescent Health: January 2015 Volume 56, Issue 1, Pages 113-119.

## Blue light

"Such arousing effects may be beneficial in the short run for learning or efficient work during the late evening hours, but...the price to pay may be...reduced sleep duration and ...accumulation of sleep debt"

Stephanie van der Lely et. al. "Blue Blocker Glasses as a Countermeasure for Alerting Effects of Evening Light-Emitting Diode Screen Exposure in Male Teenagers." Journal of Adolescent Health: January 2015 Volume 56, Issue 1, Pages 113-119.

## Blue light

Use dim red lights for night lights. Red light...least effect on sleep patterns & melatonin.  
Avoid looking at bright screens 2-3 hours before bed.  
Expose yourself to lots of bright light during the day...boost your ability to sleep at night...mood and alertness during day.

Blue light has a dark side. Harvard Health Letter: May 2012 <http://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side>



Target \$19.99



## Elevator speech

“Looking at your smartphone will keep you awake at night”

## Blue blockers & eyestrain

## Blue light

36 healthy subjects  
No-blue block vs low-blue blocking  
vs high-blue blocking eyeglasses  
2-hour computer task  
Eye strain symptom score  
CFF

Lin JB, Gerratt BW, Bassi CJ, Apte RS. Short-Wavelength Light-Blocking Eyeglasses Attenuate Symptoms of Eye Fatigue. Invest Ophthalmol Vis Sci. 2017 Jan 1;58(1):442-447. doi: 10.1167/iops.16-20663. PMID: 28118668.

## Blue light

**Subjective:**  
Eye strain symptom score  
**Objective:**  
Critical flicker fusion frequency  
(CFF)

Lin JB, Gerratt BW, Bassi CJ, Apte RS. Short-Wavelength Light-Blocking Eyeglasses Attenuate Symptoms of Eye Fatigue. Invest Ophthalmol Vis Sci. 2017 Jan 1;58(1):442-447. doi: 10.1167/iops.16-20663. PMID: 28118668.

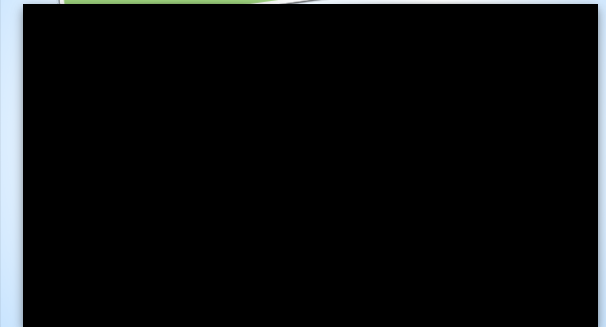
Singh S, Downie LE, Anderson AJ. Do Blue-blocking Lenses Reduce Eye Strain From Extended Screen Time? A Double-Masked Randomized Controlled Trial. Am J Ophthalmol. 2021 Jun;226:243-251. doi: 10.1016/j.ajo.2021.02.010. Epub 2021 Feb 12. PMID: 33587901.

Parameter	Frequency			Intensity		Frequency x Intensity
	Never [0]	Occasionally [1] (sporadic episodes or once a week)	Often or always [2] (2 or 3 times a week or almost every day)	Moderate [1]	Intense [2]	
Burning						
Itching						
Feeling of a foreign body						
Tearing						
Excessive blinking						
Eye redness						
Eye pain						
Heavy eyelids						
Dryness						
Blurred vision						
Double vision						
Difficulty focusing for near vision						
Increased sensitivity to light						
Colored halos around objects						
Feeling that eyesight is worsening						
Headache						
Total						

Calculate Frequency multiplied by intensity for each item. Record Frequency x Intensity as 0 = 0; 1 = 1; 2 = 2; 4 = 4; 6 = 6. Then add these values to get the total value. A total value of at least 6 suggests computer vision syndrome.  
[Segal Mdel M, Cabrero-Garcia J, Crespo A, Vardis J, Ronda E. A reliable and valid questionnaire was developed to measure computer vision syndrome at the workplace. J Clin Epidemiol. 2015 Jun;68(6):662-73. doi: 10.1016/j.jclinep.2015.01.015. Epub 2015 Jan 28. PMID: 25744132.]

[https://eyewiki.aao.org/Computer\\_Vision\\_Syndrome\\_\(Digital\\_Eye\\_Strain\)#cite\\_note-44](https://eyewiki.aao.org/Computer_Vision_Syndrome_(Digital_Eye_Strain)#cite_note-44)

## Critical flicker fusion (CFF)



<https://www.youtube.com/watch?v=6yhVuyE0e08>

## Critical flicker fusion (CFF)



<https://www.youtube.com/watch?v=eA-1YoXHlQ>

## Blue light

Critical flicker fusion frequency  
(CFF)  
Reduced CFF = more fatigue  
Time speeds up  
patient slows down

Lin JB, Gerratt BW, Bassi CJ, Apte RS. Short-Wavelength Light-Blocking Eyeglasses Attenuate Symptoms of Eye Fatigue. Invest Ophthalmol Vis Sci. 2017 Jan 1;58(1):442-447. doi: 10.1167/iops.16-20663. PMID: 28118668.

Singh S, Downie LE, Anderson AJ. Do Blue-blocking Lenses Reduce Eye Strain From Extended Screen Time? A Double-Masked Randomized Controlled Trial. Am J Ophthalmol. 2021 Jun;226:243-251. doi: 10.1016/j.ajo.2021.02.010. Epub 2021 Feb 12. PMID: 33587901.

## Blue light

36 healthy subjects  
No-blue block vs low-blue blocking  
vs high-blue blocking eyeglasses  
2-hour computer task  
Eye strain symptom score  
CFF

Lin JB, Gerratt BW, Bassi CJ, Apte RS. Short-Wavelength Light-Blocking Eyeglasses Attenuate Symptoms of Eye Fatigue. Invest Ophthalmol Vis Sci. 2017 Jan 1;58(1):442-447. doi: 10.1167/iops.16-20663. PMID: 28118668.

## Blue light

"High-blue blocking...reported... less feeling pain around/inside the eye...less feeling that the eyes were heavy...less feeling that the eyes were itchy"

Lin JB, Gerratt BW, Bassi CJ, Apte RS. Short-Wavelength Light-Blocking Eyeglasses Attenuate Symptoms of Eye Fatigue. Invest Ophthalmol Vis Sci. 2017 Jan 1;58(1):442-447. doi: 10.1167/iov.16-20663. PMID: 28118668.

## Blue light

120 symptomatic computer users  
Clear vs blue-blocking spectacles  
2-hour computer task  
Eye strain symptom score  
Critical fusion flicker frequency (CFF)

Singh S, Downie LE, Anderson AJ. Do Blue-blocking Lenses Reduce Eye Strain From Extended Screen Time? A Double-Masked Randomized Controlled Trial. Am J Ophthalmol. 2021 Jun;226:243-251. doi: 10.1016/j.ajo.2021.02.010. Epub 2021 Feb 12. PMID: 33587901.

## Critical flicker fusion (CFF)

"for eye strain symptom score, no differences were found"

Singh S, Downie LE, Anderson AJ. Do Blue-blocking Lenses Reduce Eye Strain From Extended Screen Time? A Double-Masked Randomized Controlled Trial. Am J Ophthalmol. 2021 Jun;226:243-251. doi: 10.1016/j.ajo.2021.02.010. Epub 2021 Feb 12. PMID: 33587901.

## Critical flicker fusion (CFF)

"CFF..no significant effect... [between] blue-blocking or clear lens"

Singh S, Downie LE, Anderson AJ. Do Blue-blocking Lenses Reduce Eye Strain From Extended Screen Time? A Double-Masked Randomized Controlled Trial. Am J Ophthalmol. 2021 Jun;226:243-251. doi: 10.1016/j.ajo.2021.02.010. Epub 2021 Feb 12. PMID: 33587901.

## Blue light

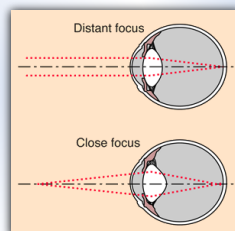
"Blue-blocking lenses did not alter signs or symptoms of eye strain with computer use"

Singh S, Downie LE, Anderson AJ. Do Blue-blocking Lenses Reduce Eye Strain From Extended Screen Time? A Double-Masked Randomized Controlled Trial. Am J Ophthalmol. 2021 Jun;226:243-251. doi: 10.1016/j.ajo.2021.02.010. Epub 2021 Feb 12. PMID: 33587901.

C=Convergence  
Insufficiency

Q: We live in a 3D world. We only have a 2D retina. How can we perceive different distances?

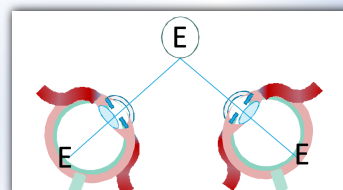
A:  
Accommodation



5:25

## THE NEAR TRIAD

1. Accommodation
2. Convergence
3. Miosis



BHOLA, RAHUL (23 JANUARY 2006). "EYEROUNDS.ORG: TUTORIAL: BINOCULAR VISION". WEBEYE.OPHTH.UIOWA.EDU. UNIVERSITY OF IOWA. RETRIEVED 11 SEPTEMBER 2020. [HTTPS://WWW.BOULDERVET.COM/WP-CONTENT/UPLOADS/SITES/478/2017/03/THE-NEAR-TRIAD.PDF](https://www.bouldervet.com/wp-content/uploads/sites/478/2017/03/THE-NEAR-TRIAD.PDF)

<https://www.youtube.com/watch?v=8f5vhrdAItw>

2:27



## Convergence Insufficiency

Symptoms:  
Gritty  
Sandy  
Burning  
Headaches  
Eyestrain  
Photophobia

Krall J, Sachs J. When dry eye and headaches are actually convergence-related eyestrain. Refractive Eyecare November 2010

Teitelbaum B, Pang Y, Krall J. Effectiveness of base in prism for presbyopes with convergence insufficiency. Optom Vis Sci. 2009;86(2):153-6.

Introducing a new breakthrough technology: neurolens® System



### SIGHTSYNC®

SightSync® uses proprietary testing techniques and sophisticated eye tracking technology to objectively measure the amount of binocular misalignment a patient is experiencing at distance and near.

SightSync® creates a dynamic customized measurement of misalignment at 6 meters and 50 cm, analyzing all elements of ocular fusion, including:

- Heterophoria
- Vergence conditioning
- Binocular peripheral fusion
- Fixation disparity
- Accommodative convergence response
- Alternating monocular central fixation

<https://www.neurolenses.com/eye-care-professionals/>

“First, place a white spot at distance.  
Slowly initiate an alternating-cover test, asking the patient to report the direction of any target movement.”

Krall J, Sachs J. When dry eye and headaches are actually convergence-related eyestrain. Refractive Eyecare November 2010

Teitelbaum B, Pang Y, Krall J. Effectiveness of base in prism for presbyopes with convergence insufficiency. Optom Vis Sci. 2009;86(2):153-6.

“Patients who see the target moving in the same direction as the occluder are exophoric.”

Krall J, Sachs J. When dry eye and headaches are actually convergence-related eyestrain. Refractive Eyecare November 2010

Teitelbaum B, Pang Y, Krall J. Effectiveness of base in prism for presbyopes with convergence insufficiency. Optom Vis Sci. 2009;86(2):153-6.

## Convergence Insufficiency

“The eyes are focused in one location but converged to another. By altering this correctly, though, there is a high likelihood that symptoms will resolve”

Jeff Krall, OD

[www.healio.com/optometry/contact-lenses-eye-wear/news/print/primary-care-optometry-news/\(c4bab9e1-9ae6-41f8-ba11-ad7da678dfb6\)/understanding-proprioception-may-be-the-key-to-treating-visual-fatigue](http://www.healio.com/optometry/contact-lenses-eye-wear/news/print/primary-care-optometry-news/(c4bab9e1-9ae6-41f8-ba11-ad7da678dfb6)/understanding-proprioception-may-be-the-key-to-treating-visual-fatigue)

525

## Convergence Insufficiency

“Keep in mind that patients can rarely tolerate more than 3 D of prism change...(1.5 D in each lens). Even 2 D...requires some adaptation.”

Krall J, Sachs J. When dry eye and headaches are actually convergence-related eyestrain. Refractive Eyecare November 2010

Teitelbaum B, Pang Y, Krall J. Effectiveness of base in prism for presbyopes with convergence insufficiency. Optom Vis Sci. 2009;86(2):153-6.

## Convergence Insufficiency

“1 D...[or] 10 D exophoric at near, either patient could be symptomatic”

Jeff Krall, OD

[www.healio.com/optometry/contact-lenses-eye-wear/news/print/primary-care-optometry-news/\(c4bab9e1-9ae6-41f8-ba11-ad7da678dfb6\)/understanding-proprioception-may-be-the-key-to-treating-visual-fatigue](http://www.healio.com/optometry/contact-lenses-eye-wear/news/print/primary-care-optometry-news/(c4bab9e1-9ae6-41f8-ba11-ad7da678dfb6)/understanding-proprioception-may-be-the-key-to-treating-visual-fatigue)

## Convergence Insufficiency

“It is truly a binocular problem, not a monocular problem”

Jeff Krall, OD

[www.healio.com/optometry/contact-lenses-eye-wear/news/print/primary-care-optometry-news/\(c4bab9e1-9ae6-41f8-ba11-ad7da678dfb6\)/understanding-proprioception-may-be-the-key-to-treating-visual-fatigue](http://www.healio.com/optometry/contact-lenses-eye-wear/news/print/primary-care-optometry-news/(c4bab9e1-9ae6-41f8-ba11-ad7da678dfb6)/understanding-proprioception-may-be-the-key-to-treating-visual-fatigue)

Contact lens wear



## Digital Zone Optics

D=Dry eye

“First, we are better equipped than ever to manage dry eye. Second, there is the potential for more confusion than ever.”

Mike dePaolis

### Step 1: Artificial tears

Step 2: Non-preserved tears  
Tea tree oil (demodex)  
Plugs  
Goggles  
ung  
Heat and expression (Lipiflow)  
IPL  
Antibiotic/steroids  
Steroids  
Secretagogues  
Restasis  
Xiidra  
Aza-Site

## Treatment

**Table 16**  
Digital management & treatment recommendations for dry eye disease<sup>10,11</sup>

**Step 1:**

- Education regarding the condition, its management, treatment and prognosis
- Modification of local environment
- Education regarding potential dietary modifications (including oral essential fatty acid supplementation)
- Identification and potential modification/information of offending systemic and topical medications
- Oral lubricants of various types (if MGD is present, then consider lipid-containing supplements)
- Sal hygiene and warm compresses of various types

**Step 2:**  
If above options are inadequate consider:

- Non-preserved ocular lubricants to minimize preservative-induced toxicity
- The use of treatment for Demodex (if present)
- Oral secretagogues
  - Palatal occlusion
  - Moisture chamber spectacles/goggles
  - Overnight treatments (such as ointment or moisture chamber devices)
  - Off-office physical heating and expression of the meibomian glands (including device-assisted therapies, such as Lipiflow)
  - Off-office intense pulsed light therapy for MGD
- Prescription drugs to manage DED<sup>12</sup>
  - Topical antibiotic or antibiotic/steroid combination applied to the lid margins for anterior blepharitis (if present)
  - Topical corticosteroids (limited-duration)
  - Topical secretagogues
  - Topical, non-steroidal immunomodulatory drugs (such as cyclosporine)
  - Topical LXA-1 antagonist drugs (such as Xiidra)
  - Oral macrolide or tetracycline antibiotics

**Step 3:**  
If above options are inadequate consider:

- Oral secretagogues
- Autologous conditioned serum eye drops
- Therapeutic contact lens options
  - Soft bandage lenses
  - Rigid scleral lenses

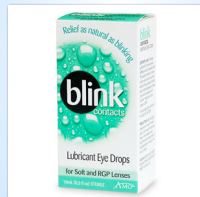
**Step 4:**  
If above options are inadequate consider:

- Topical corticosteroids for longer duration
- Amniotic membrane grafts
- Surgical palatal occlusion
- Other surgical approaches (eg tarsorrhaphy, salivary gland transplantation)

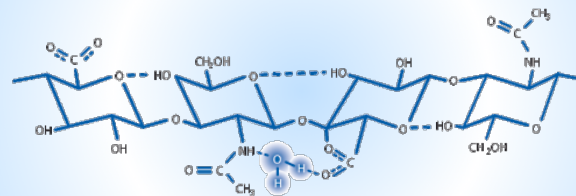
“Which artificial tears should I use?”

Sodium hyaluronate

Sodium hyaluronate

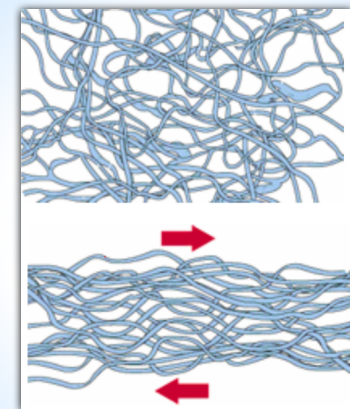


Relieva



<https://oscb-eyecare.org/e-tear-subst-fluid-trb>

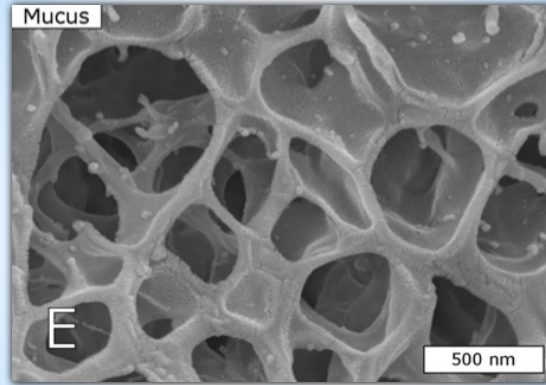
Viscoelasticity



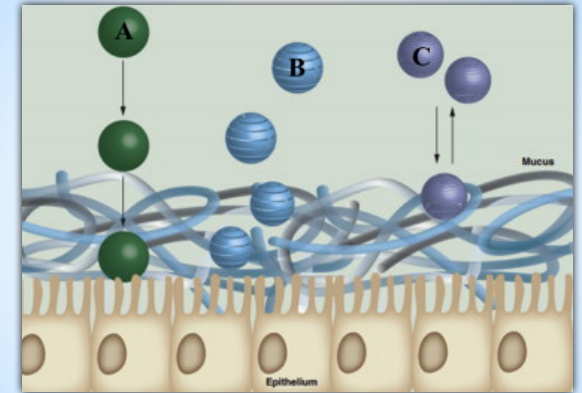
<https://oscb-eyecare.org/e-tear-subst-fluid-trb>



## Nanomicelles



<https://www.pnas.org/content/109/45/18355>



<https://www.sciencedirect.com/science/article/pii/S1818087615000124>

## Nano

Nanoparticle  
Nanomicellar  
Surface coated

Alcon Systane Complete  
AGN Refresh Mega 3  
Kala eyesuvis (loteprednol 0.25%)  
B+L Lotemax SM (loteprednol 0.38%)  
Sun Cequa (0.09% cyclosporine)

## Topical treatment

## Treatment

29 patients  
Baseline and 1 week  
6 sites  
Grp 1: 16 patients  
Grp 2: 13 patients

## Treatment

At 1 week  
Blur-Lower is better  
Grp1: 4.73  
Grp2: 2.25 p=.03

Discomfort-Lower is better  
Grp1: 2.36  
Grp2: 1.0 p=.06

## Treatment

At 1 week  
Taste-Lower is better  
Grp1: 3.43  
Grp2: 0.08 p<.001

Frequency of dryness-Lower is better  
Grp1: 1.93  
Grp2: 2.67 p=.08

## Prevention

## Reading angle

## Screen time

31 subjects  
Reading for 15 minutes on a laptop computer, tablet, e-reader, and smartphone

Talens-Estarellles, Cristian MSc1,\*; Sanchis-Jurado, Vicent PhD1; Esteve-Taboada, José J. PhD1; Pons, Álvaro M. PhD1; García-Lázaro, Santiago PhD1  
How Do Different Digital Displays Affect the Ocular Surface?, Optometry and Vision Science: December 2020 - Volume 97 - Issue 12 - p 1070-1079  
doi: 10.1097/OPX.0000000000001616

## Screen time

“Greater dryness...visual symptoms, lower tear volume and tear stability...higher osmolarity and conjunctival redness...on a computer compared with handheld devices”

Talens-Estarellles, Cristian MSc1,\*; Sanchis-Jurado, Vicent PhD1; Esteve-Taboada, José J. PhD1; Pons, Álvaro M. PhD1; García-Lázaro, Santiago PhD1  
How Do Different Digital Displays Affect the Ocular Surface?, Optometry and Vision Science: December 2020 - Volume 97 - Issue 12 - p 1070-1079  
doi: 10.1097/OPX.0000000000001616

## Screen time

“Best results were obtained with the smartphone and the e-reader, probably attributed to a lower gaze angle”

Talens-Estarellles, Cristian MSc1,\*; Sanchis-Jurado, Vicent PhD1; Esteve-Taboada, José J. PhD1; Pons, Álvaro M. PhD1; García-Lázaro, Santiago PhD1  
How Do Different Digital Displays Affect the Ocular Surface?, Optometry and Vision Science: December 2020 - Volume 97 - Issue 12 - p 1070-1079  
doi: 10.1097/OPX.0000000000001616

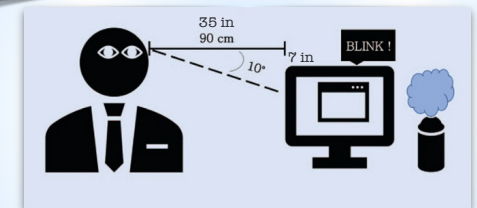
## Screen associated dry eye

“High screens resulted in greater eyestrain than low screens”

Jaschinski W, Heuer H, Kylian H. A procedure to determine the individually comfortable position of visual displays relative to the eyes. Ergonomics. 1999 Apr;42(4):535-49. doi: 10.1080/001401399185450. PMID: 10204419

Jaschinski W, Heuer H, Kylian H. Preferred position of visual displays relative to the eyes: a field study of visual strain and individual differences. Ergonomics. 1998 Jul;41(7):1034-49. doi: 10.1080/001401398186586. PMID: 9674376

## Screen associated dry eye



Mehra, Divy BS\*,†; Galor, Anat MD, MSPH\*,† Digital Screen Use and Dry Eye: A Review, Asia-Pacific Journal of Ophthalmology: November-December 2020 - Volume 9 - Issue 6 - p 491-497  
doi: 10.1097/APO.0000000000000328

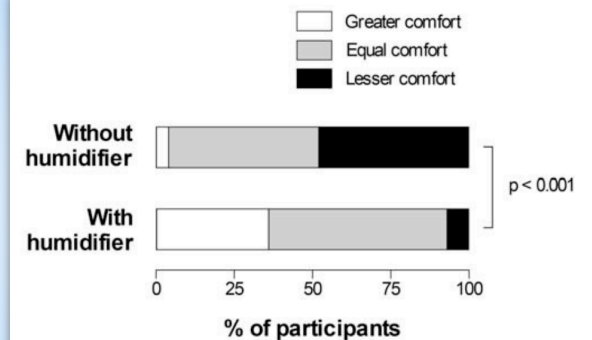
## Environment

## Screen associated dry eye

44 computer users  
Desktop humidifier  
1 hour of computer use

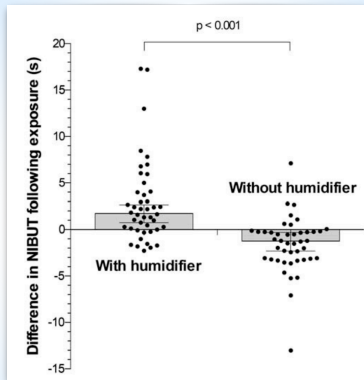
Al-Mohtaseb Z, Schachter S, Shen Lee B, Garlich J, Trattler W. The Relationship Between Dry Eye Disease and Digital Screen Use. Clin Ophthalmol. 2021;15:3811-3820. Published 2021 Sep 10. doi:10.2147/OPTH.S321591

Wang MTM, Chan E, Ea L, et al. Randomized trial of desktop humidifier for dry eye relief in computer users. Optom Vis Sci. 2017;94(11):1052-1057. doi:10.1097/OPX.0000000000001136



Wang MTM, Chan E, Ea L, et al. Randomized trial of desktop humidifier for dry eye relief in computer users. Optom Vis Sci. 2017;94(11):1052-1057. doi:10.1097/OPX.0000000000001136





Wang MTM, Chan E, Ea L, et al. Randomized trial of desktop humidifier for dry eye relief in computer users. *Optom Vis Sci.* 2017;94(11):1052–1057. doi:10.1097/OPX.0000000000001136

## Screen associated dry eye

“USB-powered desktop humidifier... produced...modest increase... humidity...significant improvements in [TBUT/NIBUT] and subjective comfort...were demonstrated

Al-Mohtaseb Z, Schachter S, Shen Lee B, Garlich J, Trattler W. The Relationship Between Dry Eye Disease and Digital Screen Use. *Clin Ophthalmol.* 2021;15:3811–3820. Published 2021 Sep 10. doi:10.2147/OPTH.S321591

Wang MTM, Chan E, Ea L, et al. Randomized trial of desktop humidifier for dry eye relief in computer users. *Optom Vis Sci.* 2017;94(11):1052–1057. doi:10.1097/OPX.0000000000001136

## Exercises

## Screen associated dry eye

The change from far to near... produced a larger increase in eyestrain when the VDUs [screens] were at eye level”

Jaschinski W, Heuer H, Kylian H. A procedure to determine the individually comfortable position of visual displays relative to the eyes. *Ergonomics.* 1999 Apr;42(4):535–49. doi: 10.1080/001401399185450. PMID: 10204419.

Jaschinski W, Heuer H, Kylian H. Preferred position of visual displays relative to the eyes: a field study of visual strain and individual differences. *Ergonomics.* 1998 Jul;41(7):1034–49. doi: 10.1080/001401398185598. PMID: 9674376.

## Depression

“I counsel them to find natural cues...such as changes in browsers or turning to a different screen”

Hauswirth SG. Dry eye disease onset at a younger age. *Optometry Times Journal*, February digital edition 2022, Volume 14, Issue 2 <https://www.optometrytimes.com/view/dry-eye-disease-onset-at-a-younger-age>

## Depression

“do conscious blinking consisting of 1 or 2 slow full blinks”

Hauswirth SG. Dry eye disease onset at a younger age. *Optometry Times Journal*, February digital edition 2022, Volume 14, Issue 2 <https://www.optometrytimes.com/view/dry-eye-disease-onset-at-a-younger-age>

## Depression

“make sure they stop and pause, taking breaks from their screens every 15 to 20 minutes.”

Hauswirth SG. Dry eye disease onset at a younger age. *Optometry Times Journal*, February digital edition 2022, Volume 14, Issue 2 <https://www.optometrytimes.com/view/dry-eye-disease-onset-at-a-younger-age>

## Screen associated dry eye

Every 20 minutes:  
2 sec gently closing eyes  
Opening eyes  
2 sec gently closing eyes  
2 sec squeezing eyes closed

Kim AD, Muntz A, Lee J, Wang MTM, Craig JP. Therapeutic benefits of blinking exercises in dry eye disease. *Cont Lens Anterior Eye.* 2021 Jun;44(3):101329. doi: 10.1016/j.clae.2020.04.014. Epub 2020 May 12. PMID: 32409236.

## Screen associated dry eye

“significant reductions were found compared...in symptom questionnaires...and TBUT”

Kim AD, Muntz A, Lee J, Wang MTM, Craig JP. Therapeutic benefits of blinking exercises in dry eye disease. *Cont Lens Anterior Eye.* 2021 Jun;44(3):101329. doi: 10.1016/j.clae.2020.04.014. Epub 2020 May 12. PMID: 32409236.

## Screen associated dry eye

50 subjects  
Electronic vs hard copy  
Video blink rates and completeness

Argilés M, Cardona G, Pérez-Cabrè E, Rodríguez M. Blink Rate and Incomplete Blinks in Six Different Controlled Hard-Copy and Electronic Reading Conditions. Invest Ophthalmol Vis Sci. 2015 Oct;56(11):6679-85. doi: 10.1167/iov.15-16967. PMID: 26517404.

## Screen associated dry eye

“only electronic reading resulted in an increase in the percentage of incomplete blinks, which may account for the symptoms experienced by VDT users”

Argilés M, Cardona G, Pérez-Cabrè E, Rodríguez M. Blink Rate and Incomplete Blinks in Six Different Controlled Hard-Copy and Electronic Reading Conditions. Invest Ophthalmol Vis Sci. 2015 Oct;56(11):6679-85. doi: 10.1167/iov.15-16967. PMID: 26517404.

## Digital device

### Tips

- **Control the airflow.**

Don't blast the car heater or air conditioning directly into your face, or sleep with a ceiling fan directly over your bed

- **Dodge the draft.**

If cold or hot air is blowing on you at work, close the vent, or, if possible, change your desk orientation.

McDonald M. The changing face of dry eye. Ophthalmology Management August 2017. <http://emaactivity1.ecn5.com/engines/publicPreview.aspx?blastID=1849374&emailID=324737033>



Thank you!

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[eyemage@mminternet.com](mailto:eyemage@mminternet.com)

Myopia

Myopia

“almost 1 billion people will have high myopia, suggesting an alarming increase of prevalence globally.”

Wu PC, Chuang MN, Choi J, Chen H, Wu G, Ohno-Matsui K, Jonas JB, Cheung CMG. Update in myopia and treatment strategy of atropine use in myopia control. Eye (Lond). 2019 Jan;33(1):3-13. doi: 10.1038/s41433-018-0139-7. Epub 2018 Jun 11. PMID: 29891900; PMCID: PMC5328548.

Myopia

“delaying myopia onset and retarding myopia progression in school-aged children is potentially the key to reduce high myopia later in life.”

Wu PC, Chuang MN, Choi J, Chen H, Wu G, Ohno-Matsui K, Jonas JB, Cheung CMG. Update in myopia and treatment strategy of atropine use in myopia control. Eye (Lond). 2019 Jan;33(1):3-13. doi: 10.1038/s41433-018-0139-7. Epub 2018 Jun 11. PMID: 29891900; PMCID: PMC5328548.

Myopia

“outdoor activities and decreasing the duration of near work have been reported to be effective in delaying myopia onset ”

Wu PC, Chuang MN, Choi J, Chen H, Wu G, Ohno-Matsui K, Jonas JB, Cheung CMG. Update in myopia and treatment strategy of atropine use in myopia control. Eye (Lond). 2019 Jan;33(1):3-13. doi: 10.1038/s41433-018-0139-7. Epub 2018 Jun 11. PMID: 29891900; PMCID: PMC5328548.



## Myopia

"higher concentrations of atropine...1% or 0.5% have been shown to be very effective...but...photophobia...up to 100%...has been associated with high dropout rate (16–58%)"

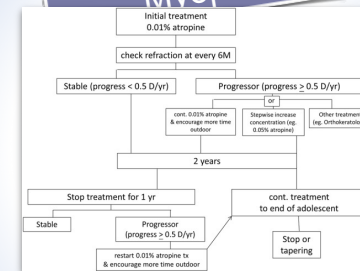
Wu PC, Chuang MN, Choi J, Chen H, Wu G, Ohno-Matsui K, Jonas JB, Cheung CMG. Update in myopia and treatment strategy of atropine use in myopia control. Eye (Lond). 2019 Jan;33(1):3-13. doi: 10.1038/s41433-018-0139-7. Epub 2018 Jun 11. PMID: 29891900; PMCID: PMC6328548.

## Myopia

"Emerging evidence continues to demonstrate the benefits of low-dose atropine used in conjunction with...multifocal contact lenses, orthokeratology, and spectacles"

<https://reviewofmm.com/vyluma-leading-with-innovation/>

## Myopia



Wu PC, Chuang MN, Choi J, Chen H, Wu G, Ohno-Matsui K, Jonas JB, Cheung CMG. Update in myopia and treatment strategy of atropine use in myopia control. Eye (Lond). 2019 Jan;33(1):3-13. doi: 10.1038/s41433-018-0139-7. Epub 2018 Jun 11. PMID: 29891900; PMCID: PMC6328548.

## Selected Clinical trials

	Route	Ages	Length	% atropine
Vyluma (Nevakar)	Drop	3-17y	3y	0.01% 0.02%
Eyenovia	Optejet	3-12y	3y	0.1% 0.01%
Sydnexis	Drop	3-14y	3y+1y	0.01% 0.03%

## Screen time

"Higher daily screen time is associated with lower cognition in children."

Walsh, Jeremy & Barnes, Joel & Tremblay, Mark & Chaput, Jean-Philippe. (2020). Associations between duration and type of electronic screen use and cognition in US children. Computers in Human Behavior. 108. 106312. 10.1016/j.chb.2020.106312.

## Screen time

"Higher TV and video watching were negatively associated with cognition."

Walsh, Jeremy & Barnes, Joel & Tremblay, Mark & Chaput, Jean-Philippe. (2020). Associations between duration and type of electronic screen use and cognition in US children. Computers in Human Behavior. 108. 106312. 10.1016/j.chb.2020.106312.

## Screen time

"These findings suggest moderating screen-use for promoting cognitive development in children."

Walsh, Jeremy & Barnes, Joel & Tremblay, Mark & Chaput, Jean-Philippe. (2020). Associations between duration and type of electronic screen use and cognition in US children. Computers in Human Behavior. 108. 106312. 10.1016/j.chb.2020.106312.

## Digital dry eye

"The association between digital screen use and DED has also been found in school-age children, specifically smart- phone use"

Al-Mohtaseb Z, Schachter S, Shen Lee B, Garlich J, Trattler W. The Relationship Between Dry Eye Disease and Digital Screen Use. Clin Ophthalmol. 2021;15:3811-3820. Published 2021 Sep 10. doi:10.2147/OPTH.S321591

## Depression

"millennials...are noticing increased symptoms of OSD, and they are presenting to our offices in higher numbers"

Hauswirth SG. Dry eye disease onset at a younger age. Optometry Times Journal, February digital edition 2022, Volume 14, Issue 2 <https://www.optometrytimes.com/view/dry-eye-disease-onset-at-a-younger-age>

## Depression

"their eyes generally feel worse at the end of the day after they have been on the computer for a long time."

Hauswirth SG. Dry eye disease onset at a younger age. Optometry Times Journal, February digital edition 2022, Volume 14, Issue 2 <https://www.optometrytimes.com/view/dry-eye-disease-onset-at-a-younger-age>

## Depression

Average age 9.6 years old  
42% had meibomian gland atrophy

Gupta PK, Stevens MN, Kashyap N, Priestley Y. Prevalence of Meibomian Gland Atrophy in a Pediatric Population. Cornea. 2018;37(4):426-430. doi:10.1097/ICO.0000000000001476