WOO UNIVERSITY

Contact Lens Indications in the Management of Computer Vision Syndrome and Digital Eye Strain

Dr. Giancarlo Montani

If you have any questions, you may send an email to

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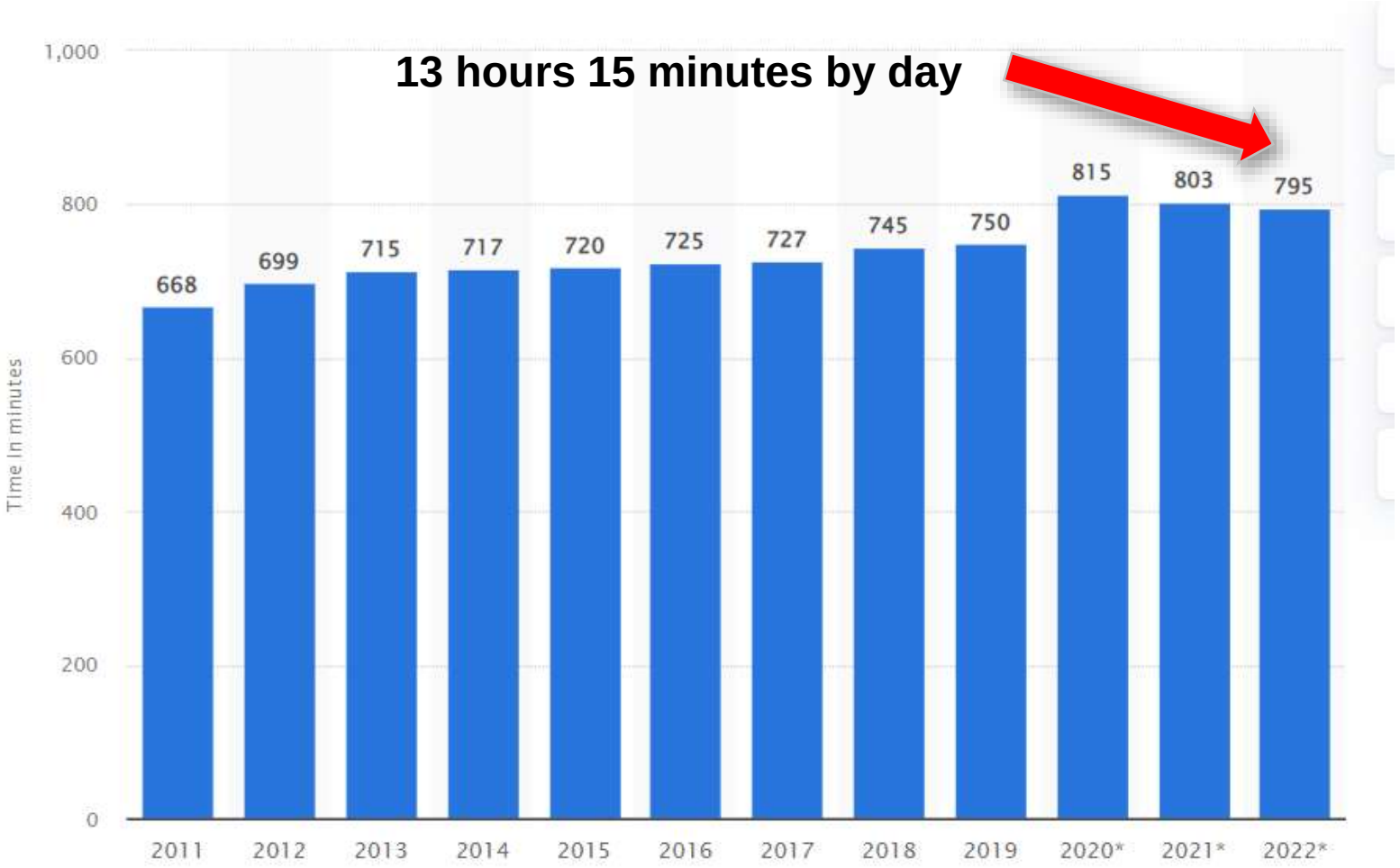
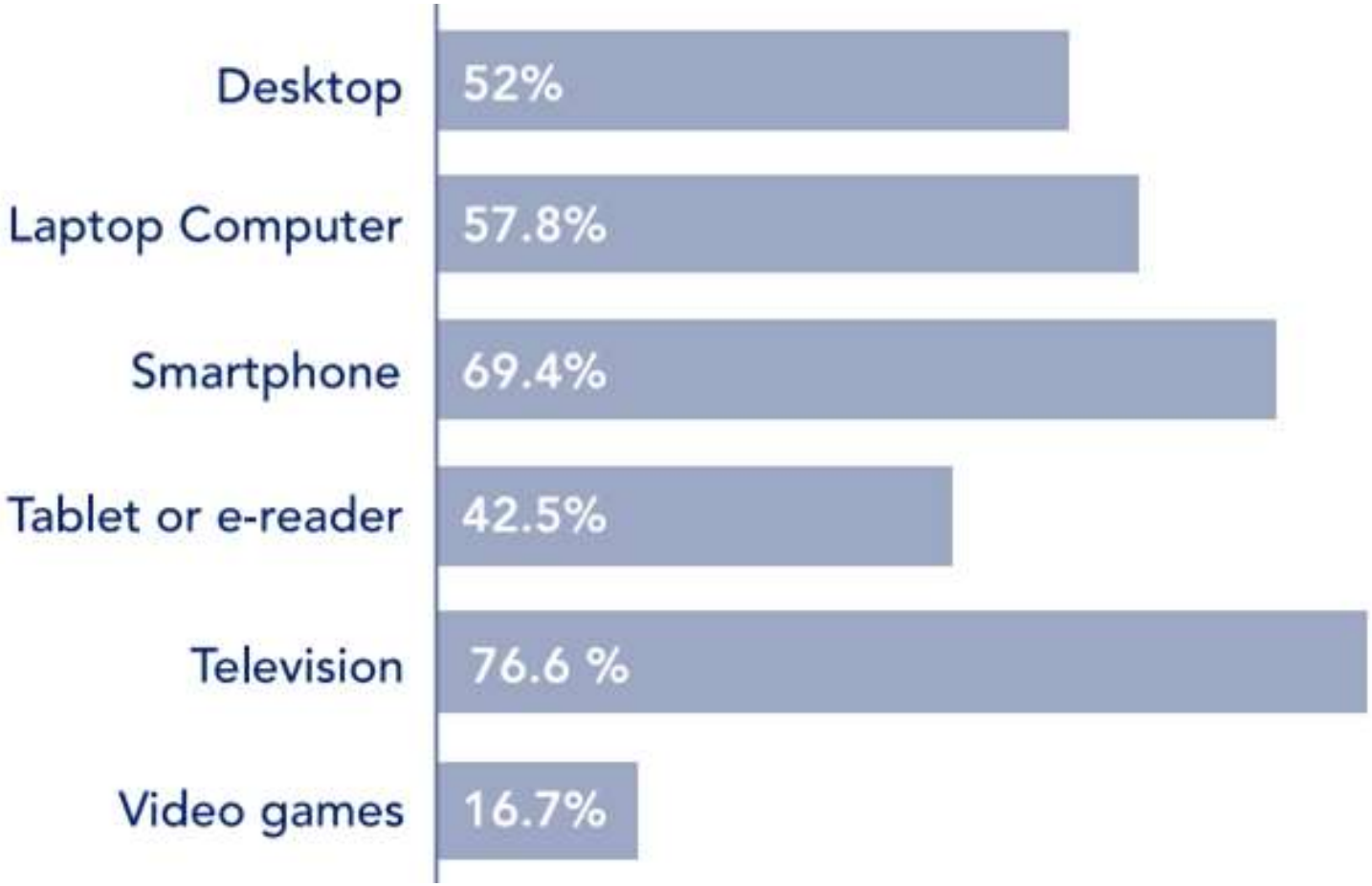
The digital screen is everywhere: at home, at work, at school and everywhere in between.

Hours spent in front of digital systems



https://www.statista.com/statistics/278544/time-spent-with-media-in-the-us/

Digital Devices Most Commonly Used

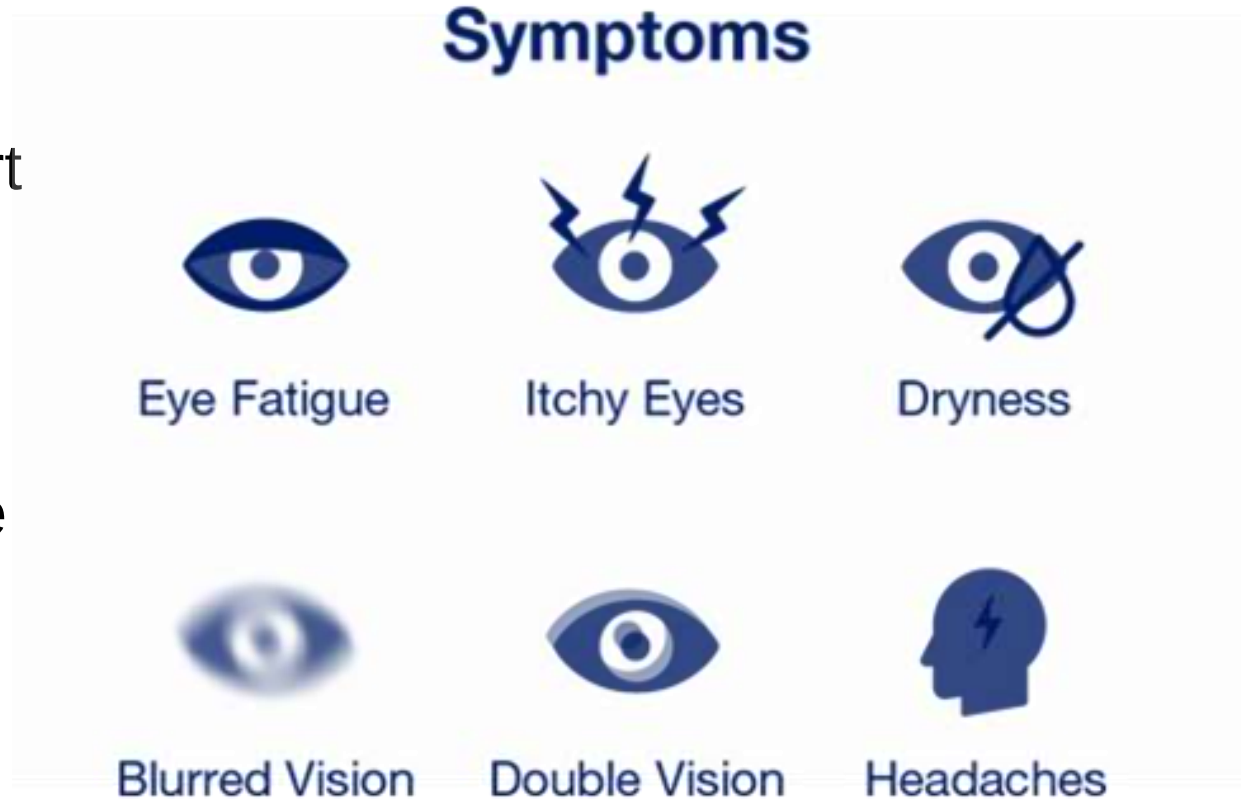


THE VISION COUNCIL

Digital devices use can induce eye discomfort and vision problems

Many individuals experience eye discomfort and vision problems when viewing digital screens for extended periods.

The level of discomfort appears to increase with the amount of digital screen use.



Jaiswal et al. Ocular and visual discomfort associated with smartphones, tablets and computers: what we do and do not know. Clin Exp Optom. 2019 Jan 21. [Epub ahead of print]

Computer vision syndrome and digital eye strain -*Definition*

American Optometric Association

Group of eye and vision-related problems that result from prolonged computer, tablet, e-reader and mobile phone use.

Common symptoms associated with digital eye strain

Tired eyes (40%)

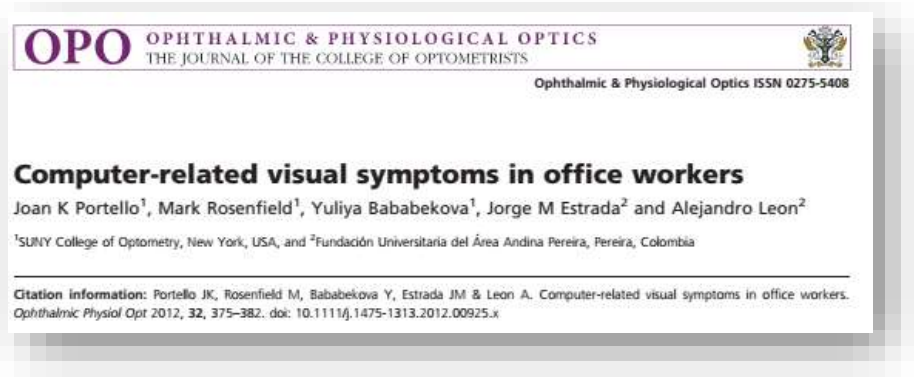
Dry eyes (32%)

Eyestrain or eye discomfort (31%)

Irritated or burning eyes (28%).

Light sensitivity (26%)

Blur at distance (23%) or near (17%)



OPO OPHTHALMIC & PHYSIOLOGICAL OPTICS
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Computer-related visual symptoms in office workers

Joan K Portello[1], Mark Rosenfield[1], Yuliya Bababekova[1], Jorge M Estrada[2] and Alejandro Leon[2]

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Citation information: Portello JK, Rosenfield M, Bababekova Y, Estrada JM & Leon A. Computer-related visual symptoms in office workers. *Ophthalmic Physiol Opt* 2012, **32**, 375–382. doi: 10.1111/j.1475-1313.2012.00925.x

Common symptoms associated with digital eye strain

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ORIGINAL ARTICLE

OPO THE COLLEGE OF OPTOMETRISTS

Attitudes of optometrists in the UK and Ireland to Digital Eye Strain and approaches to assessment and management

Patrick A Moore | James S Wolffsohn | Amy L Sheppard

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Abstract

Purpose: To investigate the attitudes and understanding of optometrists in the UK and Ireland towards Digital Eye Strain (DES), and to examine related practice patterns.

Methods: An anonymous online questionnaire was developed, covering attitude and understanding of DES, examination of patients who may be experiencing DES and approaches to management options. The questionnaire was promoted to UK and Ireland optometrists via professional bodies and local and area optometric committees.

Results: 406 responses were included in the analysis. Most respondents agreed that DES was an important concern for optometrists (88.9%). 91.4% reported they felt confident in discussing possible symptoms of DES and management options; this was weakly and negatively associated with number of years qualified ($r_s = -0.198$, $p \leq 0.001$). Estimations of the proportion of patients affected by DES were lower than reports in the literature (median 25%, IQR 10%–50%). Most respondents always (60.6%) or frequently (21.9%) inquired about device usage in routine case history taking, and also asked follow-up questions, although 29.3% only asked about the presence of symptoms half the time or less. Advising on regular breaks (84.0%), lubricants (55.7%) and environment/set up (69.2%) were felt to be extremely or very important by most respondents. Advising on specialist spectacle lenses, specifically blue filtering designs, was considered extremely or very important by 34.2% and 15.2%, respectively.

Conclusion: Given the agreement that DES is a significant issue causing frequent and persistent symptoms, and practitioners reported high levels of confidence in discussing DES, patients can expect to receive advice on symptoms and management from their optometrist. Simple management strategies were felt to be most important to advise on, with more uncertainty linked to specialist spectacle lenses.

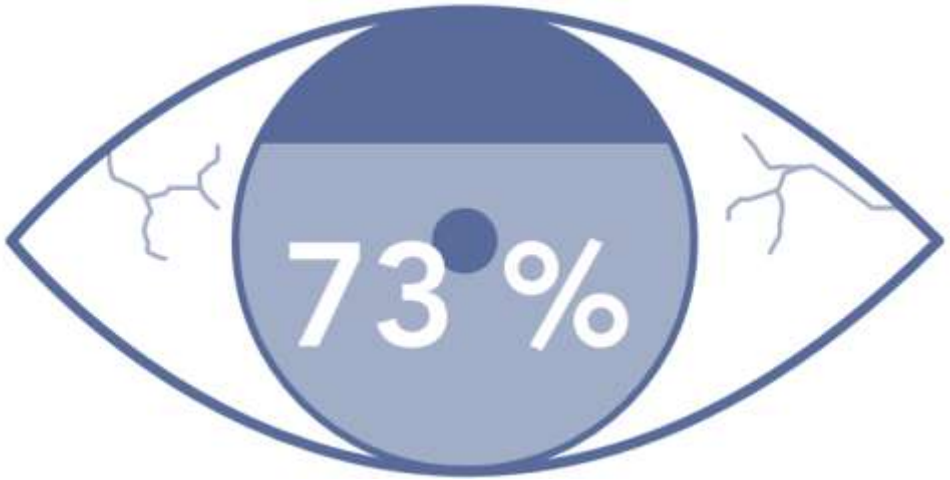
KEYWORDS
computer vision syndrome, digital eye strain, optometrists

TABLE 4 Key symptoms of DES cited by $n = 391$ optometrist respondents

Symptom	Percentage of respondents citing (*n*)
Asthenopia or eye strain/ fatigue	72.6 (284)
Headache	64.7 (253)
Dry or irritated eyes	56.0 (219)
Focussing issues or blurred vision	48.8 (191)
Ocular soreness or redness	35.8 (140)
Non-specific discomfort	6.6 (26)
Photophobia or glare	6.1 (24)
Binocular vision disturbance e.g. diplopia	3.6 (14)
Musculoskeletal issues	3.1 (12)
Insomnia	1.5 (6)
Lid twitching	1.0 (4)
Don't know	0.5 (2)

Who is more involved

THE VISION COUNCIL



Adults under 30 experience the highest rates of digital eye strain symptoms (73%) compared with other age groups

Who is more involved

80% of 200 children between 10 and 17 years of age said their eyes burned, itched, felt tired or blurry after using a digital device

(AOA American Eye-Q survey, 2014)

Who is more involved

Children attending classes as part of a remote learning strategy had:

- more rapid myopia progression,
- increased frequency of dry eye and visual fatigue symptoms
- exhibited signs of vergence and accommodation disturbances such as acute acquired concomitant esotropia and convergence insufficiency

Open access Original research

BMJ Open

Effects of remote learning during the COVID-19 lockdown on children's visual health: a systematic review

María Camila Cortés-Albornoz, Sofía Ramírez-Guerrero, William Rojas-Carabali, Alejandra de-la-Torre, Claudia Talero-Gutiérrez

To cite: Cortés-Albornoz MC, Ramírez-Guerrero S, Rojas-Carabali W, *et al*. Effects of remote learning during the COVID-19 lockdown on children's visual health: a systematic review. *BMJ Open* 2022;**12**:e062388. doi:10.1136/bmjopen-2022-062388

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2022-062388).

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ABSTRACT

Objectives Increased exposure to digital devices as part of online classes increases susceptibility to visual impairments, particularly among school students taught using e-learning strategies. This study aimed to identify the impact of remote learning during the COVID-19 lockdown on children's visual health.

Design Systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

Data sources Scopus, PubMed and ScienceDirect databases from the year 2020 onwards.

Eligibility criteria We included cross-sectional, case–control, cohort studies, case series and case reports, published in English, Spanish or French, that approached the effects of remote learning during the COVID-19 lockdown on visual health in neurotypical children.

Data extraction and synthesis We included a total of 21 articles with previous quality assessments using the Joanna Briggs checklist. Risk of bias assessment was applied using the National Institutes of Health quality assessment tool for before-and-after studies with no control group; the tool developed by Hoy *et al* to assess cross-sectional studies; the Murad *et al* tool to evaluate the methodological quality of case reports and case series; and the Newcastle-Ottawa Scale for cohort studies.

Results All but one study reported a deleterious impact of the COVID-19 lockdown on visual health in children. Overall, the most frequently identified ocular effects were refractive errors, accommodation disturbances and visual symptoms such as dry eye and asthenopia.

Conclusions Increased dependence on digital devices for online classes has either induced or exacerbated visual disturbances, such as rapid progression of myopia, dry eye and visual fatigue symptoms, and vergence and accommodation disturbances, in children who engaged in remote learning during the COVID-19 lockdown.

PROSPERO registration number CRD42022307107.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A systematic review was conducted in three different databases, studies were filtered following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.
- ⇒ Analysed studies approached the effects of remote learning during the COVID-19 lockdown on visual health in children.
- ⇒ To facilitate comparison, eligible studies were clustered according to the main ocular effects evaluated, including refractive errors (myopia), accommodation disturbances (esotropia) and visual symptoms (dry eye and fatigue).
- ⇒ We used quality assessment guidelines and specific risk of bias assessment tools for each study design included.
- ⇒ Heterogeneous methods used in each study, including both subjective and objective measures, limit precise comparisons between them.

INTRODUCTION

Since the WHO declared a global pandemic in March 2020, COVID-19 has become the focus of governmental decisions aimed at protecting the public and limiting the death toll. Schools, universities and businesses have been forced to close to prevent the spread of the virus, limiting in-person relationships and substantially enhancing our digital dependence. The lifestyle and behavioural modifications that have emerged in response to the lockdowns have affected approximately 80% of the world's student population.[1 2]

The establishment of in-house quarantine led to a significant decrease in the amount of time spent engaged in outdoor activities, reduction in exposure to sunlight and increase in time spent doing near work. These factors can enhance the risk of visual impairments, especially among school and university students encouraged to adopt a digital learning approach.[3] A growing dependence on e-learning and electronic devices has increased the incidence of visual fatigue, the onset and progression of myopia, dry eye, irregular astigmatism and acute concomitant esotropia among other ocular pathologies.[4]

Even before the COVID-19 pandemic, an estimated 22.9% of the global population had myopia.[5] During the COVID-19 lockdown, the increased need for electronic devices, digital screens and virtual classrooms

Who is more involved

Excessive duration of online classes and digital device use are serious issues that can result in higher convergence insufficiency symptom scores in children. Online classes longer than 4 hours are more detrimental to abnormal binocular vergence and accommodation parameters than those shorter than 4 hour

Binocular Accommodation and Vergence Dysfunction in Children Attending Online Classes During the COVID-19 Pandemic: Digital Eye Strain in Kids (DESK) Study-2

Amit Mohan, MBBS, MS; Pradhnya Sen, MBBS, MS; Chintan Shah, MBBS, DOMS; Krashan Datt, DOT; Elesh Jain, DOMS, DNB

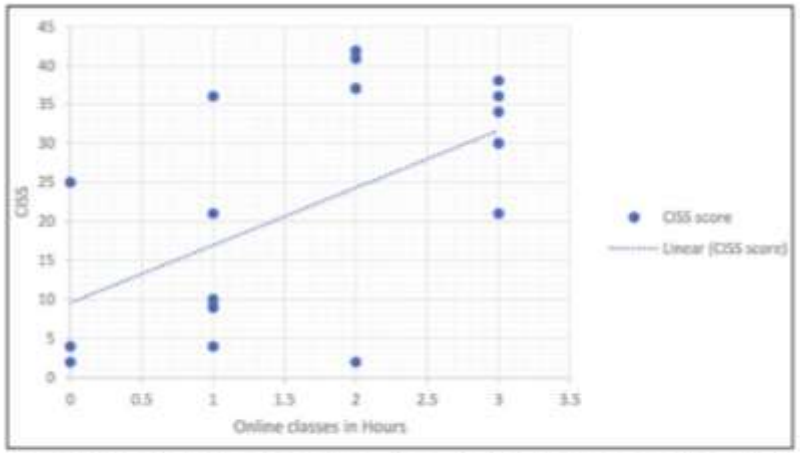
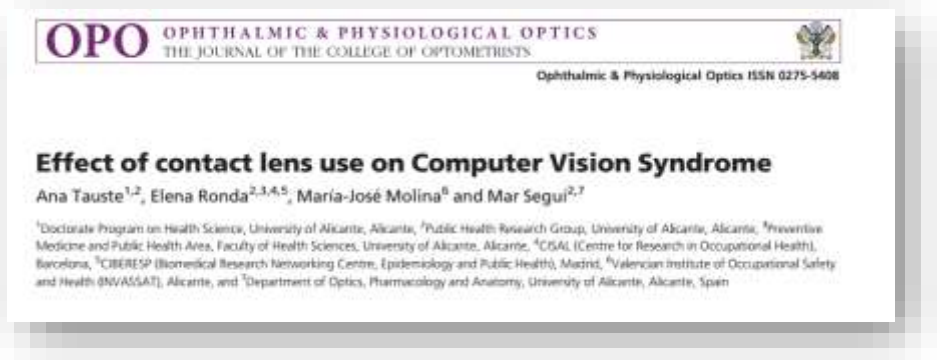


Figure 1. XY scatter chart showing relation between online class activities and Convergence Insufficiency Symptom Survey (CISS) score.

Contact lens wear and digital eye strain

Who wear contact lenses and are exposed to the computer for more than 6 h day are more likely to suffer symptoms than non-lens wearers working at the computer for the same amount of time with a prevalence of 65% vs 50%.



Contact lens wear and digital eye strain

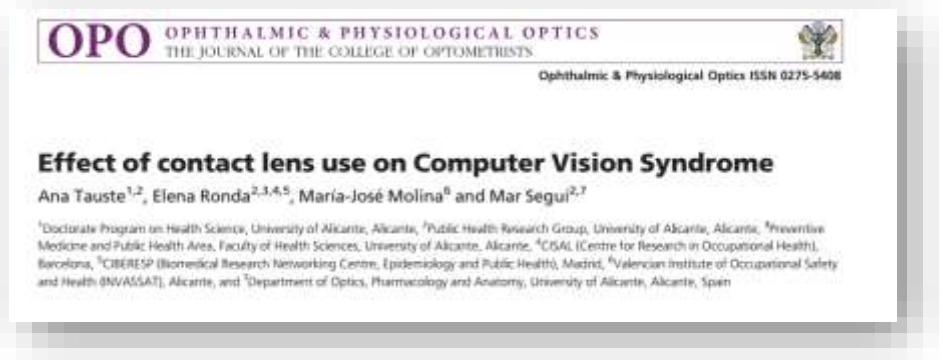
Contact lens wearerspresented a higher prevalence of:

dryness (73% vs 36%, p<0.001)

burning (30% vs 20%,p=0.04),

feeling of a foreign body (42% vs 30%,p=0.02)

excessive blinking (40% vs 28%, p=0.02)



Contact lens wear and digital eye strain

The most common symptoms in contact lens wearers as compared to non-wearers were:

red eye (47.9% vs 29.6%, p<0.01)

scratchiness (31.0% vs 9.9%, p<0.01).

With symptoms appearance at *end of day* (53.6% vs 32.24%, p<0.01)

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OPTOMETRY AND VISION SCIENCE

ORIGINAL ARTICLE

Symptoms in a Population of Contact Lens and Noncontact Lens Wearers Under Different Environmental Conditions

JOSE MANUEL GONZALEZ-MEIJOME, OD, FIACLE, MANUEL A. PARAFITA, MD, PhD, EVA YEBRA-PIMENTEL, PhD, and JOSE B. ALMEIDA, PhD

Department of Physics (Optometry), School of Sciences, University of Minho, Braga, Portugal (JMG-M, JBA), Department of Surgery (Ophthalmology) (MAP) and Department of Applied Physics (Optometry) (EY-P), School of Optics and Optometry, University of Santiago de Compostela, Spain

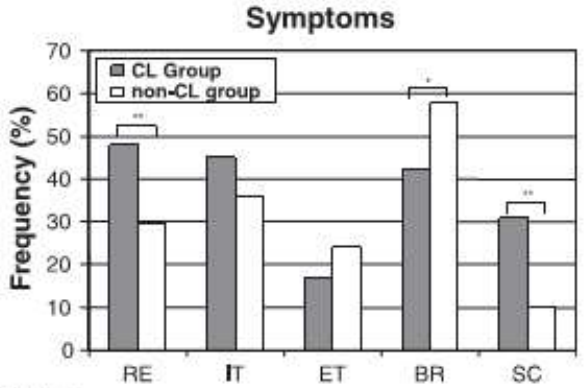


FIGURE 1.
Frequency of symptoms of red eye (RE), itching (IT), excessive tearing (ET), burning (BR), and scratchiness (SC) for subjects in the CL wear group (dark bars) and n-CL group (white bars). Brackets indicate significant differences (*p < 0.05; **p < 0.01).

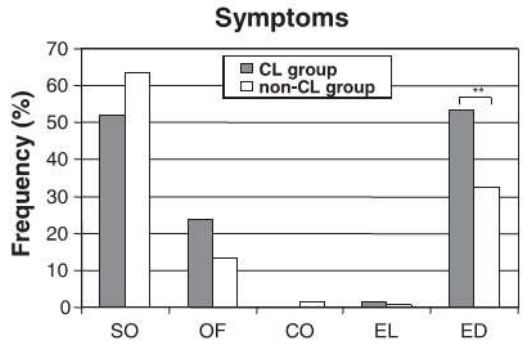


FIGURE 2.
Pattern of symptom appearance as being "sometimes" (SO), "often" (OF), "constant" (CO), "early in the day" (EL), and at the "end of the day" (ED) in the CL and n-CL wear groups. Brackets indicate significant differences (*p < 0.05; **p < 0.01). χ^2 not applicable at CO and EL, because more than 20% of the samples have expected count <5.

Contact lens wear and digital eye strain

Office workers who wore contact lenses and spent more than 4 hours engaged in VDT work had a lower tear meniscus volume with significant dry eye and visual symptoms triggered by environmental factors

The Impact of Contact Lens Wear and Visual Display Terminal Work on Ocular Surface and Tear Functions in Office Workers

TAKASHI KOJIMA, OSAMA M. A. IBRAHIM, TAIS WAKAMATSU, ATSUSHI TSUYAMA, JUNKO OGAWA, YUKIHIRO MATSUMOTO, MURAT DOGRU, AND KAZUO TSUBOTA

TABLE 3. Comparison of Age, Sex, Schirmer Test Results, Tear Film Break-up Time Values, Vital Staining Scores, Tear Meniscus Heights, Symptom Questionnaire Scores, and Distribution of the Percentages of Dry Eye Diagnosis between Contact Lens and Noncontact Lens Wearers

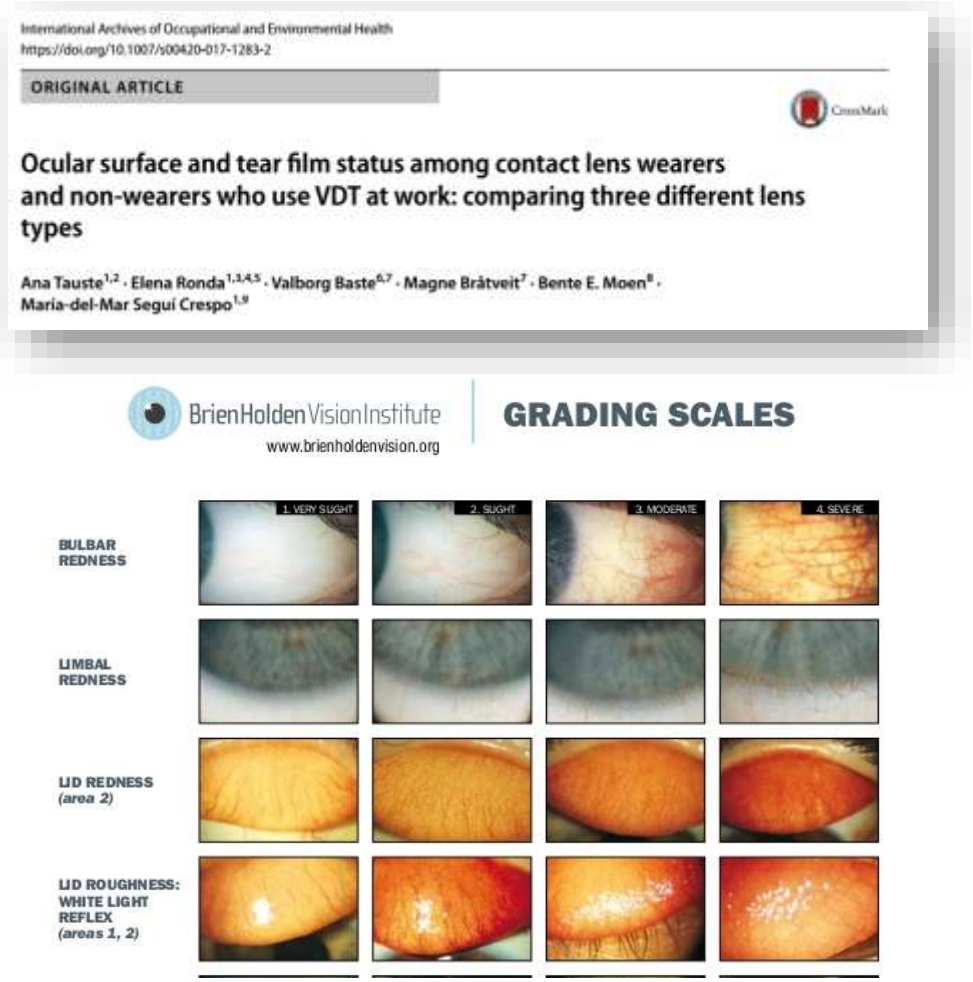
	Contact Lens Wearer	Non–Contact Lens Wearer	*P* Value
No. of subjects	69	102	
Age (years)	34.3 ± 7.3	36.7 ± 7.2	.102
Sex (male/female)	17/52	36/66	.190
Schirmer I test (mm)	12.3 ± 9.5	14.7 ± 10.9	.261
Tear film BUT (sec)	4.1 ± 1.9	5.0 ± 2.9	.106
Fluorescein score (pts)	2.0 ± 1.7	1.6 ± 1.7	.130
Rose Bengal score (pts)	1.5 ± 1.3	1.2 ± 1.2	.073
Tear meniscus height (mm)	0.58 ± 0.31	0.69 ± 0.34	.013[a]
Questionnaire (pts)			
Mean dry eye symptom score	39.1 ± 15.0	27.1 ± 15.6	<.001[a]
Mean visual symptom score	29.2 ± 18.8	20.1 ± 12.9	.002[a]
Mean environment symptom score	36.7 ± 5.4	15.3 ± 14.7	<.001[a]
Mean total dry eye severity score	32.3 ± 11.9	25.0 ± 12.7	<.001[a]
Mean dry eye symptom aggravation score by air conditioners	2.1 ± 1.1	1.3 ± 1.2	<.001[a]

Contact lens wear and digital eye strain

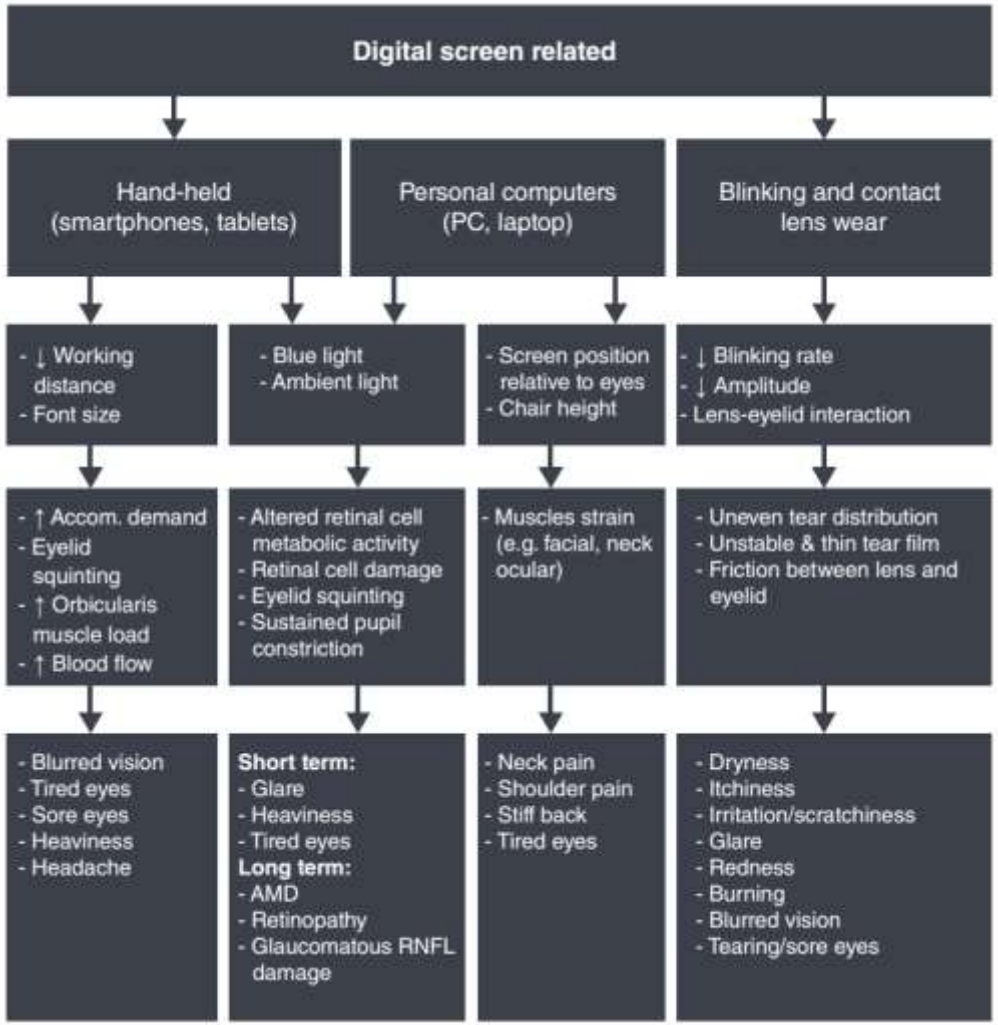
Regular use of contact lenses during VDT exposure at work

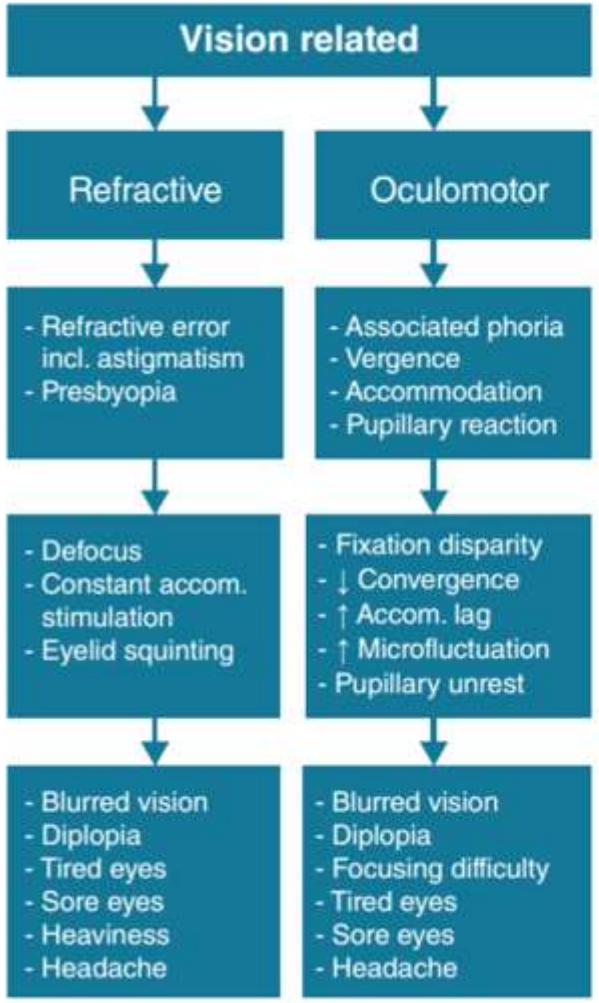
increases risk of bulbar, limbal and lid redness, and lid roughness.

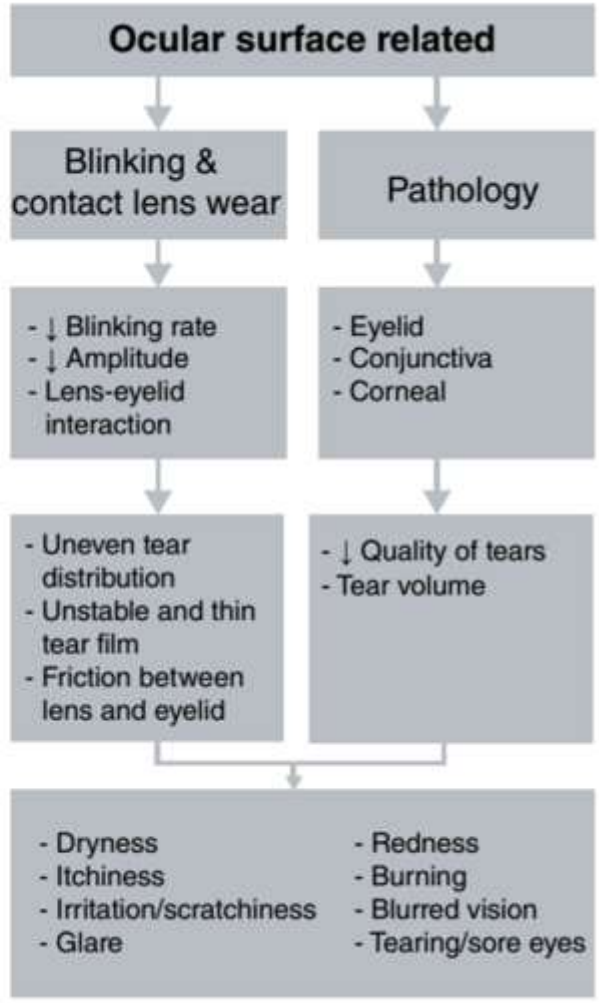
In the case of limbal and lid redness, the risk is higher among those who use VDT more than 4 h per day.



Causes of computer vision syndrome and digital eyestrain







Hall L, Coles-Brennan C. Digital eye strain: more screen time = more digital eye strain. Contact Lens Spectrum 2015; 30: 38–40

Screen resolution and accomodative response

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OPO THE COLLEGE OF OPTOMETRISTS

ORIGINAL ARTICLE
Special Issue Article

The effect of image resolution of display types on accommodative microfluctuations

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[2]School of Optometry and Vision Science, University of Bradford, Bradford, UK
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Abstract

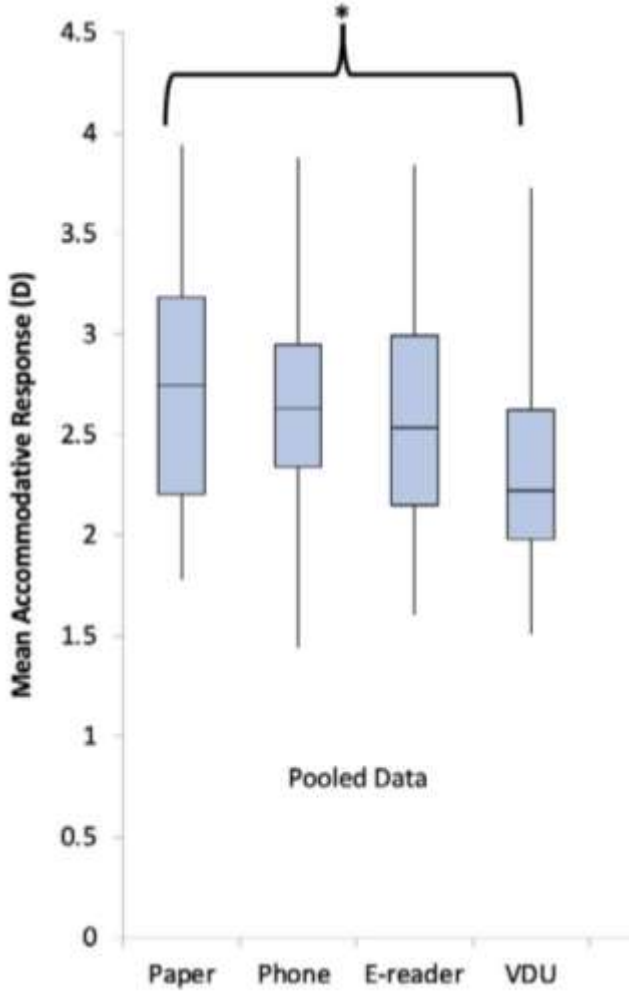
Purpose: To determine whether accommodative microfluctuations (AMFs) are affected by the image resolution of the display type being observed. The effect of refractive error is also examined.

Methods: Twenty participants, (10 myopes and 10 emmetropes) observed a target on four different displays: paper, smartphone, e-reader and visual display unit screen (VDU), whilst their accommodative responses were measured using a continuous recording infrared autorefractor. The accommodative response and AMF measures comprising low frequency components (LFC), high frequency components (HFC) and the root mean square (RMS) of the AMFs were analysed.

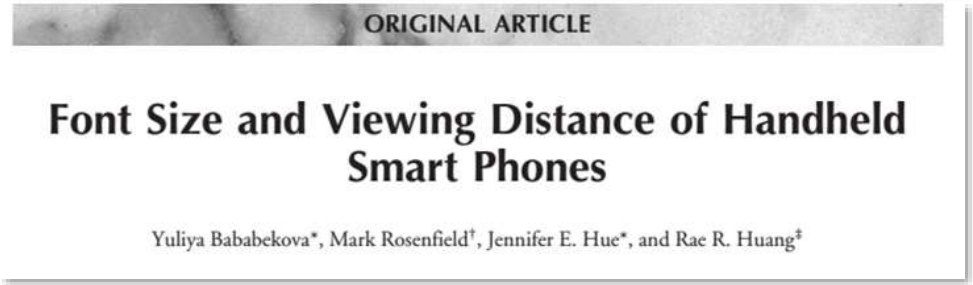
Results: A significant increase in LFC power was observed for the paper stimulus when compared to the VDU and smartphone conditions. Myopes demonstrated a significantly higher LFC and mean accommodative response compared to emmetropes across the four displays. A significant difference in the mean AR between the displays with the lowest and highest resolution was found. A higher mean AR was found with higher resolution of the image. The HFC and RMS accommodation were not affected by display type.

Conclusion: The mean accommodative response and the mean LFC power appear to respond differently depending on the type of display in use. Higher resolution devices showed a reduced lag of accommodation to the accommodative demand; however, this may cause a lead of accommodation in myopes for higher resolution display types.

Higher resolution devices showed a reduced lag of accommodation to the accommodative demand; however, this may cause a lead of accommodation in myopes



Viewing distance and smartphone use



ORIGINAL ARTICLE

Font Size and Viewing Distance of Handheld Smart Phones

Yuliya Bababekova*, Mark Rosenfield†, Jennifer E. Hue*, and Rae R. Huang‡

The mean working distances is closer than the typical near working distance of 40 cm.

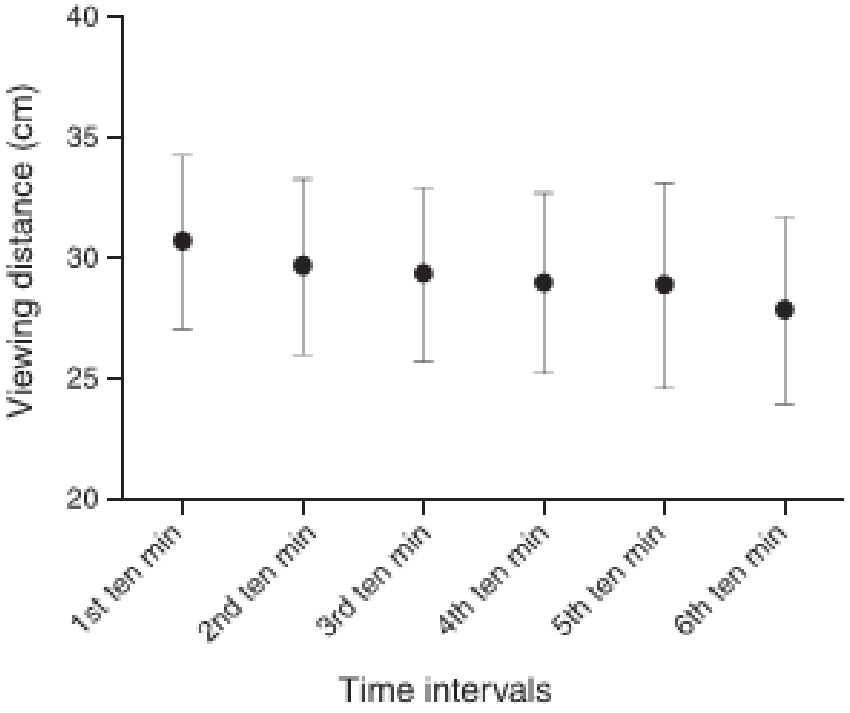
The mean working distance for text messages and internet viewing was 36.2 cm (range, 17.5 to 58.0 cm) and 32.2 cm (range, 19 to 60 cm) with an increased accommodative and convergence demand.

	Text message, mean (±1 SD)	Text message (range)	Web page, mean (±1 SD)	Web page (range)
Font size (mm)	1.6 (0.35)	1.0 to 3.0	1.1 (0.34)	0.5 to 32.0
Snellen fraction	6/19.2 (5.25)	6/8.3 to 6/35.3	6/15.1 (4.78)	6/5.9 to 6/28.5
M acuity	1.1 (0.24)	0.7 to 2.1	0.8 (0.23)	0.3 to 1.4
Working distance (cm)	36.2 (7.12)	17.5 to 58.0	32.2 (7.41)	19.0 to 60.0

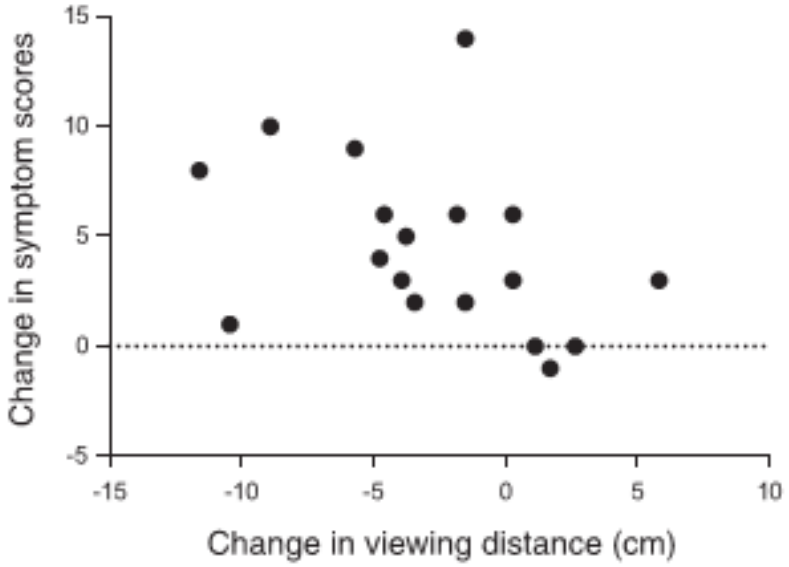
Note that the standard deviation for the Snellen fraction refers only to the denominator of the fraction.

Viewing distance and Symptoms

Mean working distance is reduced with the time of use



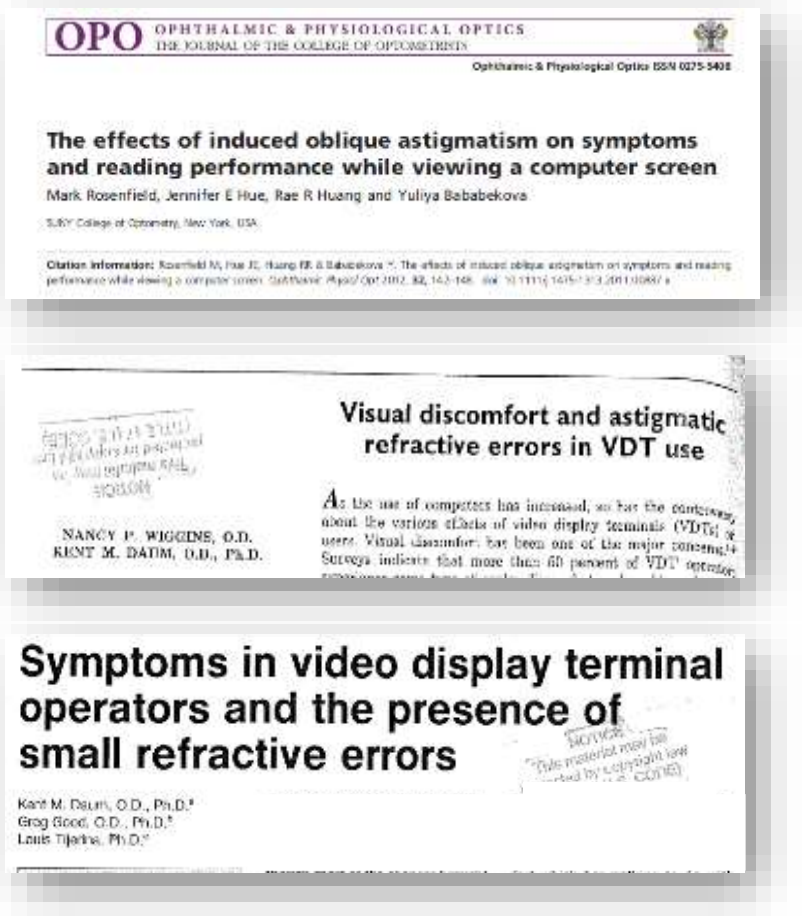
A positive change in symptom score indicates a greater severity of symptoms at the end of the hour. A positive change in working distance indicates that the smartphone was held further away at the end of the hour.



Clinical and experimental optometry 2017; 100 133-137

Refractive errors and digital eye strain

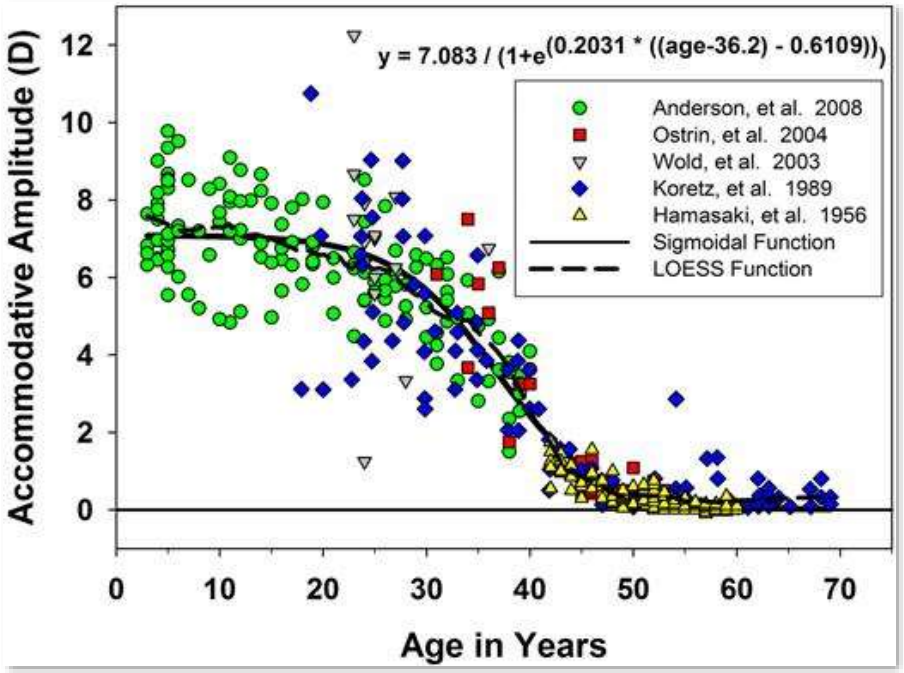
Low uncorrected hyperopia, astigmatism and anisometropia (0,50D) could be a cause of digital eyestrain.



Accomodation and digital eye strain

Symptoms related to an accomodative problem are:

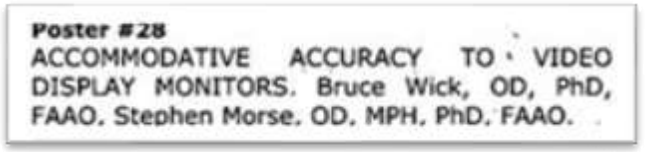
- *near blur*
- *post-work distance blur*
- *slowness of focus changes*
- *eyestrain*
- *general ocular discomfort*

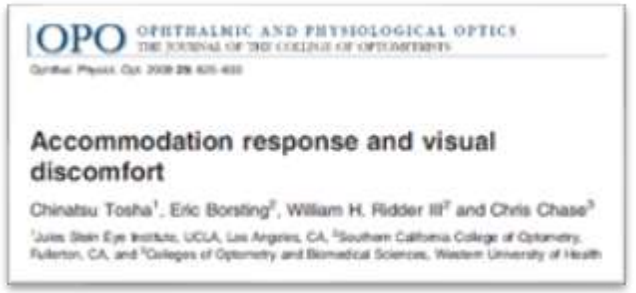


Accomodative accuracy

After digital device use the accomodative response is reduced (accomodative LAG increase).

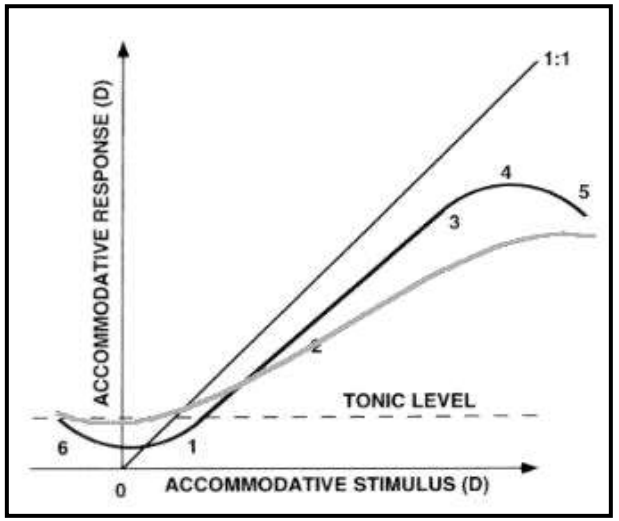
The LAG increase is higher reducing the distance.


Poster #28
ACCOMMODATIVE ACCURACY TO VIDEO DISPLAY MONITORS. Bruce Wick, OD, PhD, FAAO. Stephen Morse. OD. MPH. PhD. FAAO.


OPO OPHTHALMIC AND PHYSIOLOGICAL OPTICS

Accommodation response and visual discomfort

Chinatsu Tosha[1], Eric Borsting[2], William H. Ridder III[3] and Chris Chase[3]

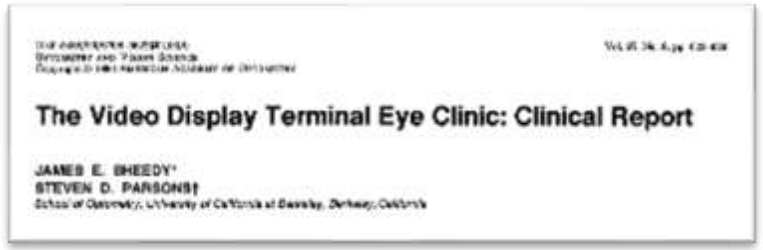


Accomodative facility

With digital devices accommodative facility can change and to be associated with symptoms of eyestrain.

Sheedy have found that in symptomatic subjects in 90 seconds the number of cycles with a ±1,50D were <20.

Binocular accommodative facility (BAF) is reduced after 60 min of reading on a smartphone.



The Video Display Terminal Eye Clinic: Clinical Report

JAMES E. SHEEDY*
STEVEN D. PARSONS†

CURRENT EYE RESEARCH
2020, VOL. 45, NO. 4, 428–434

Taylor & Francis

Smartphone Use and Effects on Tear Film, Blinking and Binocular Vision

Blanka Golebiowski, Jennifer Long, Kirsten Harrison, Abigail Lee, Ngozi Chidi-Egboka, and Lisa Asper

School of Optometry and Vision Science, UNSW Sydney, Australia

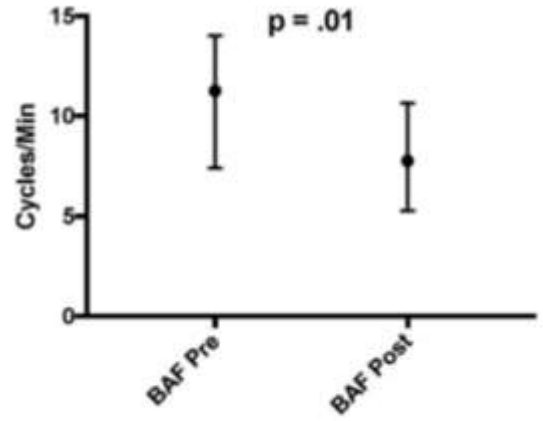
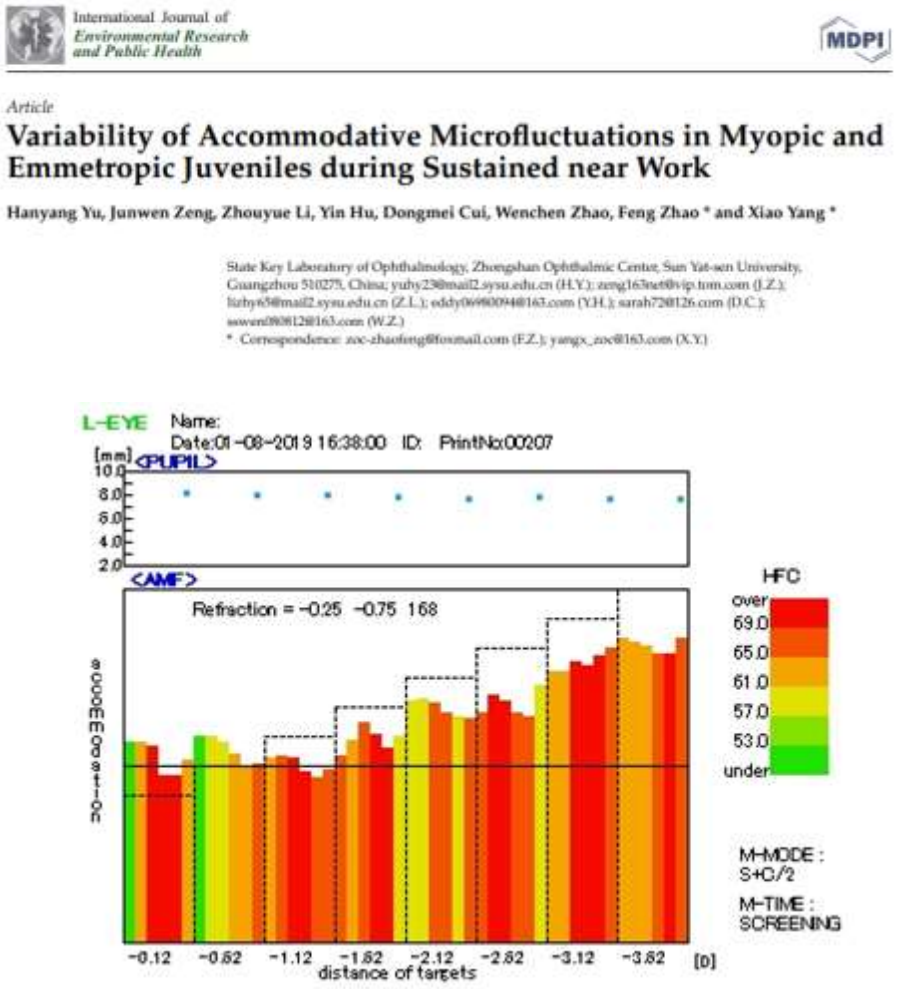


Figure 4. Binocular accommodative facility (BAF) (median, IQR) pre- and post-60 min of reading on a smartphone.

Accommodative micro-fluctuations (AMF)

Accommodative micro-fluctuations (AMF) are small dioptric changes during accommodation and may be a sensitive, objective indicator of fatigue under sustained near work.



International Journal of Environmental Research and Public Health

MDPI

Article

Variability of Accommodative Microfluctuations in Myopic and Emmetropic Juveniles during Sustained near Work

Hanyang Yu, Junwen Zeng, Zhouyue Li, Yin Hu, Dongmei Cui, Wenchen Zhao, Feng Zhao * and Xiao Yang *

State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510275, China; yuhy23@mail2.sysu.edu.cn (H.Y.); zeng163net@vip.tom.com (J.Z.); lizhy65@mail2.sysu.edu.cn (Z.L.); eddy06980944@163.com (Y.H.); sarah720126.com (D.C.); wwen0808128@163.com (W.Z.)

* Correspondence: zoc-zhaofeng@foxmail.com (F.Z.); yangx_zoc@163.com (X.Y.)

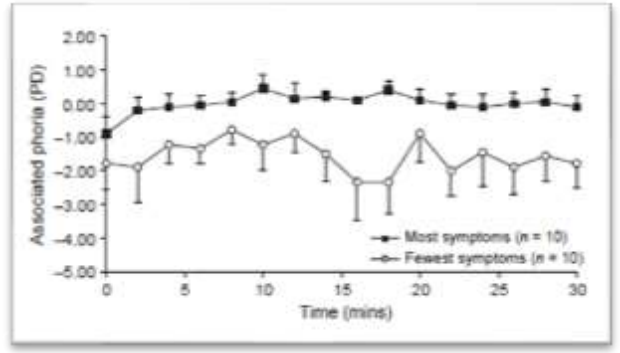
Associated phoria

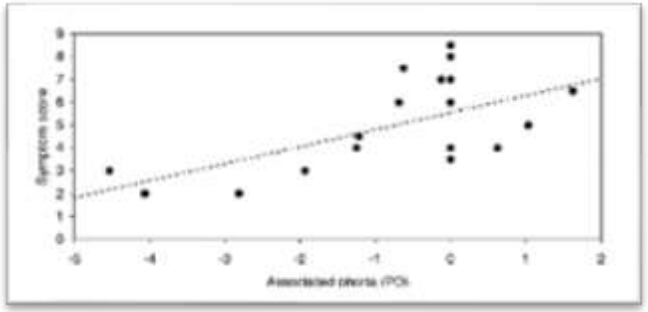
After 30 min of computer work didn’t found significant variation of associated phoria. They found that visual symptoms were higher with ortho and eso condition and lower with exo (1,55Δ).


Accommodation and convergence during sustained computer work

Juanita D. Collier, O.D., and Mark Rosenfield, M.C.Optom., Ph.D.

State University of New York, State College of Optometry, New York, New York.

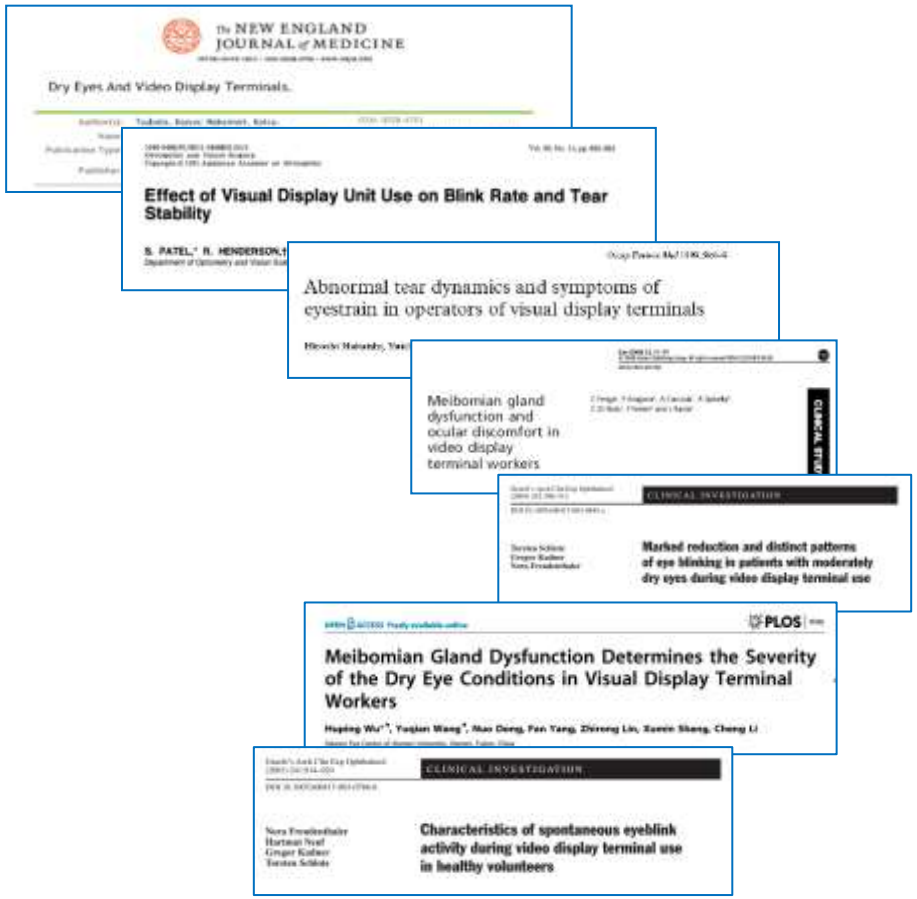




Digital device use and dry eye

With digital devices use:

- *Blink rates ↓*
- *Incomplete blinks ↑*
- *Lipid layer ↓*
- *Tear evaporation ↑*
- *Tear instability ↑*
- *MGD ↑*



Digital device use and dry eye

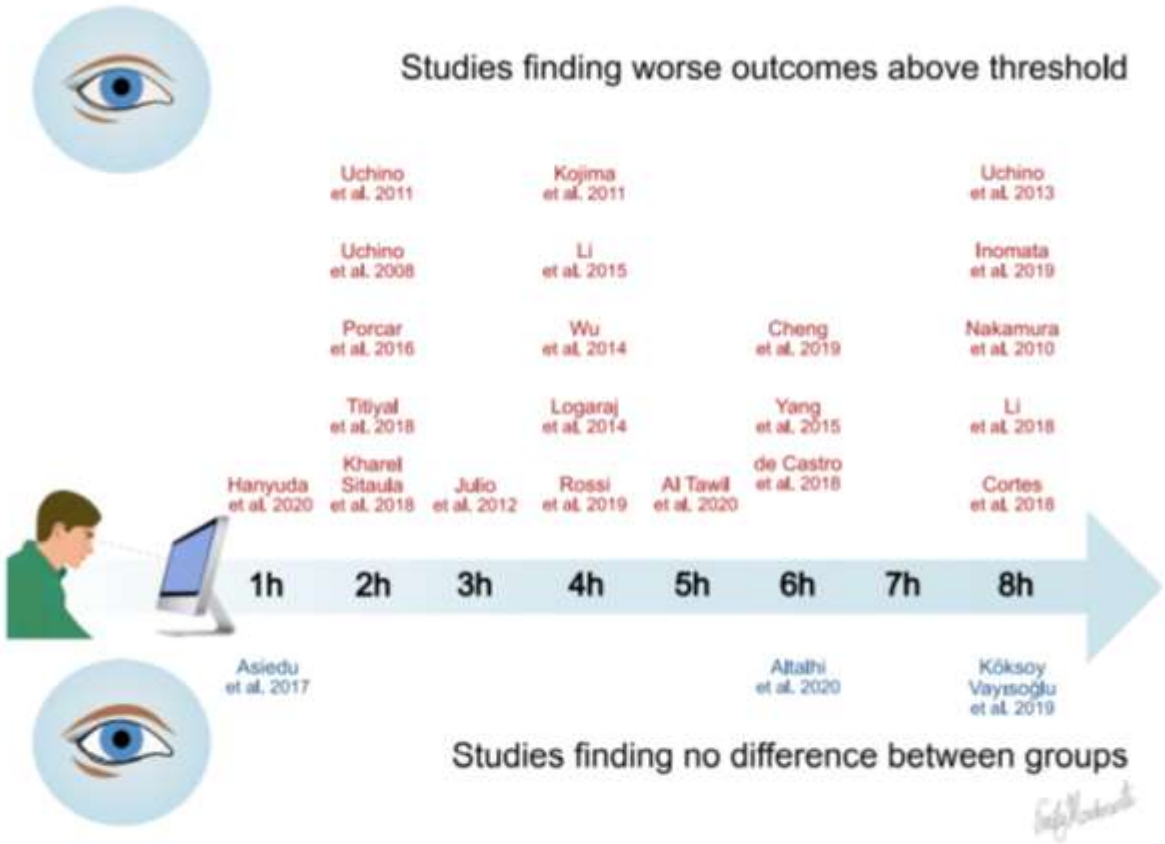


Fig. 6. Association between daily duration of VDT use and dry eye disease (DED) or DED-related signs and symptoms. Daily VDT use duration found to significantly increase the prevalence of reported eye dryness or DED in epidemiological studies. Hours of VDT exposure listed represents the

Haakon Fjaervoll, The association between visual display terminal use and dry eye: a review. Acta Ophthalmol.2021 Oct 25. Online ahead of print.

Digital device use and dry eye

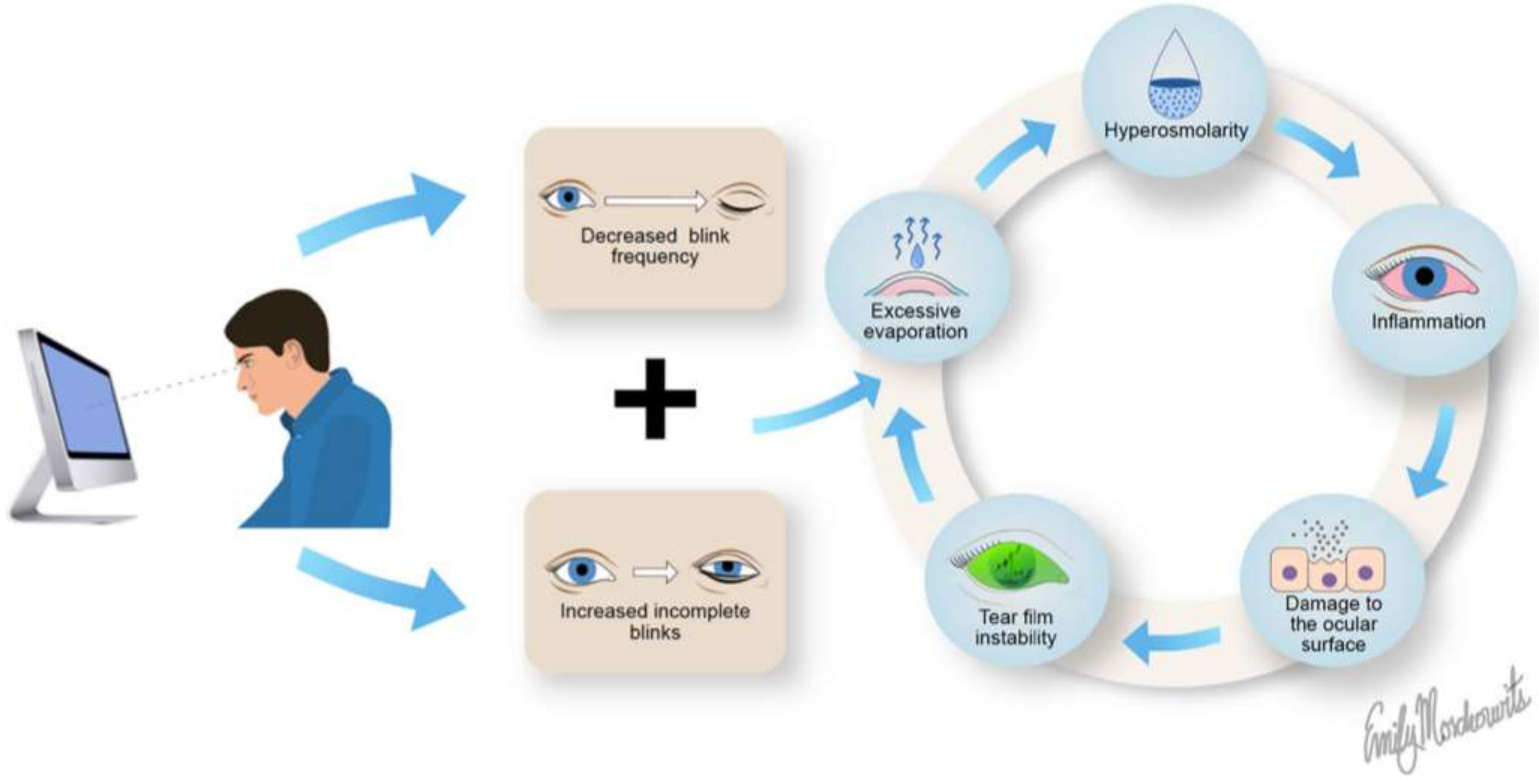


Fig. 1. The pathophysiology of VDT associated dry eye disease (DED). VDT use increases evaporation by reducing blink frequency and increasing the number of incomplete blinks and drives the vicious circle of DED.

Haakon Fjaervoll, The association between visual display terminal use and dry eye: a review. Acta Ophthalmol.2021 Oct 25. Online ahead of print.

Blink rate and VDT use

It has been shown that VDT use may reduces the spontaneous eyeblink rate approximately by the 70%

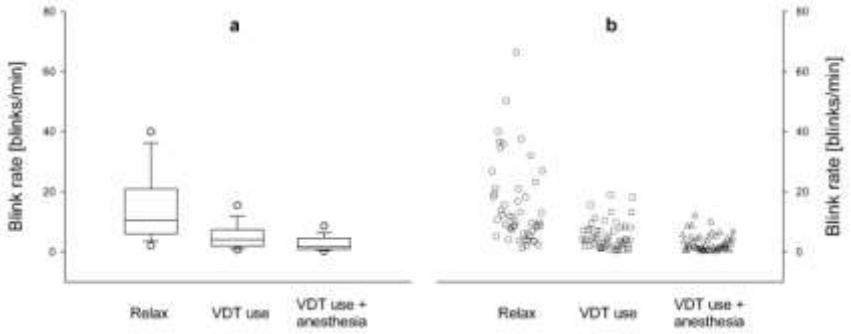
Graefe's Arch Clin Exp Ophthalmol (2003) 241:914–920
DOI 10.1007/s00417-003-0786-6

CLINICAL INVESTIGATION

Nora Freudenthaler
Hartmut Neuf
Gregor Kadner
Torsten Schlote

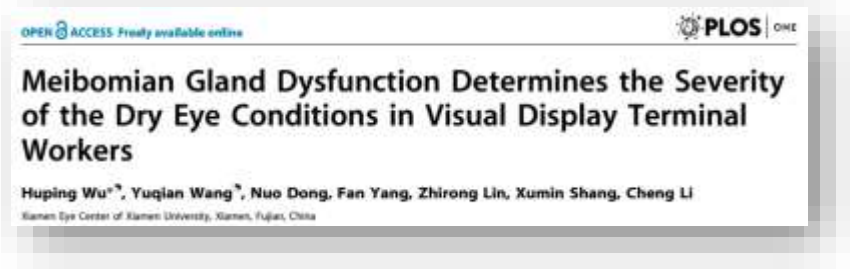
Characteristics of spontaneous eyeblink activity during video display terminal use in healthy volunteers

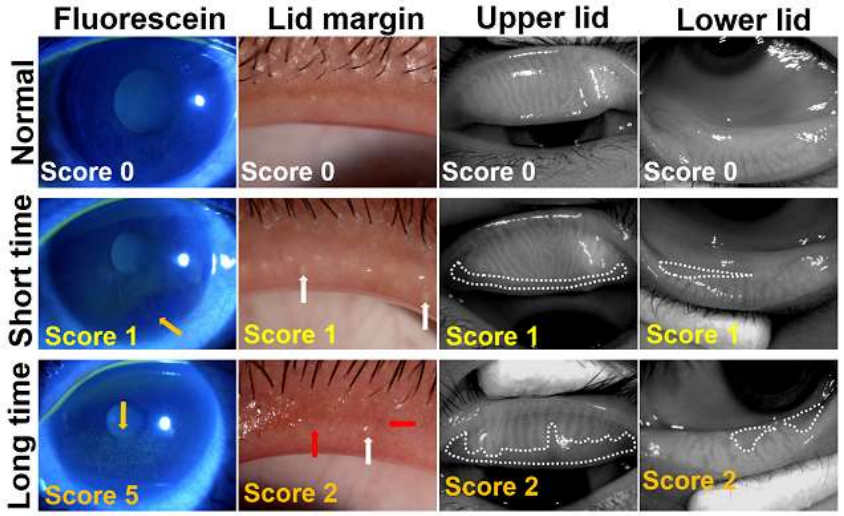
Examination conditions	SBER (blinks/min) Mean ± SD	Wilcoxon test (*P*)
a) Relaxation	15.54±13.74	<0.001 a vs. b
b) VDT use (without corneal anaesthesia)	5.34±4.53	<0.001 b vs. c
c) VDT use (with corneal anaesthesia)	2.78±2.77	<0.001 a vs. c



External causes

Incomplete blinks are considered a greater contributing factor to tear instability than reduced frequency of blinks.





Incomplete blink and VDT use

In addition, the completeness of blinks also has an impact on the likelihood of developing corneal desiccation and contact lens surface dryness.

Current Eye Research, 36(3), 190–197, 2011

ISSN: 0271-3683 print/ 1460-2202 online
DOI: 10.3109/02713683.2010.544442

informa
healthcare

ORIGINAL ARTICLE

Blink Rate, Blink Amplitude, and Tear Film Integrity during Dynamic Visual Display Terminal Tasks

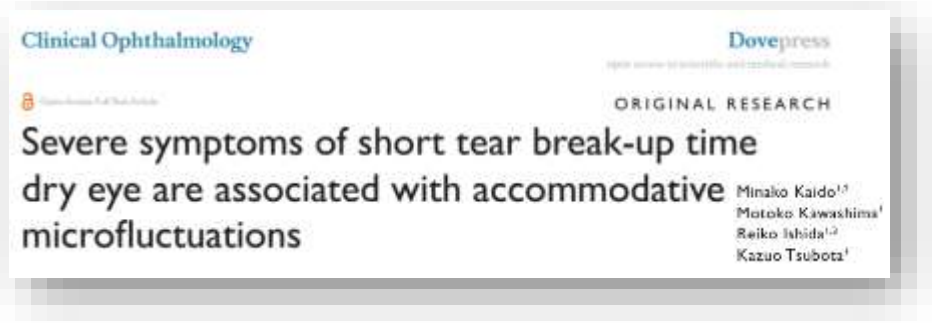
Genís Cardona[1], Carles García[1], Carme Serés[1], Meritxell Vilaseca[2], and Joan Gispets[1]

[1]*Research Group of Centre Universitari de la Visió (GRCUV), Optics and Optometry Department, Technical University of Catalonia*

[2]*Centre for Sensors, Instruments and Systems Development (CD6), Optics and Optometry Department, Technical University of Catalonia*

Tear film instability and AMF

Tear film instability is associated with deterioration of functional VA, accommodative microfluctuations, and DE symptoms.



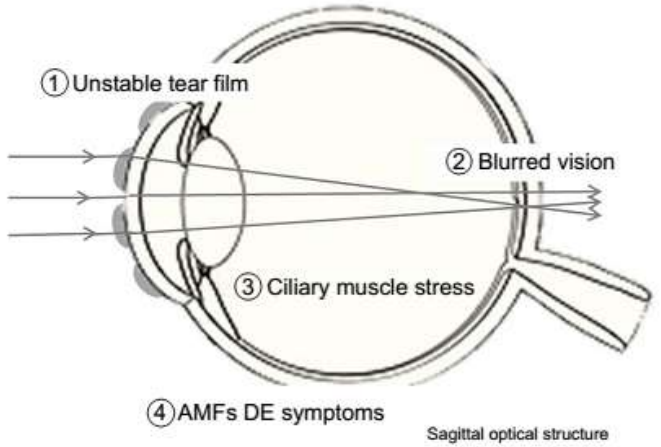
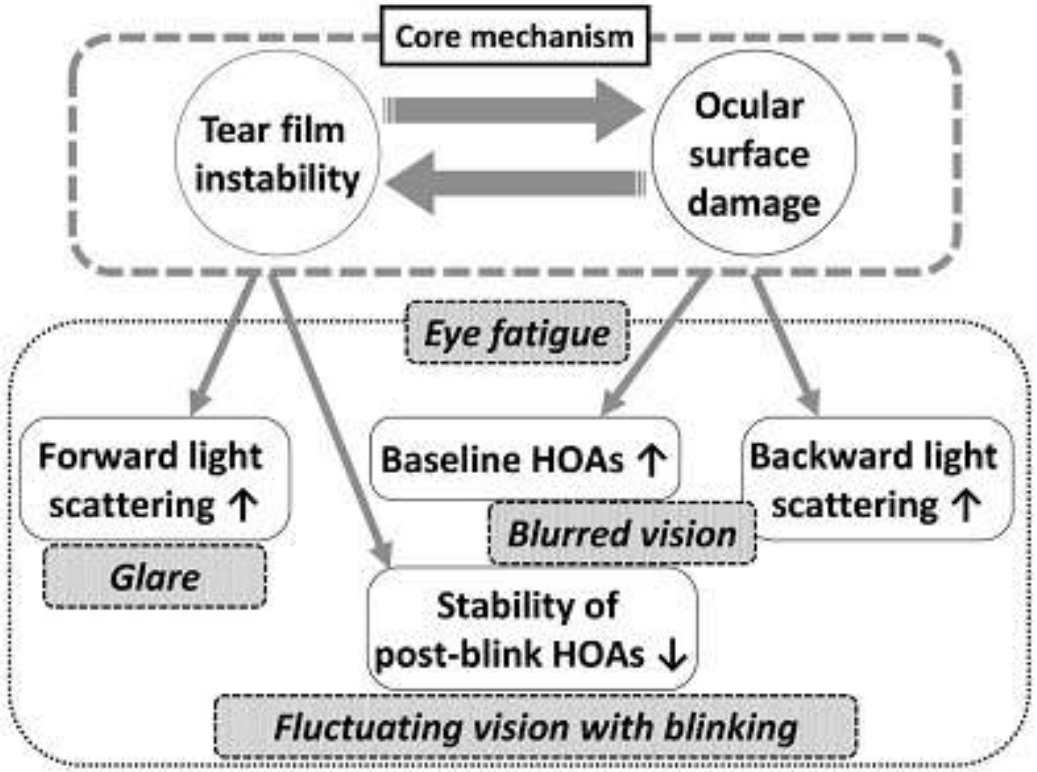


Figure 4 The mechanism of occurrence of dry eye symptoms. Image defocus due to tear instability represents visual impairment.
Note: Blurring may possibly cause ciliary muscle spasms, which eventually induce AMF and cause DE symptoms including ocular fatigue.
Abbreviations: AMF, accommodative microfluctuation; DE, dry eye.

Tear film instability and AMF

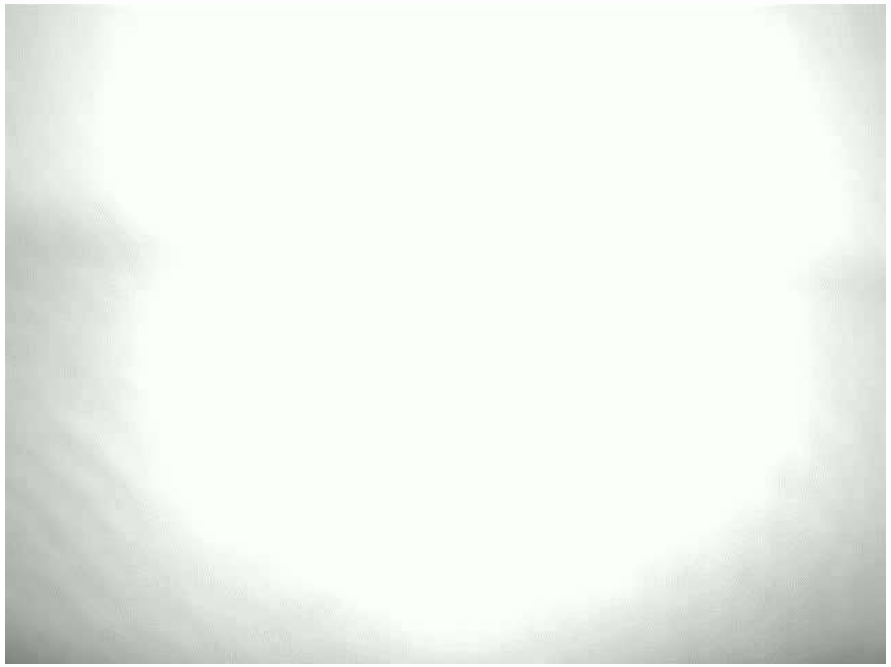


SUPPLEMENT

(*Cornea* 2016;0:1–6)

Mechanisms of Visual Disturbance in Dry Eye

Shizuka Koh, MD



Digital device use and dry eye

ORIGINAL INVESTIGATION

How Do Different Digital Displays Affect the Ocular Surface?

Cristian Talens-Estarelles, MSc,[1] Vicent Sanchis-Jurado, PhD,[1] José J. Esteve-Taboada, PhD,[1] Álvaro M. Pons, PhD,[1] and Santiago García-Lázaro, PhD[1]

SIGNIFICANCE: Digital display use has been accepted as a contributing factor to dry eye disease. Nowadays, plenty of new models of digital displays have been developed, and the differences in their nature and the ways in which they are set and used may contribute to differences in the eye-related problems they cause.

PURPOSE: This study aimed to analyze the differences in ocular surface, tear film, and visual fatigue parameters after reading on different digital displays, with and without initial instillation of artificial tears.

METHODS: Thirty-one healthy individuals ranging in age from 20 to 26 years (mean ± standard deviation, 21.26 ± 1.73 years) were included in this prospective clinical study. Subjects' ocular surface, tear film, and visual fatigue parameters were assessed after reading for 15 minutes on a laptop computer, tablet, e-reader, and smartphone with matching characteristics and a baseline measurement. Measurements were taken with and without the instillation of artificial tears before the reading tasks and included the Ocular Surface Disease Index questionnaire, the Computer Vision Syndrome Questionnaire, tear meniscus height, the Schirmer I test, noninvasive keratograph break-up time, osmolarity, bulbar redness, and pupil size.

RESULTS: Statistically significant differences in the Ocular Surface Disease Index, Computer Vision Syndrome Questionnaire, tear meniscus height, the Schirmer I test, noninvasive keratograph break-up time, osmolarity, and bulbar redness were obtained when comparing the displays ($P < .05$). Best results were obtained with the smartphone and the e-reader. Conversely, the computer produced the highest disturbance on the ocular surface and tear film. Finally, the instillation of artificial tears revealed no statistical improvement of ocular surface or tear film parameters for the same device ($P > .05$).

CONCLUSIONS: Taking into account the clinical tests for dry eye diagnosis, the smartphone may be considered as the least disturbing display, producing lower dry eye signs and symptoms in comparison with other devices.

Author Affiliations:
[1]Department of Optics and Optometry and Vision Sciences, University of Valencia, Valencia, Spain
[*]cristian.talens@uv.es

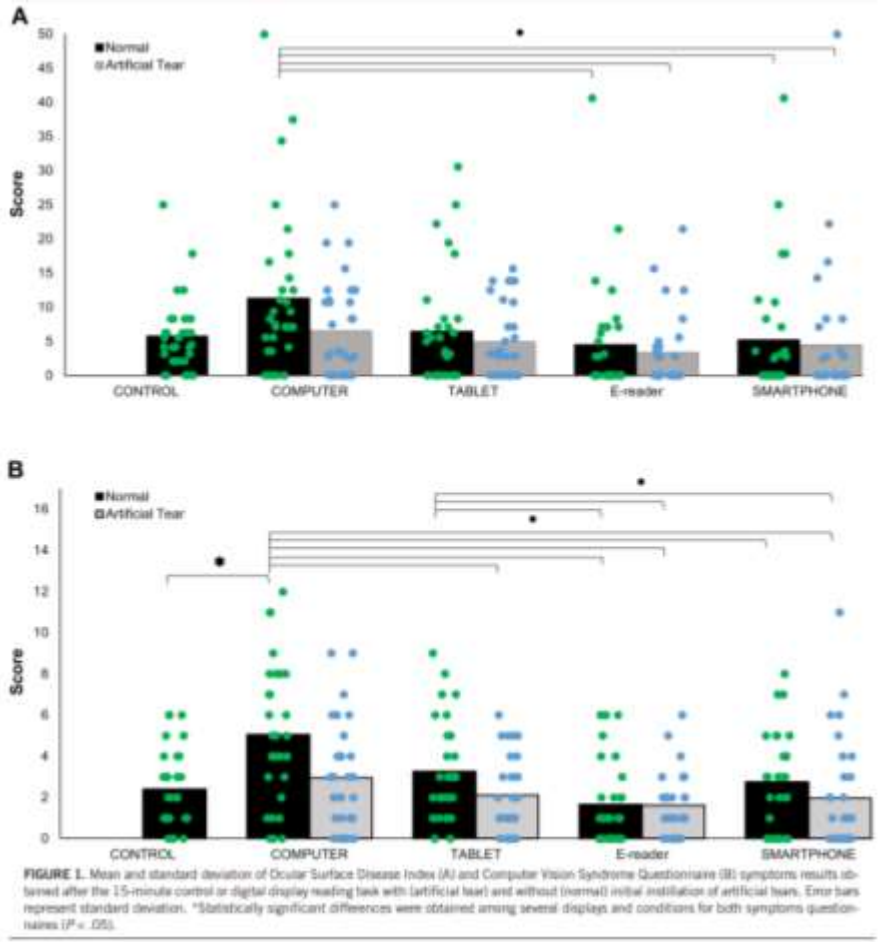
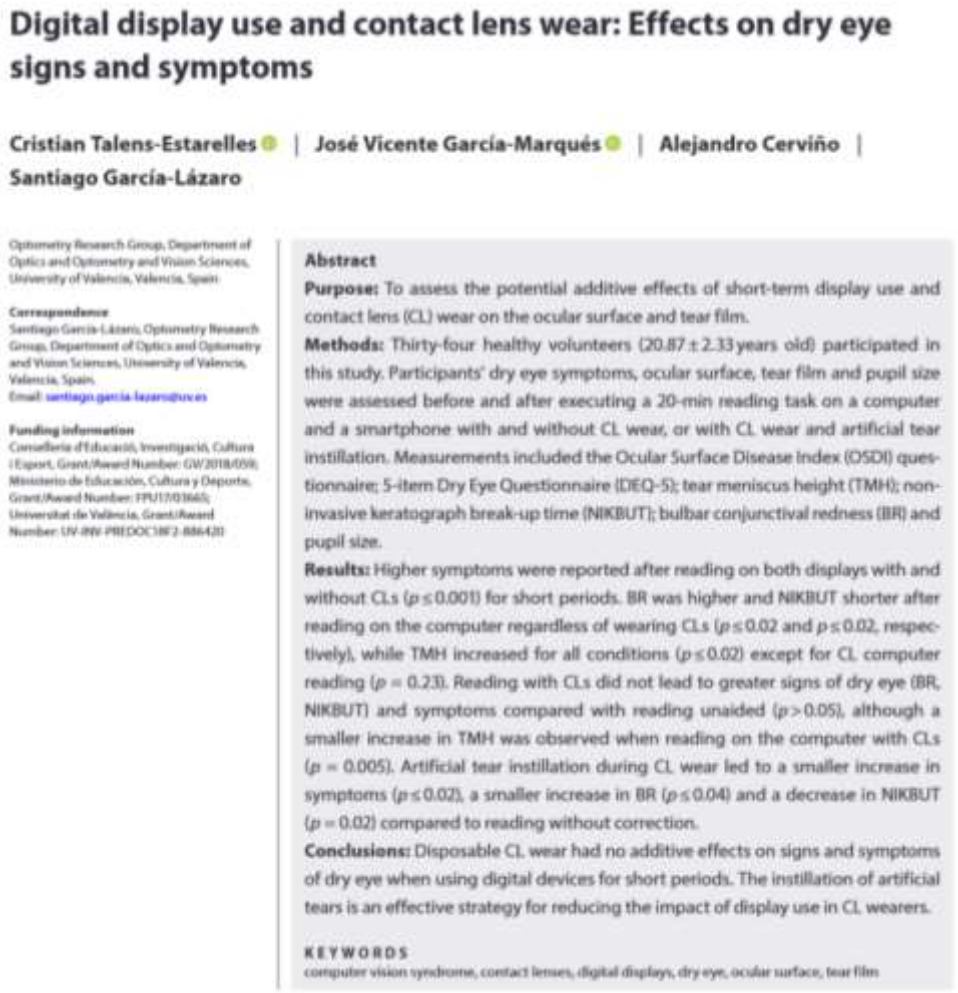


FIGURE 1. Mean and standard deviation of Ocular Surface Disease Index (A) and Computer Vision Syndrome Questionnaire (B) symptoms results obtained after the 15-minute control or digital display reading task with (artificial tear) and without (normal) initial instillation of artificial tears. Error bars represent standard deviation. *Statistically significant differences were obtained among several displays and conditions for both symptoms questionnaires ($P < .05$).

Taking into account the clinical tests for dry eye diagnosis,
the smartphone may be considered as
the least disturbing display, producing lower dry eye signs
and symptoms in comparison with other devices

Digital device use and dry eye



Digital display use and contact lens wear: Effects on dry eye signs and symptoms

Cristian Talens-Estarelles | José Vicente García-Marqués | Alejandro Cerviño | Santiago García-Lázaro

Optometry Research Group, Department of Optics and Optometry and Vision Sciences, University of Valencia, Valencia, Spain

Correspondence
Santiago García-Lázaro, Optometry Research Group, Department of Optics and Optometry and Vision Sciences, University of Valencia, Valencia, Spain.
Email: santiago.garcia-lazaro@uv.es

Funding information
Conselleria d'Educació, Investigació, Cultura i Esport, Grant/Award Number: GV/2018/059; Ministerio de Educación, Cultura y Deporte, Grant/Award Number: FPU17/03665; Universitat de València, Grant/Award Number: UV-INV-PREDOC18F2-886420

Abstract

Purpose: To assess the potential additive effects of short-term display use and contact lens (CL) wear on the ocular surface and tear film.

Methods: Thirty-four healthy volunteers (20.87 ± 2.33 years old) participated in this study. Participants' dry eye symptoms, ocular surface, tear film and pupil size were assessed before and after executing a 20-min reading task on a computer and a smartphone with and without CL wear, or with CL wear and artificial tear instillation. Measurements included the Ocular Surface Disease Index (OSDI) questionnaire; 5-item Dry Eye Questionnaire (DEQ-5); tear meniscus height (TMH); non-invasive keratograph break-up time (NIKBUT); bulbar conjunctival redness (BR) and pupil size.

Results: Higher symptoms were reported after reading on both displays with and without CLs ($p \leq 0.001$) for short periods. BR was higher and NIKBUT shorter after reading on the computer regardless of wearing CLs ($p \leq 0.02$ and $p \leq 0.02$, respectively), while TMH increased for all conditions ($p \leq 0.02$) except for CL computer reading ($p = 0.23$). Reading with CLs did not lead to greater signs of dry eye (BR, NIKBUT) and symptoms compared with reading unaided ($p > 0.05$), although a smaller increase in TMH was observed when reading on the computer with CLs ($p = 0.005$). Artificial tear instillation during CL wear led to a smaller increase in symptoms ($p \leq 0.02$), a smaller increase in BR ($p \leq 0.04$) and a decrease in NIKBUT ($p = 0.02$) compared to reading without correction.

Conclusions: Disposable CL wear had no additive effects on signs and symptoms of dry eye when using digital devices for short periods. The instillation of artificial tears is an effective strategy for reducing the impact of display use in CL wearers.

KEYWORDS
computer vision syndrome, contact lenses, digital displays, dry eye, ocular surface, tear film

- Contact lens wear has no additive effects on signs and symptoms of dry eye when using digital devices for short periods.
- Screen position may be especially relevant in contact lens wearers, with hand-held devices being held closer and at lower gaze angles, thereby causing less disruption to the tear film.

Computer vision syndrome questionnaire

ELSEVIER

Journal of Clinical Epidemiology 68 (2015) 662–673

Journal of Clinical Epidemiology

A reliable and valid questionnaire was developed to measure computer vision syndrome at the workplace

María del Mar Seguí[a,*], Julio Cabrero-García[b], Ana Crespo[a], José Verdú[c], Elena Ronda[d]

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[b]Nursing Department, Faculty of Health Sciences, University of Alicante, Carretera de San Vicente del Raspeig s/n, 03690, San Vicente del Raspeig, Alicante, Spain

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[d]Community Nursing Preventive Medicine Public Health and History of Science Department, Public Health Research Group, Occupational Health Research Centre (CISAL), CIBER Epidemiology and Public Health (CIBERESP), University of Alicante, Carretera de San Vicente del Raspeig s/n, 03690, San Vicente del Raspeig, Alicante, Spain

Accepted 21 January 2015; Published online 28 January 2015

Abstract

Objectives: To design and validate a questionnaire to measure visual symptoms related to exposure to computers in the workplace.

Study Design and Setting: Our computer vision syndrome questionnaire (CVS-Q) was based on a literature review and validated through discussion with experts and performance of a pretest, pilot test, and retest. Content validity was evaluated by occupational health, optometry, and ophthalmology experts. Rasch analysis was used in the psychometric evaluation of the questionnaire. Criterion validity was determined by calculating the sensitivity and specificity, receiver operator characteristic curve, and cutoff point. Test–retest repeatability was tested using the intraclass correlation coefficient (ICC) and concordance by Cohen's kappa (κ).

Results: The CVS-Q was developed with wide consensus among experts and was well accepted by the target group. It assesses the frequency and intensity of 16 symptoms using a single rating scale (symptom severity) that fits the Rasch rating scale model well. The questionnaire has sensitivity and specificity over 70% and achieved good test–retest repeatability both for the scores obtained [ICC = 0.802; 95% confidence interval (CI): 0.673, 0.884] and CVS classification (κ = 0.612; 95% CI: 0.384, 0.839).

Conclusion: The CVS-Q has acceptable psychometric properties, making it a valid and reliable tool to control the visual health of computer workers, and can potentially be used in clinical trials and outcome research.

Keywords: Asthenopia; Computer terminals; Occupational health; Occupational exposure; Eye diseases; Diagnosis

Appendix B. COMPUTER VISION SYNDROME QUESTIONNAIRE (CVS-Q)

To be completed by worker

Indicate whether you experience any of the following symptoms during the time you use the computer at work. For each symptom, mark with an **X**:

a. First, the frequency, that is, how often the symptom occurs, considering that:

NEVER = the symptom does not occur at all

OCCASIONALLY = sporadic episodes or once a week

OFTEN OR ALWAYS = 2 or 3 times a week or almost every day

b. Second, the intensity of the symptom:

Remember: if you indicated NEVER for frequency, you should not mark anything for intensity.

	a. Frecuency			b. Intensity	
	NEVER	OCCASIONALLY	OFTEN OR ALWAYS	MODERATE	INTENSE
1 Burning					
2 Itching					
3 Feeling of a foreign body					
4 Tearing					
5 Excessive blinking					
6 Eye redness					
7 Eye pain					
8 Heavy eyelids					
9 Dryness					
10 Blurred vision					

Computer vision syndrome questionnaire

ELSEVIER

Journal of Clinical Epidemiology 68 (2015) 662–673

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[a]Optic Pharmacology and Anatomy Department, Public Health Research Group, University of Alicante, Carretera de San Vicente del Raspeig s/n, 03690, San Vicente del Raspeig, Alicante, Spain

[b]Nursing Department, Faculty of Health Sciences, University of Alicante, Carretera de San Vicente del Raspeig s/n, 03690, San Vicente del Raspeig, Alicante, Spain

[c]Balmis Research Group on Community Health and History of Science, Community Nursing Preventive Medicine Public Health and History of Science Department, University of Alicante, Carretera de San Vicente del Raspeig s/n, 03690, San Vicente del Raspeig, Alicante, Spain

[d]Community Nursing Preventive Medicine Public Health and History of Science Department, Public Health Research Group, Occupational Health Research Centre (CISAL), CIBER Epidemiology and Public Health (CIBERESP), University of Alicante, Carretera de San Vicente del Raspeig s/n, 03690, San Vicente del Raspeig, Alicante, Spain

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Conclusion: The CVS-Q has acceptable psychometric properties, making it a valid and reliable tool to control the visual health of computer workers, and can potentially be used in clinical trials and outcome research.

Keywords: Asthenopia; Computer terminals; Occupational health; Occupational exposure; Eye diseases; Diagnosis

11 Double vision					
12 Difficulty focusing for near vision					
13 Increased sensitivity to light					
14 Coloured halos around objects					
15 Feeling that sight is worsening					
16 Headache					

To be completed by investigator

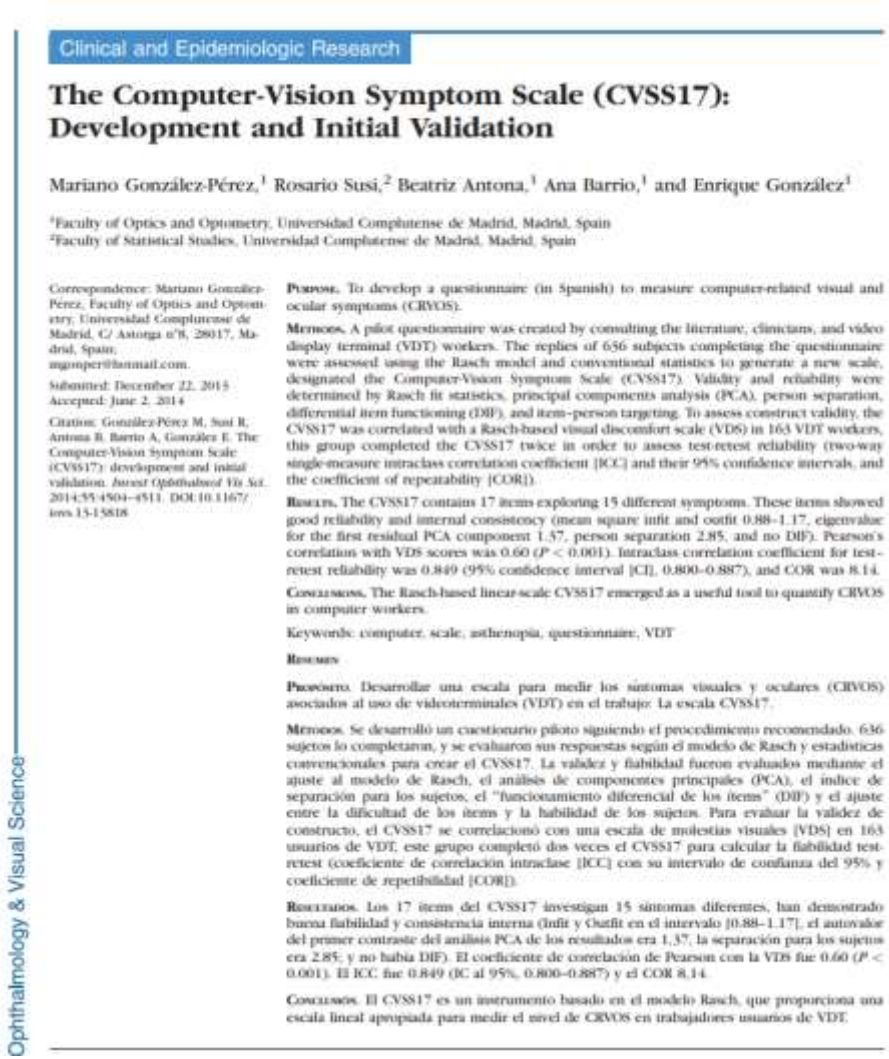
Calculation of **TOTAL SCORE** Apply the following expression:

$$\text{Score} = \sum_{i=1}^{16} (\text{frequency of symptom occurrence})_i \times (\text{intensity of symptom})_i$$

Considering that:

- Frequency:
  - Never=0
  - Occasionally=1
  - Often or always=2
- Intensity
  - Moderate=1
  - Intense=2

Computer vision syndrome questionnaire



Clinical and Epidemiologic Research

The Computer-Vision Symptom Scale (CVSS17): Development and Initial Validation

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[1]Faculty of Optics and Optometry, Universidad Complutense de Madrid, Madrid, Spain
[2]Faculty of Statistical Studies, Universidad Complutense de Madrid, Madrid, Spain

Correspondence: Mariano González-Pérez, Faculty of Optics and Optometry, Universidad Complutense de Madrid, C/ Arenga n°8, 28017, Madrid, Spain; mgonper@hotmail.com.

Submitted: December 22, 2013
Accepted: June 2, 2014

Citation: González-Pérez M, Susi R, Antona B, Barrio A, González E. The Computer-Vision Symptom Scale (CVSS17): development and initial validation. *Invest Ophthalmol Vis Sci.* 2014;55:4504–4511. DOI:10.1167/iovs.13-13818

Purpose. To develop a questionnaire (in Spanish) to measure computer-related visual and ocular symptoms (CRVOS).

Methods. A pilot questionnaire was created by consulting the literature, clinicians, and video display terminal (VDT) workers. The replies of 656 subjects completing the questionnaire were assessed using the Rasch model and conventional statistics to generate a new scale, designated the Computer-Vision Symptom Scale (CVSS17). Validity and reliability were determined by Rasch fit statistics, principal components analysis (PCA), person separation, differential item functioning (DIF), and item–person targeting. To assess construct validity, the CVSS17 was correlated with a Rasch-based visual discomfort scale (VDS) in 163 VDT workers, this group completed the CVSS17 twice in order to assess test-retest reliability (two-way single-measure intraclass correlation coefficient [ICC] and their 95% confidence intervals, and the coefficient of repeatability [COR]).

Results. The CVSS17 contains 17 items exploring 15 different symptoms. These items showed good reliability and internal consistency (mean square infit and outfit 0.88–1.17, eigenvalue for the first residual PCA component 1.57, person separation 2.85, and no DIF). Pearson's correlation with VDS scores was 0.60 ($P < 0.001$). Intraclass correlation coefficient for test-retest reliability was 0.849 (95% confidence interval [CI], 0.800–0.887), and COR was 8.14.

Conclusions. The Rasch-based linear-scale CVSS17 emerged as a useful tool to quantify CRVOS in computer workers.

Keywords: computer, scale, asthenopia, questionnaire, VDT

Resumen

Propósito. Desarrollar una escala para medir los síntomas visuales y oculares (CRVOS) asociados al uso de videoterminales (VDT) en el trabajo: La escala CVSS17.

Métodos. Se desarrolló un cuestionario piloto siguiendo el procedimiento recomendado. 656 sujetos lo completaron, y se evaluaron sus respuestas según el modelo de Rasch y estadísticas convencionales para crear el CVSS17. La validez y fiabilidad fueron evaluados mediante el ajuste al modelo de Rasch, el análisis de componentes principales (PCA), el índice de separación para los sujetos, el "funcionamiento diferencial de los ítems" (DIF) y el ajuste entre la dificultad de los ítems y la habilidad de los sujetos. Para evaluar la validez de constructo, el CVSS17 se correlacionó con una escala de molestias visuales (VDS) en 163 usuarios de VDT, este grupo completó dos veces el CVSS17 para calcular la fiabilidad test-retest (coeficiente de correlación intraclase [ICC] con su intervalo de confianza del 95% y coeficiente de repetibilidad [COR]).

Resultados. Los 17 ítems del CVSS17 investigan 15 síntomas diferentes, han demostrado buena fiabilidad y consistencia interna (Infit y Outfit en el intervalo [0.88–1.17], el autovalor del primer contraste del análisis PCA de los resultados era 1,3[5], la separación para los sujetos era 2.85; y no había DIF). El coeficiente de correlación de Pearson con la VDS fue 0.60 ($P < 0.001$). El ICC fue 0.849 (IC al 95%, 0.800–0.887) y el COR 8,14.

Conclusiones. El CVSS17 es un instrumento basado en el modelo Rasch, que proporciona una escala lineal apropiada para medir el nivel de CRVOS en trabajadores usuarios de VDT.

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CVSS17

Name, Surname:_____

Age:___ **Date:**_____

FOLLOWING QUESTIONS ASK ABOUT HOW YOU FELT DURING YOUR LAST FOUR WORKING WEEKS:

If you normally wear glasses or contact lenses during most of your working hours, answer as if you were wearing them.
Please, circle your preferred choice in each question.

A2. Have you noticed that the letters on the screen become blurry while you're working with your computer?

1. None at all 2. Very little 3. Little
4. A moderate amount 5. Much 6. Very much

A4. Have you felt your eyes tired during or after working with your computer?

1. Never 2. Almost never 3. Seldom 4. Ocassionally
5. Frequently 6. Almost always 7. Always

A9. Did your eyes hurt when working with you computer?

4. Always 3. Frequently 2. Rarely 1. Never

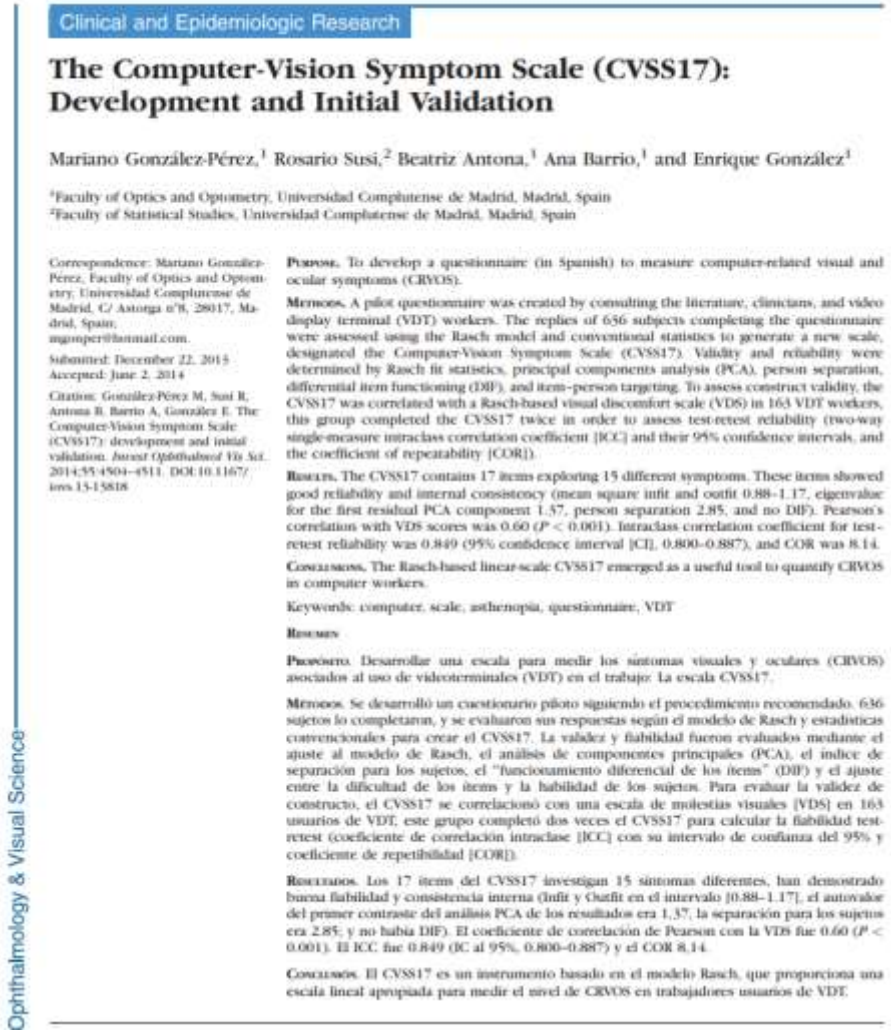
A17. Have you noticed your eyes heavy after some time working with your computer?

4. Always 3. Frequently 2. Rarely 1. Never

A20. Did you have to blink a lot while using the computer at work?

1. Never 2. Rarely 3. Frequently 4. Always

Computer vision syndrome questionnaire



Clinical and Epidemiologic Research

The Computer-Vision Symptom Scale (CVSS17): Development and Initial Validation

Mariano González-Pérez,[1] Rosario Susi,[2] Beatriz Antona,[1] Ana Barrio,[1] and Enrique González[1]

[1]Faculty of Optics and Optometry, Universidad Complutense de Madrid, Madrid, Spain
[2]Faculty of Statistical Studies, Universidad Complutense de Madrid, Madrid, Spain

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Citation: González-Pérez M, Susi R, Antona B, Barrio A, González E. The Computer-Vision Symptom Scale (CVSS17): development and initial validation. *Invest Ophthalmol Vis Sci.* 2014;55:4504–4511. DOI:10.1167/iovs.13-13818

Purpose. To develop a questionnaire (in Spanish) to measure computer-related visual and ocular symptoms (CRVOS).

Methods. A pilot questionnaire was created by consulting the literature, clinicians, and video display terminal (VDT) workers. The replies of 656 subjects completing the questionnaire were assessed using the Rasch model and conventional statistics to generate a new scale, designated the Computer-Vision Symptom Scale (CVSS17). Validity and reliability were determined by Rasch fit statistics, principal components analysis (PCA), person separation, differential item functioning (DIF), and item–person targeting. To assess construct validity, the CVSS17 was correlated with a Rasch-based visual discomfort scale (VDS) in 163 VDT workers, this group completed the CVSS17 twice in order to assess test-retest reliability (two-way single-measure intraclass correlation coefficient [ICC] and their 95% confidence intervals, and the coefficient of repeatability [COR]).

Results. The CVSS17 contains 17 items exploring 15 different symptoms. These items showed good reliability and internal consistency (mean square infit and outfit 0.88–1.17, eigenvalue for the first residual PCA component 1.57, person separation 2.85, and no DIF). Pearson's correlation with VDS scores was 0.60 ($P < 0.001$). Intraclass correlation coefficient for test-retest reliability was 0.849 (95% confidence interval [CI], 0.800–0.887), and COR was 8.14.

Conclusions. The Rasch-based linear-scale CVSS17 emerged as a useful tool to quantify CRVOS in computer workers.

Keywords: computer, scale, asthenopia, questionnaire, VDT

Resumen

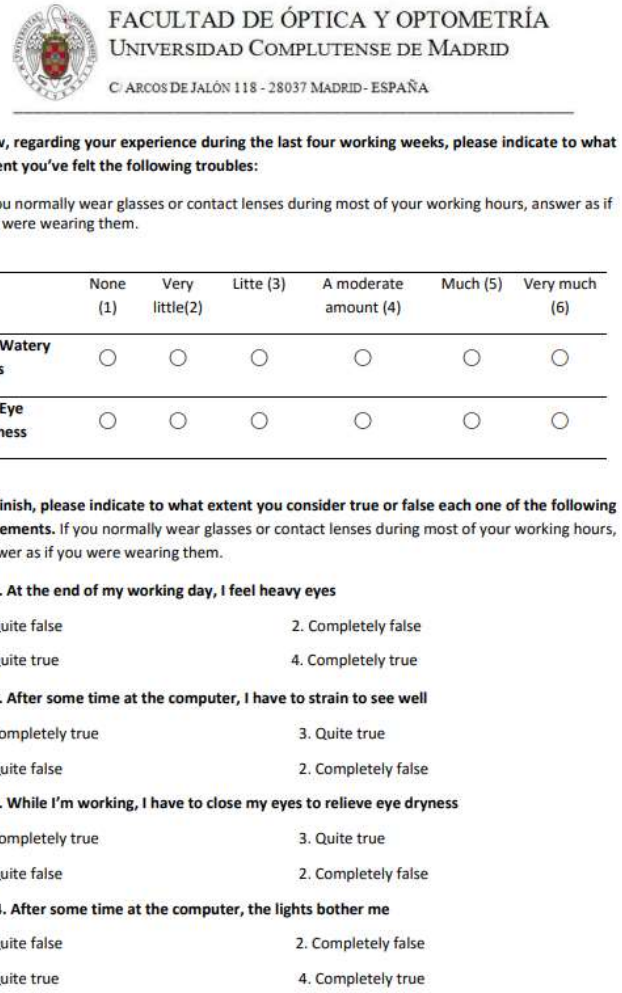
Propósito. Desarrollar una escala para medir los síntomas visuales y oculares (CRVOS) asociados al uso de videoterminales (VDT) en el trabajo: La escala CVSS17.

Métodos. Se desarrolló un cuestionario piloto siguiendo el procedimiento recomendado. 656 sujetos lo completaron, y se evaluaron sus respuestas según el modelo de Rasch y estadísticas convencionales para crear el CVSS17. La validez y fiabilidad fueron evaluados mediante el ajuste al modelo de Rasch, el análisis de componentes principales (PCA), el índice de separación para los sujetos, el "funcionamiento diferencial de los ítems" (DIF) y el ajuste entre la dificultad de los ítems y la habilidad de los sujetos. Para evaluar la validez de constructo, el CVSS17 se correlacionó con una escala de molestias visuales (VDS) en 163 usuarios de VDT, este grupo completó dos veces el CVSS17 para calcular la fiabilidad test-retest (coeficiente de correlación intraclase [ICC] con su intervalo de confianza del 95% y coeficiente de repetibilidad [COR]).

Resultados. Los 17 ítems del CVSS17 investigan 15 síntomas diferentes, han demostrado buena fiabilidad y consistencia interna (Infit y Outfit en el intervalo [0.88–1.17], el autovalor del primer contraste del análisis PCA de los residuos era 1,57, la separación para los sujetos era 2.85; y no había DIF). El coeficiente de correlación de Pearson con la VDS fue 0.60 ($P < 0.001$). El ICC fue 0.849 (IC al 95%, 0.800–0.887) y el COR 8,14.

Conclusiones. El CVSS17 es un instrumento basado en el modelo Rasch, que proporciona una escala lineal apropiada para medir el nivel de CRVOS en trabajadores usuarios de VDT.

Ophthalmology & Visual Science



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Now, regarding your experience during the last four working weeks, please indicate to what extent you've felt the following troubles:

If you normally wear glasses or contact lenses during most of your working hours, answer as if you were wearing them.

	None (1)	Very little(2)	Litte (3)	A moderate amount (4)	Much (5)	Very much (6)
B7. Watery eyes	○	○	○	○	○	○
B8. Eye redness	○	○	○	○	○	○

To finish, please indicate to what extent you consider true or false each one of the following statements. If you normally wear glasses or contact lenses during most of your working hours, answer as if you were wearing them.

C16. At the end of my working day, I feel heavy eyes

1. Quite false — 2. Completely false
3. Quite true — 4. Completely true

C21. After some time at the computer, I have to strain to see well

4. Completely true — 3. Quite true
1. Quite false — 2. Completely false

C23. While I'm working, I have to close my eyes to relieve eye dryness

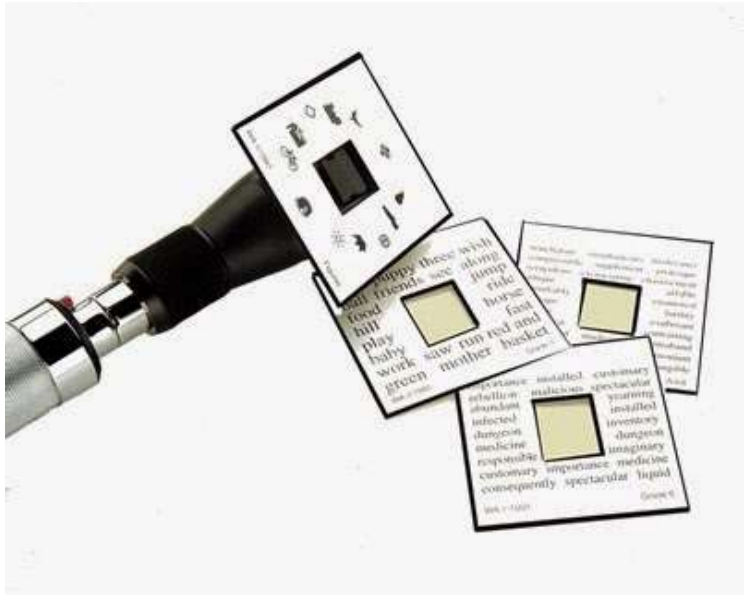
4. Completely true — 3. Quite true
1. Quite false — 2. Completely false

C24. After some time at the computer, the lights bother me

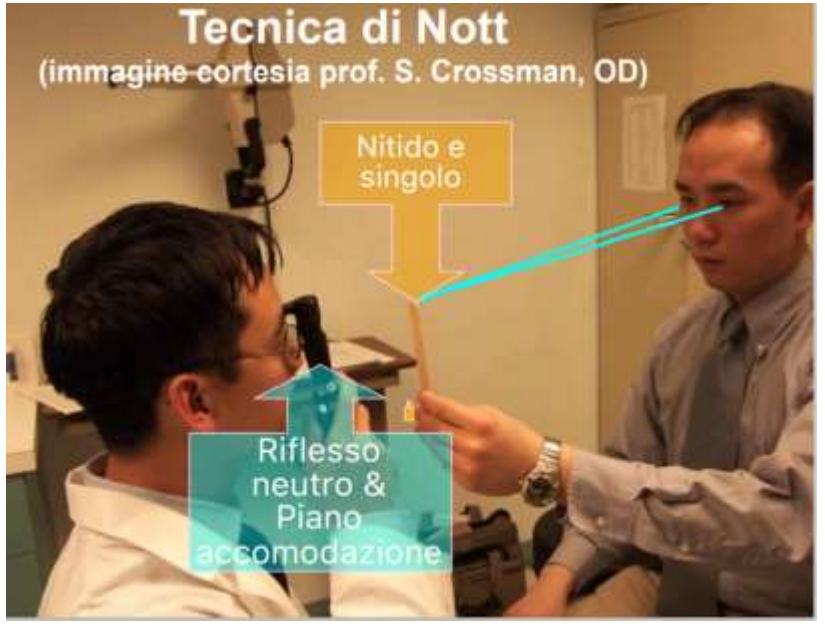
1. Quite false — 2. Completely false
3. Quite true — 4. Completely true

Accomodative response measurement

MEM retinoscopy



Nott retinoscopy



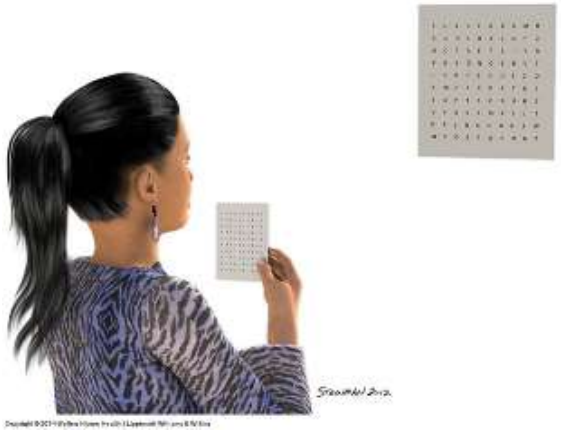
Accomodative facility measurements

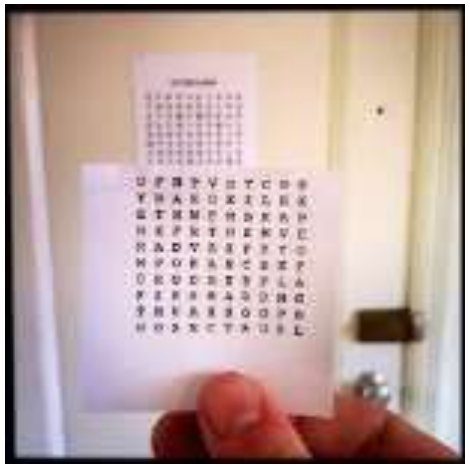
a) *Flipper ± 1,50 D (*<20 cycles *in* 90 seconds in *symptomatic subjects)*

b) *Accomodative rock*

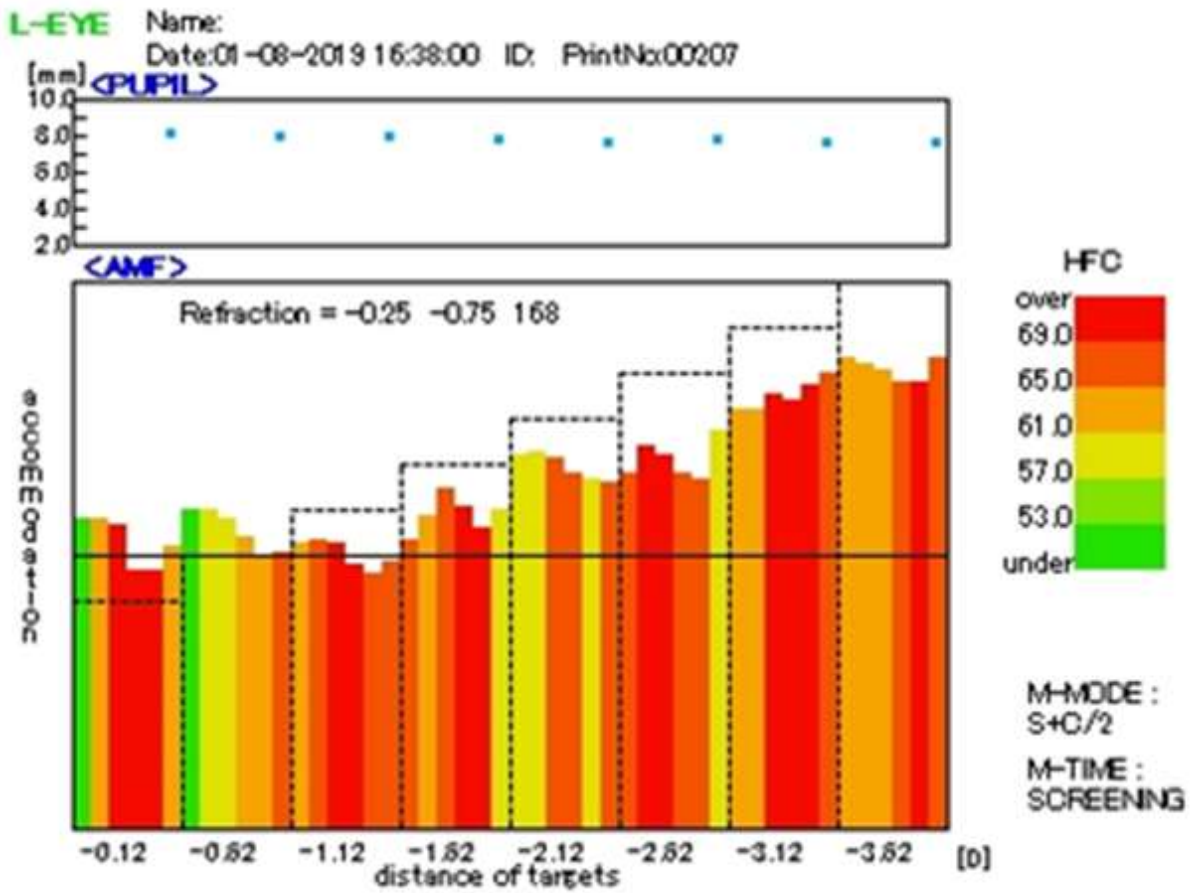
a

b





AMF mesurements



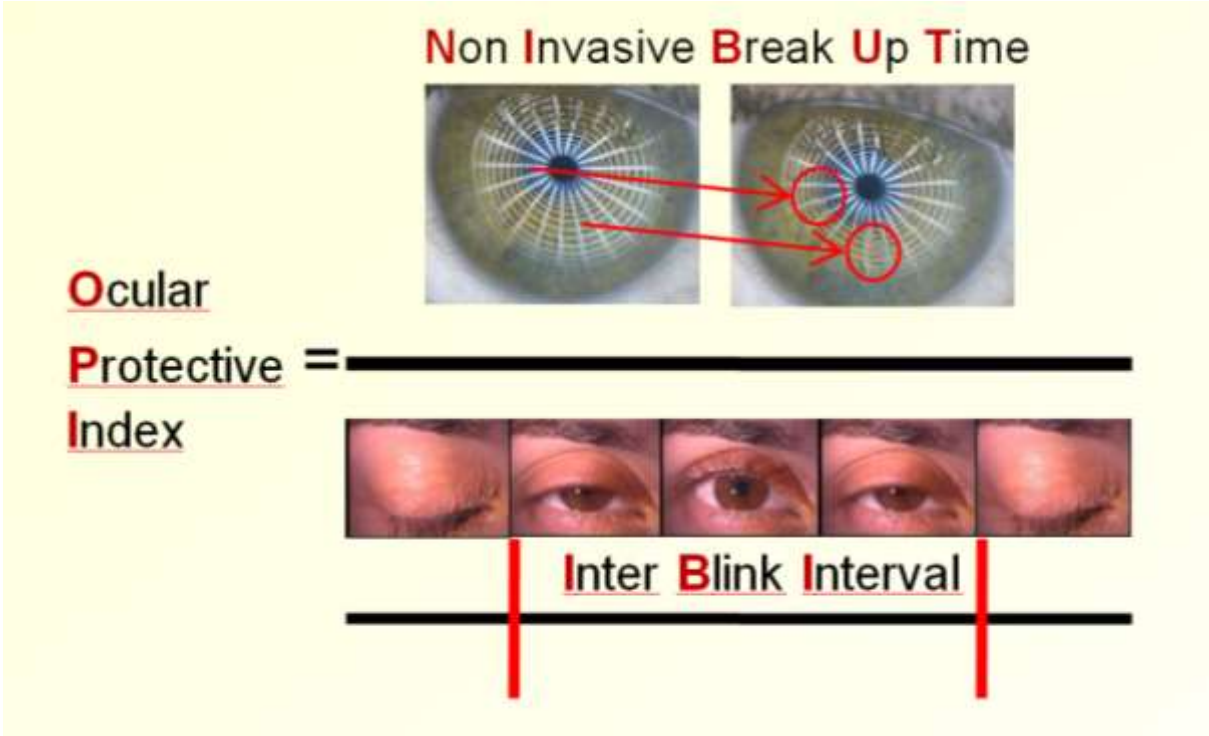
OPI index

REVIEW

(*Cornea* 2008;27:509–513)

The Ocular Protection Index

George W. Ousler III, BS, Katrina Wilcox Hagberg, BS, Michael Schindelar, BS, Donna Welch, RN, BSN, and Mark B. Abelson, MD, CM, FRCS(C)



Expected value> 1

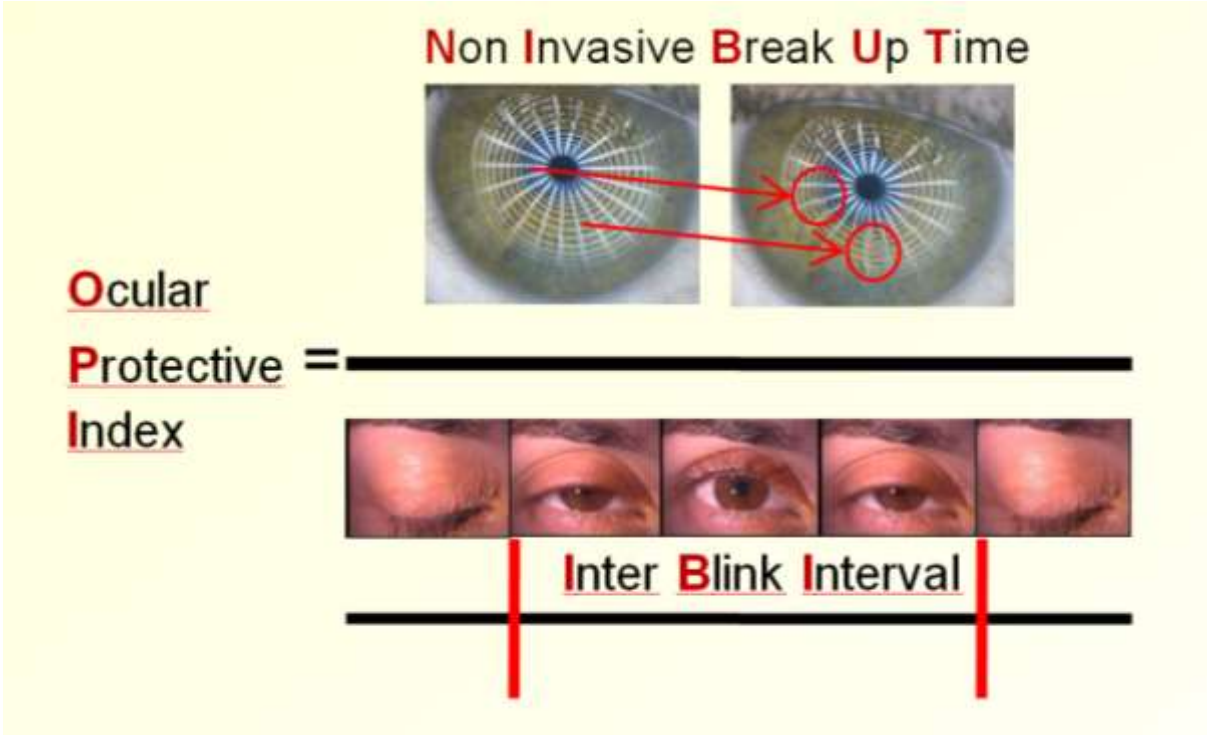
OPI index

REVIEW

(*Cornea* 2008;27:509–513)

The Ocular Protection Index

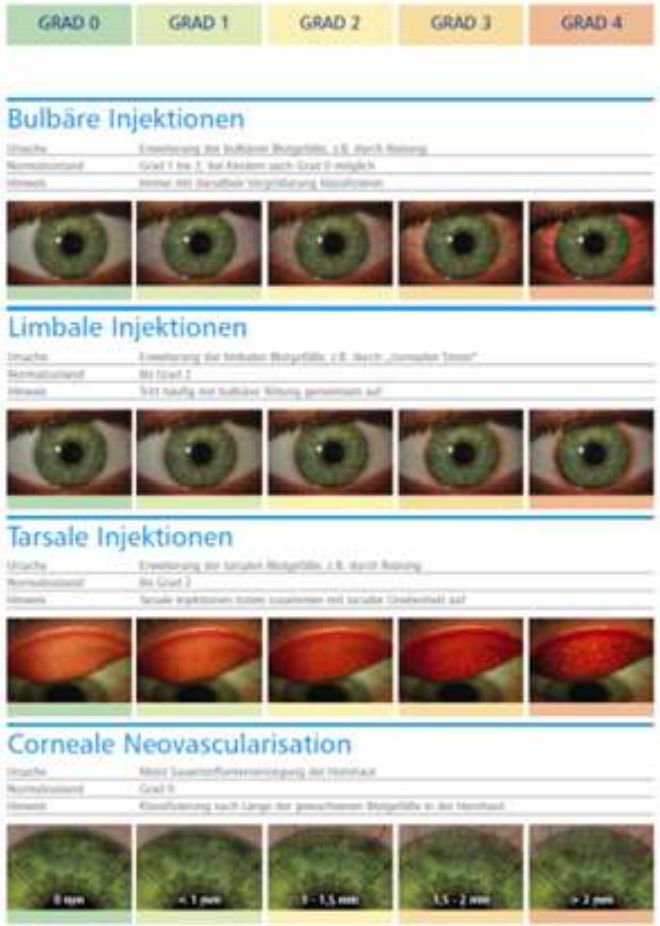
George W. Ousler III, BS, Katrina Wilcox Hagberg, BS, Michael Schindelar, BS, Donna Welch, RN, BSN, and Mark B. Abelson, MD, CM, FRCS(C)

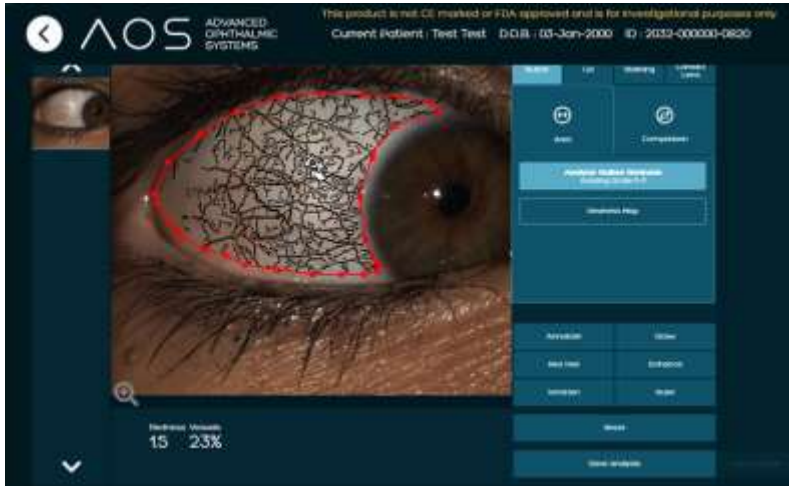


VDTIBI = IBI * 3,5
considering a 70% reduction of a number of blinks in a minute

Expected value> 1

Bulbar redness and corneal staining grading





Prescriptive considerations: refractive errors

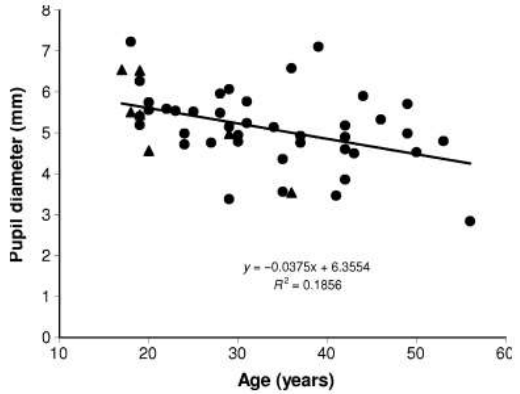
Reafractive error	Power	Comments
Hyperopia	> +0,50 dt	Correction with symptoms
Myopia	> -2,00 dt	Partially corrected for vdt use if subject removes glasses for near
Myopia	Full correction	Without symptoms
Astigmatisms	> 0,50 dt	Full correction

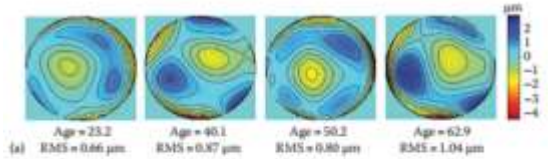
Prescriptive considerations: positive addition

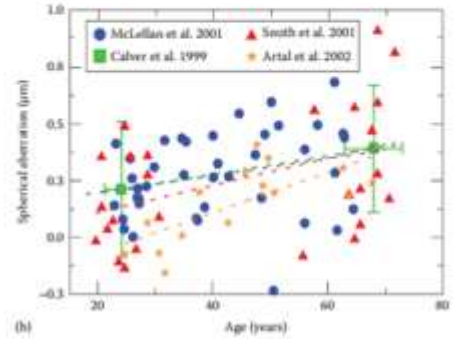
Test	Consider Added Plus	Added Plus NOT Indicated
Refractive Error	Hyperopia	Myopia
Near phoria	***Esophoria***	Exophoria
AC/A	***High***	Low
Base Out at near	Normal to high	Low
NRA/PRA	Low PRA	Low NRA
MEM	***High***	Low
Accommodative Amplitudes	Low	Normal
Accommodative Facility	Difficulty with minus	Difficulty with plus

Management of digital eye strain with soft Cls

Not all multifocal Cls can be effective to support the accomodative and binocular vision functions. These kind of Cls are designed to guarantee the best effect on presbyopic eyes and their performance can be different in young eyes.







Effects of multifocal lenses in non - presbyopic

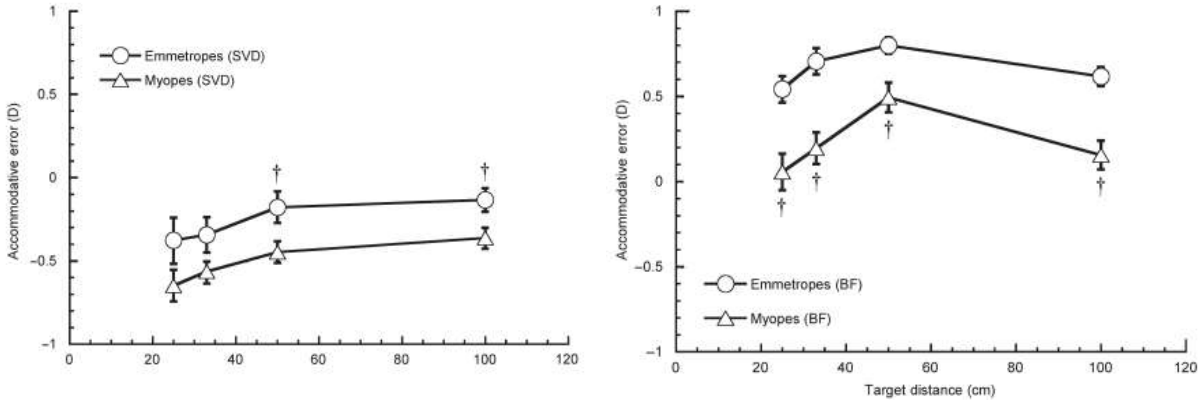
10 emmetropes and 25 myopes; mean age, 22.8 ± 2.5 years

The Cls used were a single vision lenses with the distance power (SVD) and a center distance multiconcentric bifocal (BF) with +1.50 dt near addition.

Ophthal. Physiol. Opt. 2008 28: 62–72

Accommodation in emmetropic and myopic young adults wearing bifocal soft contact lenses

Janice Tarrant, Holly Severson and Christine F. Wildsoet



Effects of multifocal lenses in non - presbyopic

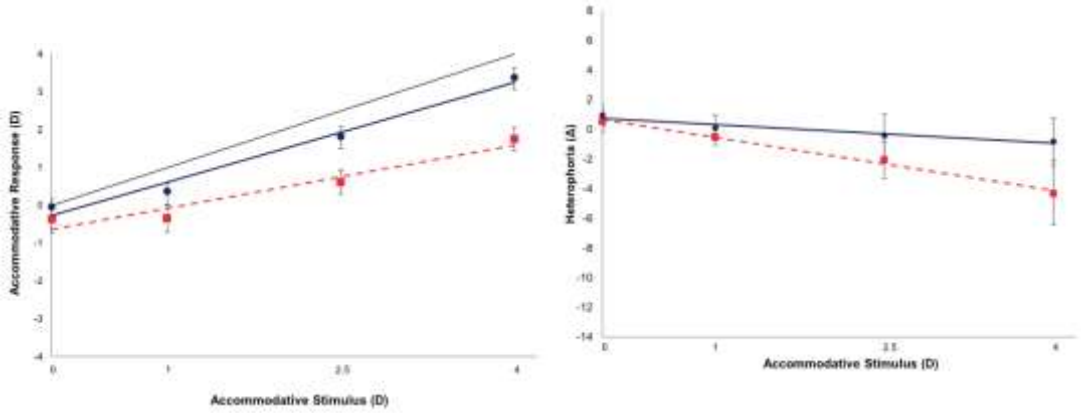
15 myopic patients with age between 7 and 15 yrs CD design multifocal Cls with an add of +2.50dt

Patients exhibited reduced accommodative responses and more exophoria at increasingly higher accommodative demands than with single vision Cls

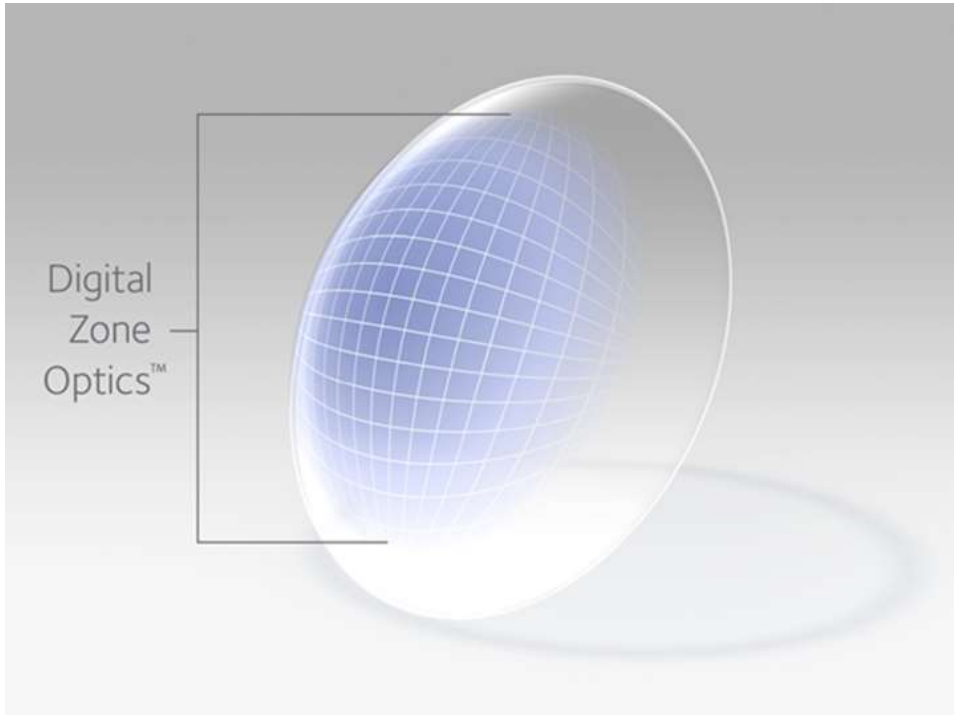
ORIGINAL ARTICLE

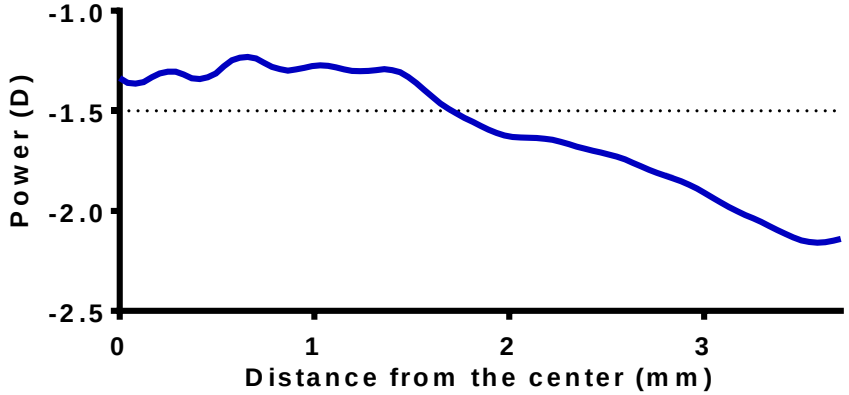
Accommodation and Phoria in Children Wearing Multifocal Contact Lenses

Celia R. Gong*, David Troilo†, and Kathryn Richdale‡



Management of DES with CIs with specific contact lens design





Front multi-aspheric anterior surface

Management of DES with CIs with specific contact lens design: effects on AMF

This lens design can reduce the AMF during smartphone use compared with the equivalent spherical design with possible positive effect on symptoms.

Contact Lens and Anterior Eye 43 (2020) 493–496

Contents lists available at ScienceDirect

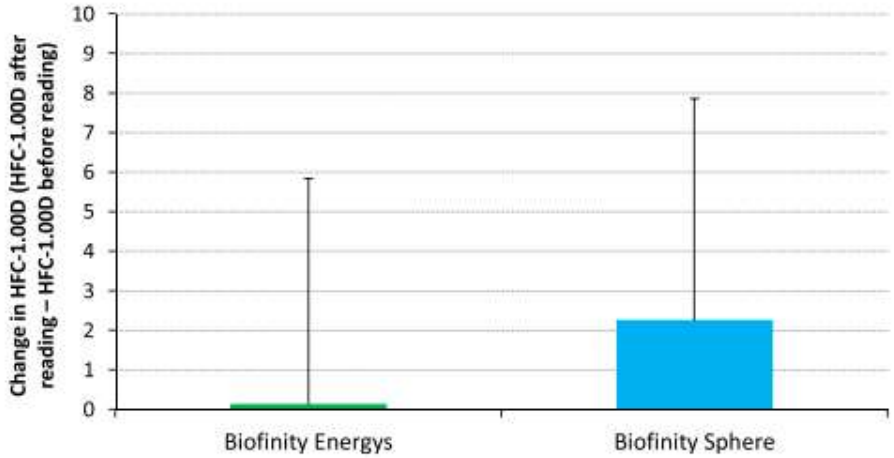
Contact Lens and Anterior Eye

journal homepage: www.elsevier.com/locate/clae

Changes in accommodative micro-fluctuations after wearing contact lenses of different optical designs

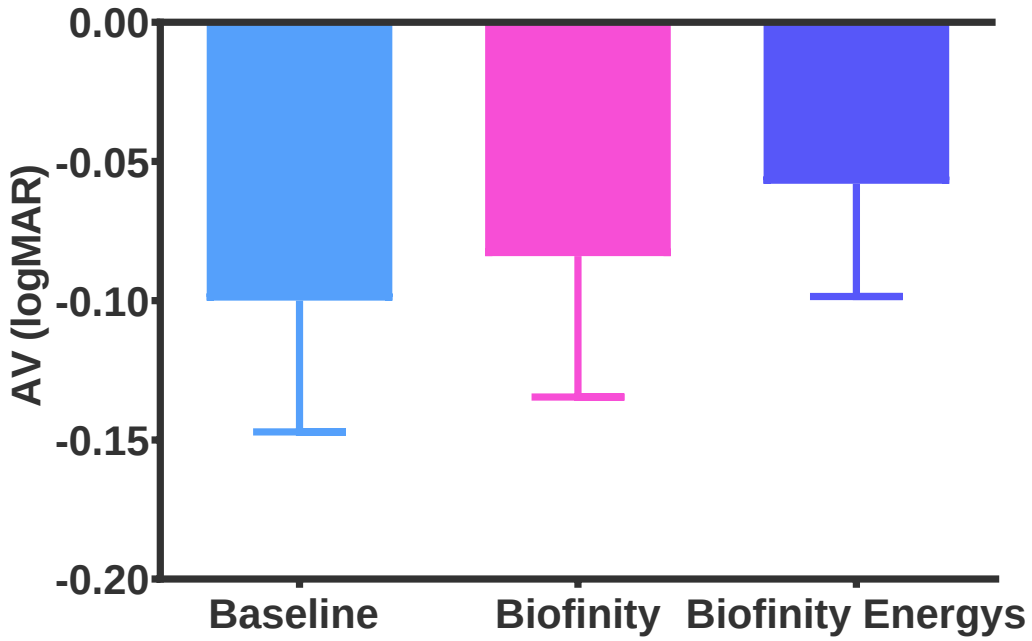
Masayoshi Kajita[a], Taku Muraoka[b], Gary Orsborn[c,*]

[a] Kajita Eye Clinic, Kyosi Building, 4F, 3-6-3, Shibaura, Minato-ku, Tokyo, Japan
[b] CooperVision Japan, Inc., 2-36-13, Ebisu, Shibuya-Ku, Tokyo, Japan
[c] CooperVision Inc., San Ramon, CA, United States



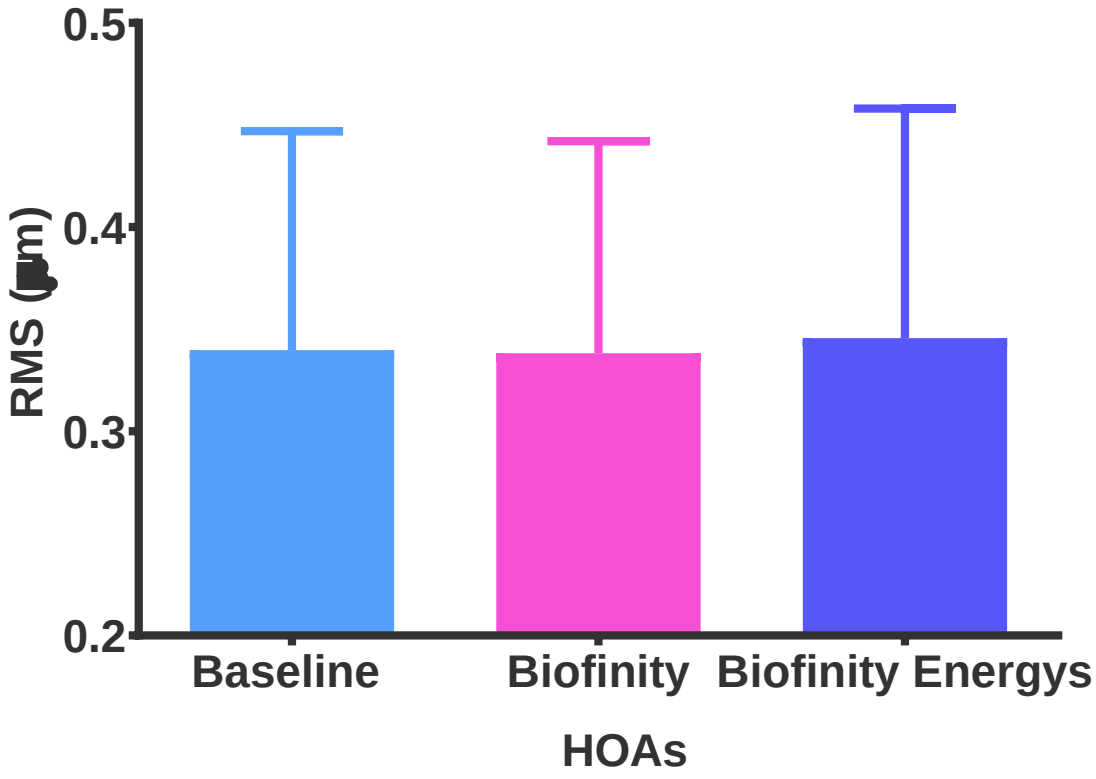
Management of DES with CIs with specific contact lens design: effects on VA

- The subjects enrolled had a refractive error of -2.37±2.88D (mean±SD) and an age of 22.8±2.9yrs.
- The binocular visual acuity value obtained at baseline was -0.10 ± 0.05logMar and did not changed statistically significantly (p = 0.142) using Biofinity (-0.08 ± 0.05logMar) and Biofinity Energys (-0.06 ± 0.04logMar).



Management of DES with CIs with specific contact lens design: effects on HOAs

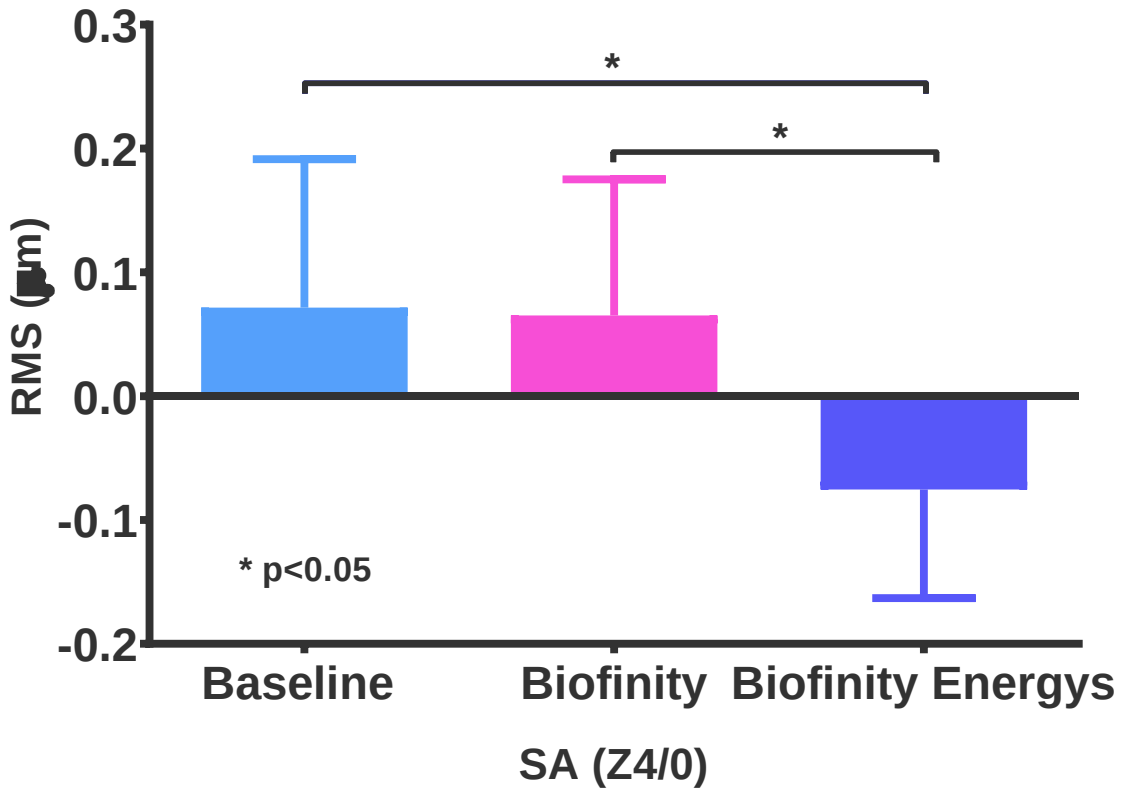
HOAs did not show statistically significant variations induced by the two contact lens designs (p = 0.931) with a value of 0.339 ± 0.124µm at baseline, 0.338 ± 0.118µm with Biofinity and 0.345 ± 0.121µm with Biofinity Energys.



Management of DES with CIs with specific contact lens design: effects on SA

Statistically significant differences were found for spherical aberration (Z^0_4) (F = 6.06 and p= 0.006) with a value of 0.071 ± 0.119µm at baseline, 0.065 ± 0.108µm with Biofinity lenses and a significant negative shift with Biofinity Energys lenses (-0.075 ± 0.091µm).

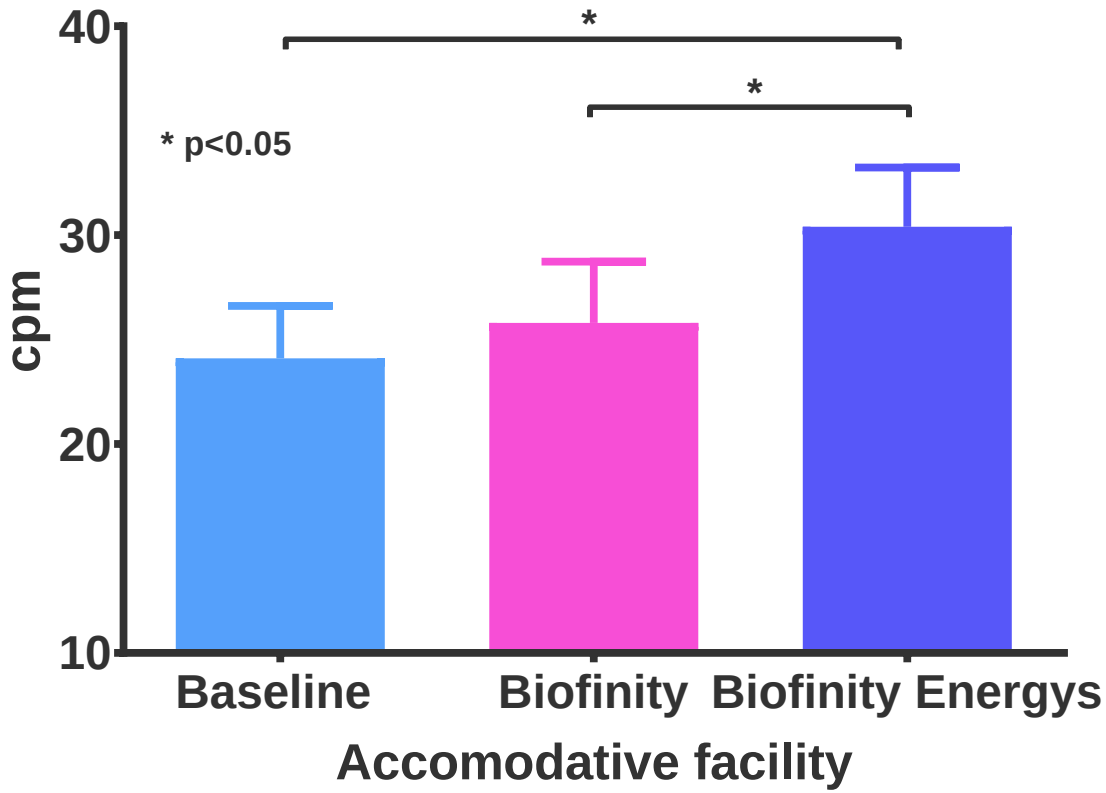
No statistically significant differences were found for coma ($Z^{\pm1}_3$) and trefoil ($Z^{\pm3}_3$)



Management of DES with CIs with specific contact lens design: effects on Accomodative facility

Statistically significant differences was found for:

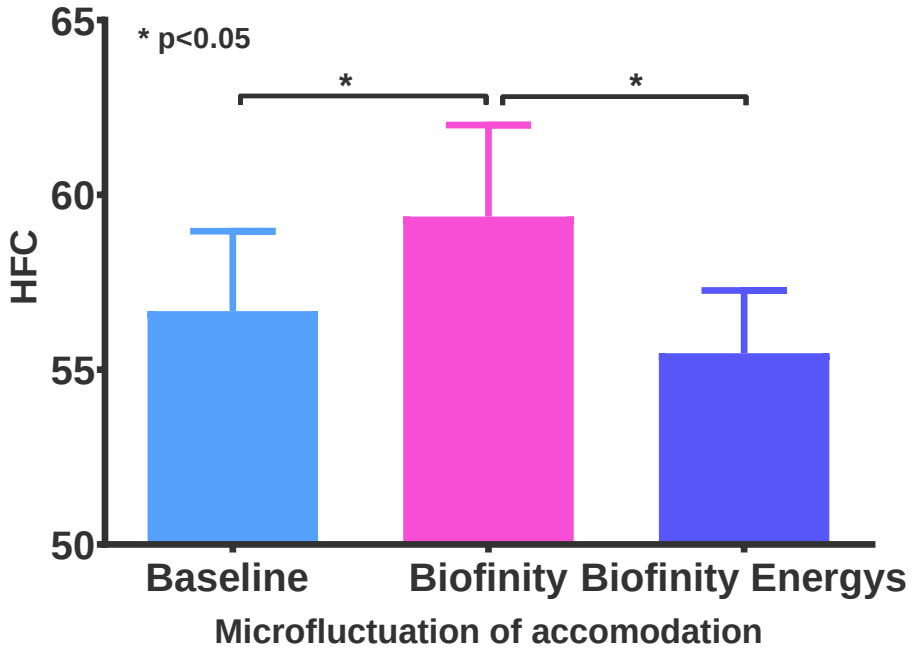
- accommodative facility (F = 13.86 and p <0.0001) showing 24.1 ± 2.5cpm at baseline, 25.8 ± 2.9cpm with Biofinity and 30.4 ± 2.8cpm with Biofinity Energys



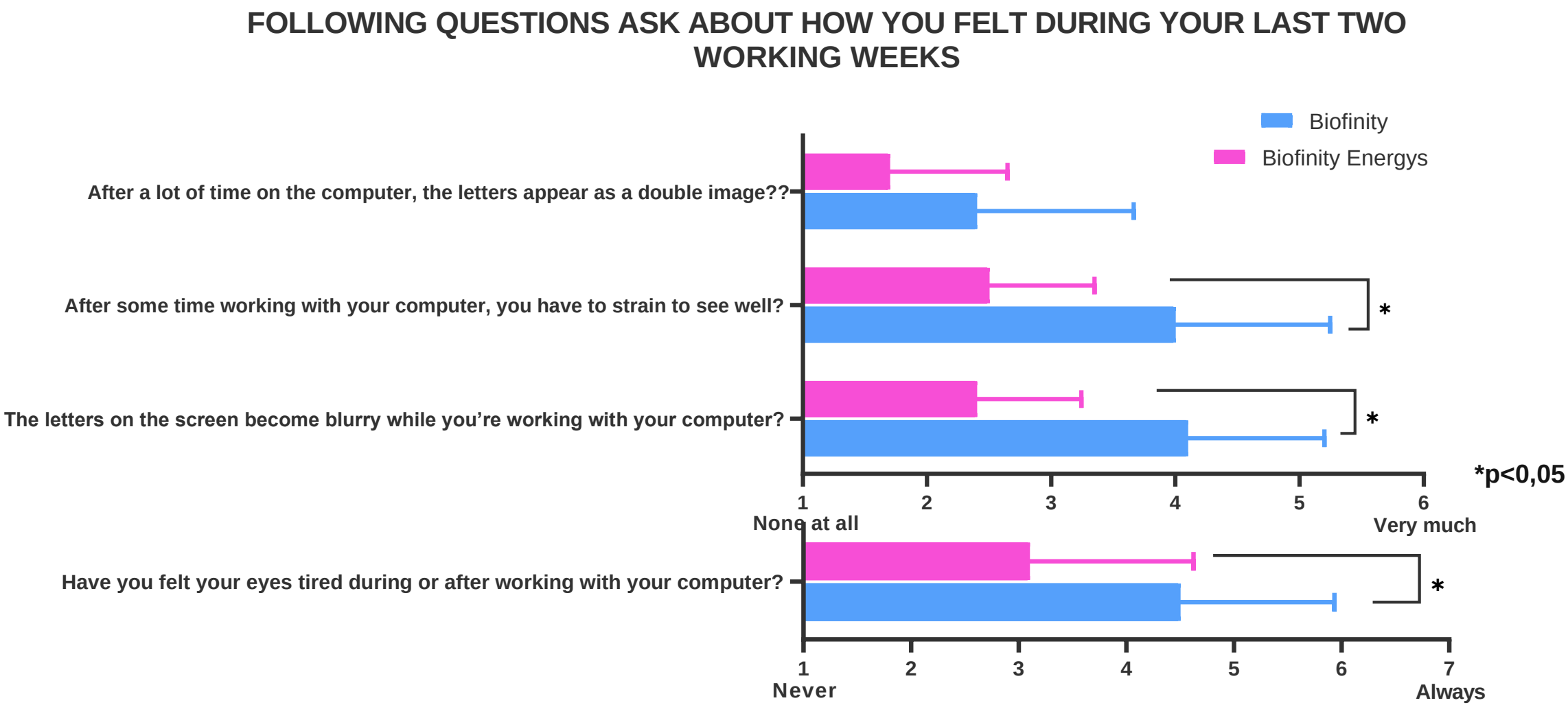
Management of DES with CIs with specific contact lens design: effects on AMF

Statistically significant differences was found for:

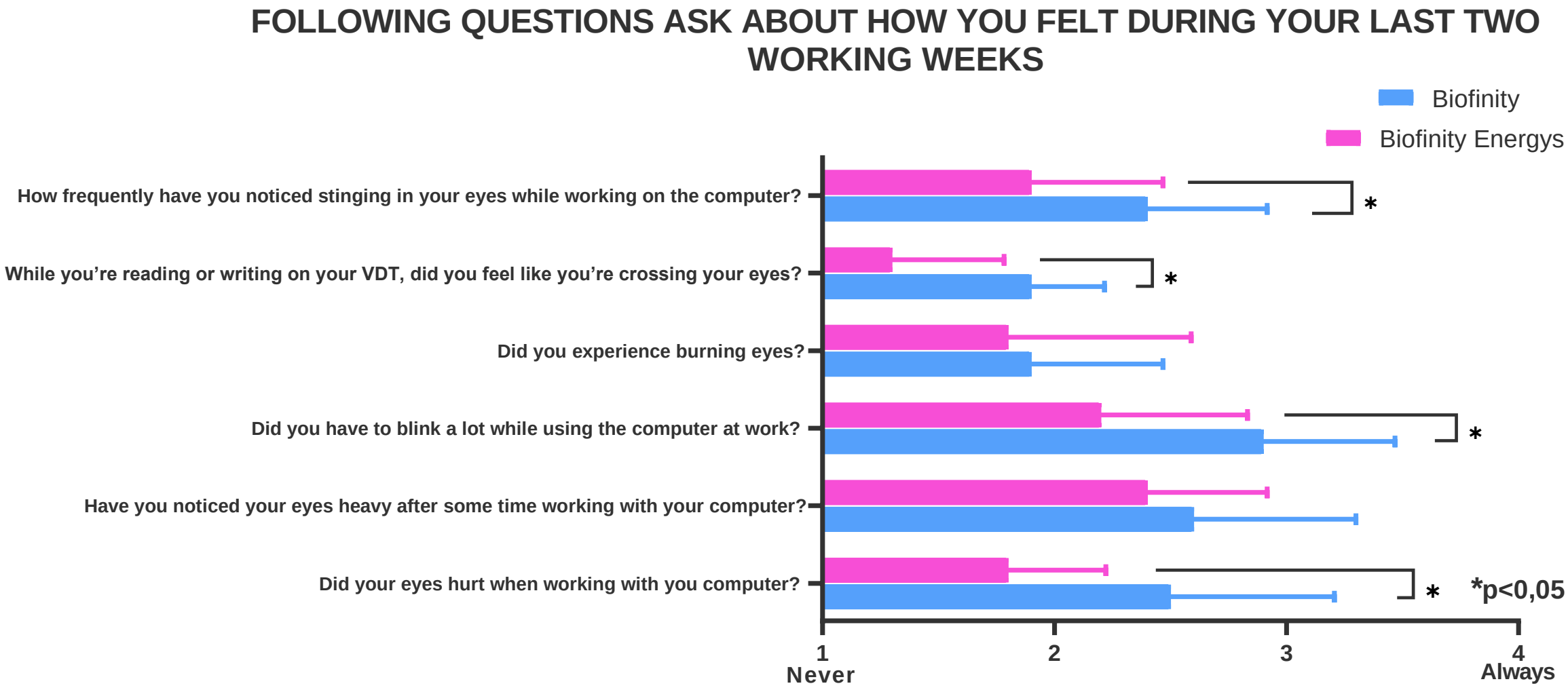
- HFC of microfluctuations of accommodation (F = 7.84 and p = 0.002) showing 56.67 ± 2.28HFC at baseline, 59.38 ± 2.61HFC with Biofinity and 55.47 ± 1.79HFC with Biofinity Energys



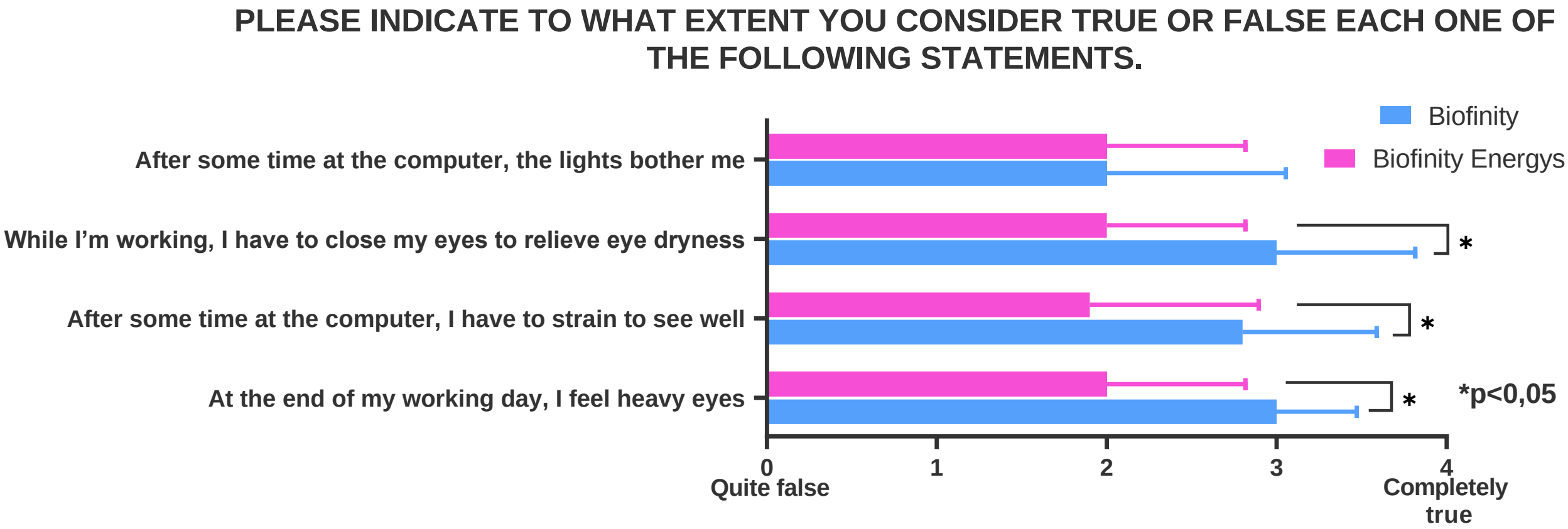
Management of DES with CIs with specific contact lens design: effects on symptoms



Management of DES with CIs with specific contact lens design: effects on symptoms

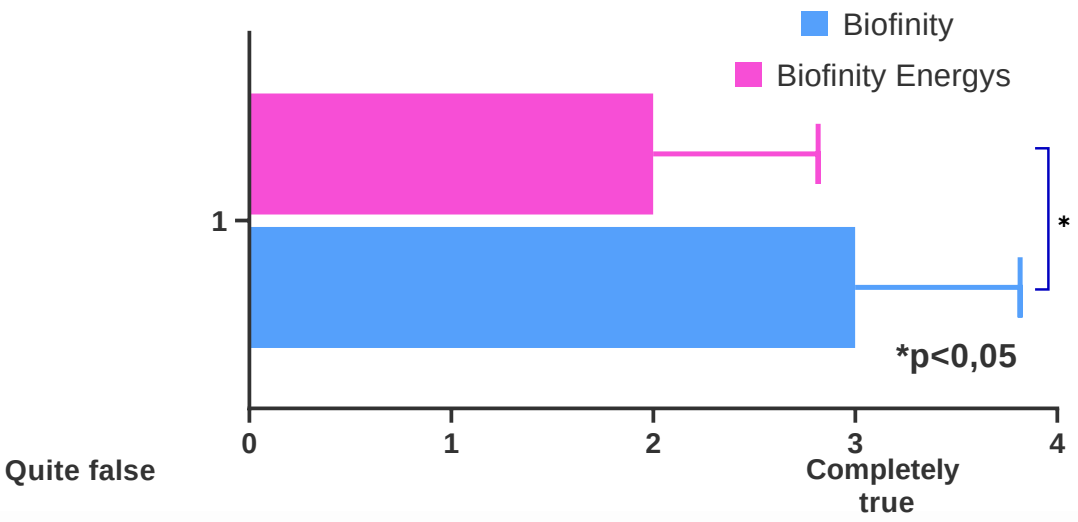


Management of DES with CIs with specific contact lens design: effects on symptoms



Management of DES with CIs with specific contact lens design: effects on symptoms

While I'm working, I have to close my eyes to relieve eye dryness



1040-5488/15/9209-e214/0 VOL. 92, NO. 9, PP. e214–e221
OPTOMETRY AND VISION SCIENCE

ORIGINAL ARTICLE

Can Binocular Vision Disorders Contribute to Contact Lens Discomfort?

Erin M. Rueff*, P. Ewen King-Smith†, and Melissa D. Bailey‡

ABSTRACT

Purpose. To determine the relationship between binocular vision (BV) disorder and dry eye symptoms and the frequency of BV disorders in subjects with contact lens–induced dry eye symptoms.

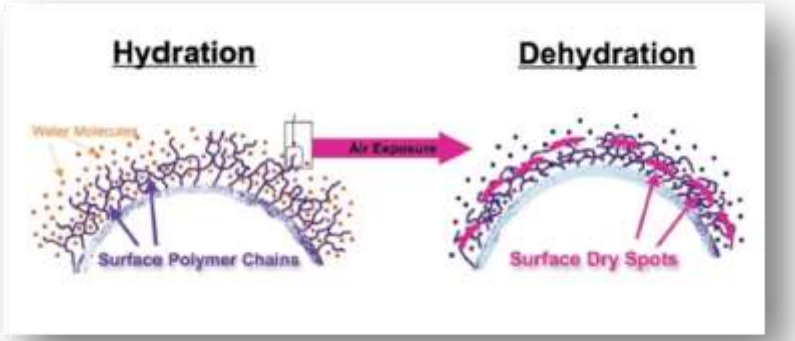
Methods. Subjects recruited for a larger dry eye study (n = 104) completed the Ocular Surface Disease Index (OSDI) and Convergence Insufficiency Symptom Survey (CISS) to determine if symptoms assessed on these two surveys were related. Also, myopic soft contact lens wearers (n = 29) with self-reported dry eye symptoms were recruited. Subjects completed the OSDI and CISS to assess severity of dry eye and BV disorder symptoms. Basic BV and dry eye testing was performed on each subject.

Results. Severity of symptoms assessed on the OSDI and CISS was found to be significantly correlated in the larger subject group ($\rho = 0.68$, $p = 0.0001$). This significant correlation warranted further investigation of both symptoms and clinical signs. In the group of myopic soft contact lens wearers, 48.3% had a BV disorder. This proportion appeared to be higher than previously reported prevalence estimates of BV disorders. Accommodative lag greater than or equal to 1.00 diopter was the most common BV disorder sign encountered (48.3%), and pseudo-convergence insufficiency was the most common BV

Conclusions. Symptoms related to dry eye and BV disorders overlap. Subjects with symptoms of discomfort while wearing soft contact lenses may be experiencing a concurrent or stand-alone BV disorder. Accommodative insufficiency and pseudo-convergence insufficiency were common in the sample of myopic soft contact lens wearers. Clinicians should screen symptomatic contact lens–induced dry eye patients for BV disorders. Dry eye studies should assess basic BV function. (Optom Vis Sci 2015;92:e214–e221)

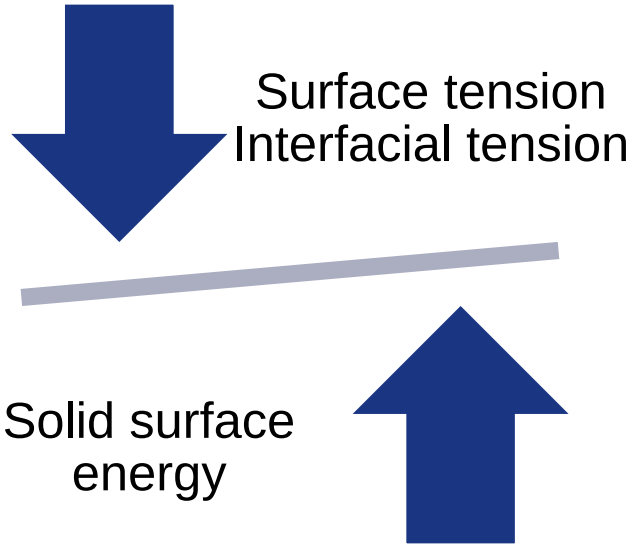
Management of DES with CIs : effects of contact lens wettability

- A stable pre-lens tear film between blinks is important on a "*hydrophilic*" surface of silicone-containing CLs to prevent their "*hydrophobicity*"
- During wear, the front surface of the CL can dry out, creating a hydrophobic environment.
- The *hydrophilic* portions tend to rotate to a position inside the lens while *hydrophobic* portions rotate to the dry environment at the surface.



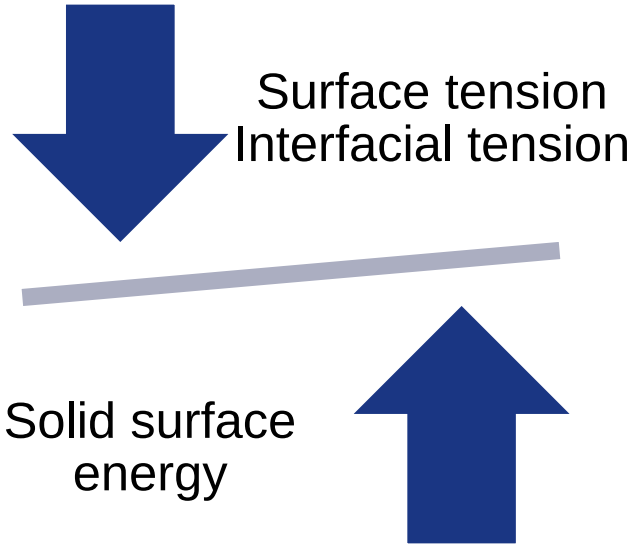
How to improve wettability?

- *Internal wetting agents* - Long chain, high-molecular-weight internal wetting agent based on polyvinylpyrrolidone (MeniSilk technology)
- *Non surface treatment* - Hydrophilic monomers “migrate” to the surface of the lens, (AquaGen technology)
- *Releasing wetting agents* - internal wetting agent based on HA and TSP, (Fusion technology)



How to improve wettability?

- *Water gradient surface* - 33% Water in core, transitioning through a water gradient to a hydrogel surface layer that exceeds 80% water
- *External wetting agents* - Lens care solutions containing surfactants, surfactants added to blister pack solutions
- *Surface treatment* – Plasma treatment or Hydra-PEG technology (Nanogloss technology).



Management with Eyedrops

Eyedrops use is effective to reduce symptoms of dry eye in VDT users.

Cleaning eyedrops to use with contact lens are effective too.

Exp. Eye Res. (1999) 68, 663–669
Article No. exer.1998.0636 available online at http://www.idealibrary.com on IDEAL®

The Influence of Eye Solutions on Blinking and Ocular Comfort at Rest and During Work at Video Display Terminals

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Instituto de Neurociencias, Universidad Miguel Hernández, 03550 San Juan de Alicante, Spain

CLINICAL RESEARCH

Effects of two eye drop products on computer users with subjective ocular discomfort

Francis C. Skilling, Jr., M.D.,[a] Tony A. Weaver, M.D.,[a] Kenneth P. Kato, M.D.,[a] Jerry G. Ford, M.D.,[a] and Elyse M. Dussia, M.D.[b]

[a]Eye Associates of Tallahassee, PA, Tallahassee, Florida and [b]eMD Clinicals, Inc., Sherman Oaks, California

vision

MDPI

Article

Improving Visual Comfort during Computer Gaming with Preservative-Free Hyaluronic Acid Artificial Tears Added to Ergophthalmological Measures

Fernando Trancoso Vaz [1], Ester Fernández-López [2], María José Roig-Revert [1], Alicia Martín [1] and Cristina Peris-Martínez [2,3,*]

Digital display use and contact lens wear: Effects on dry eye signs and symptoms

Cristian Talens-Estarelles | José Vicente García-Marqués | Alejandro Cerviño | Santiago García-Lázaro

Management with lens care solutions

70% of reusable contact lens wearers who experience dryness while using digital devices use rewetting drops for dryness.

Pall B, Wales M, Roussopoulou E. Eye care professional and contact lens wearer perspectives on digital screen devices. Optom Vis Sci. 2014;91: e145197

Management with lens care solutions

Solutions incorporated with wetting agents compared with solutions without these agents intruduce significant reduction in symptoms of dryness and lower blink rates

OPO OPHTHALMIC & PHYSIOLOGICAL OPTICS
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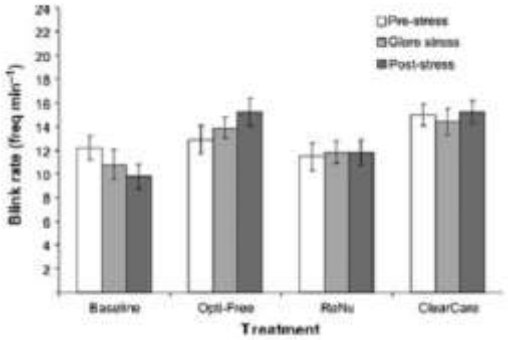
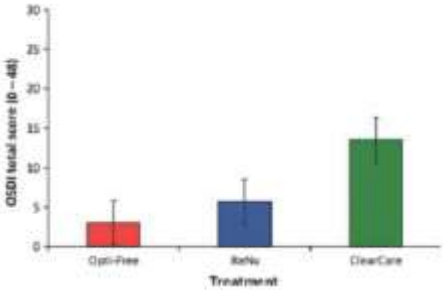
Comparative effect of lens care solutions on blink rate, ocular discomfort and visual performance

Shun-nan Yang[1], Yu-chi Tai[1], James E Sheedy[1], Beth Kinoshita[1], Matthew Lampa[1] and Jami R Kern[2]

[1]Vision Performance Institute, Pacific University College of Optometry, Forest Grove, USA, and [2]Alcon Corporation, Fort Worth, USA

Citation information: Yang N, Tai C, Sheedy JE, Kinoshita B, Lampa M & Kern JR. Comparative effect of lens care solutions on blink rate, ocular discomfort and visual performance. *Ophthalmic Physiol Opt* 2012, **32**: 412–420. doi: 10.1111/j.1475-1313.2012.00922.x





Management with DD contact lenses

Using a DD modality to reduce the likelihood of discomfort from ineffective lens cleaning or poor surface wettability.

Management- Omega3 use

Consumption O3FAs supplement improves symptoms, tear stability, and conjunctival cytology but not tear production in symptomatic VDT users

ARTICLE

Short-Term Omega 3 Fatty Acids Treatment for Dry Eye in Young and Middle-Aged Visual Display Terminal Users

Rahul Bhargava, M.S., Prachi Kumar, M.D., and Yogesh Arora, M.S.

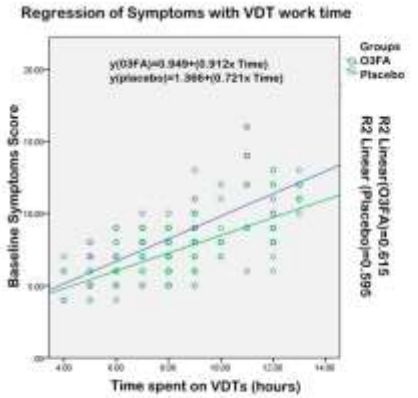


FIG. 3. Scatter plot showing linear regression of symptoms with visual display terminal (VDT) work time.

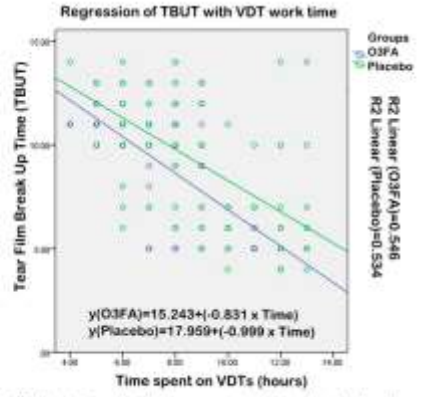


FIG. 5. Scatter plot showing regression of tear film breakup time (TBUT) with visual display terminal (VDT) work time.

20-20-20 rule

Although widely cited as a treatment option, these results do not support the proposal of using 20-second scheduled breaks as a therapeutic intervention for digital eye strain. However, these findings should not be interpreted as evidence that taking breaks is not helpful. Rather, it seems likely that longer break durations or a different frequency of breaks may be required to produce significant effects

ORIGINAL INVESTIGATION

20-20-20 Rule: Are These Numbers Justified?

Sophia Johnson, BS[1] and Mark Rosenfield, MCOptom, PhD, FAAO[1]*

SIGNIFICANCE: The use of digital devices has increased substantially in recent years across all age groups for both vocational and avocational purposes. There are a wide range of proposed therapeutic and management options for this condition, including optical, medical, and ergonomic interventions.

PURPOSE: Regular breaks are frequently recommended by clinicians to minimize digital eye strain. The so-called 20-20-20 rule, whereby individuals are advised to fixate on an object at least 20 feet (6 m) away for at least 20 seconds every 20 minutes is widely cited. Unfortunately, there is relatively little peer-reviewed evidence to support this rule. The aim of this investigation was to determine whether scheduled breaks are effective in reducing the adverse effects of digital device usage.

METHODS: The study was carried out on 30 young subjects who performed a 40-minute, cognitively demanding reading task from a tablet computer. The task required them to read random words and to identify which ones began with a specific letter chosen by the experimenter. The task was undertaken on four separate occasions, with 20-second breaks being allowed every 5, 10, 20, or 40 minutes (i.e., no break), respectively. Both before and after each trial, subjects completed a questionnaire regarding ocular and visual symptoms experienced during the session. In addition, both reading speed and task accuracy were quantified during each trial.

RESULTS: A significant increase in post-task symptoms (with respective to the pre-task value) was observed for all four trials ($P < .001$). However, there was no significant effect of scheduled breaks on reported symptoms ($P = .70$), reading speed ($P = .93$), or task accuracy ($P = .55$).

CONCLUSIONS: Although widely cited as a treatment option, these results do not support the proposal of using 20-second scheduled breaks as a therapeutic intervention for digital eye strain.

Optom Vis Sci 2023;100:52–56. doi:10.1097/OPX.0000000000001971

Supplemental Digital Content: *Direct URL links are provided within the text.*

SDC

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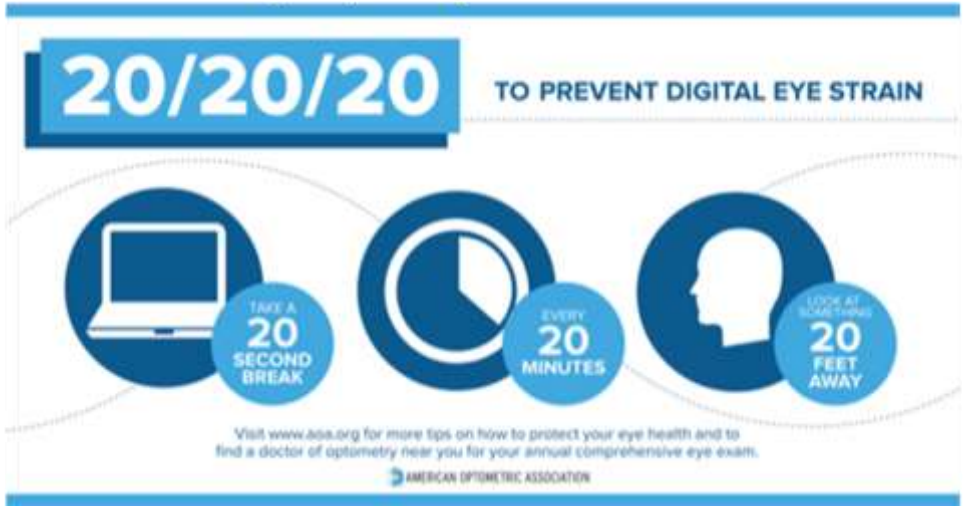

In conclusion

Digital eye strain is a very common problem in young adults.

Its management with Cls starts to compensate the refractive errors to obtain best corrected VA

Multifocal/EDOF Cls can be used also, real benefit on accomodative/binocular function.

Not all designs work in the same way

In conclusion

It is important also to use contact lens materials with high wettability, low dehydration and with the property to maintain a stable pre-lens tear film between blinks.

Grazie

Thank you

Merci

спасибо

Besten Dank

Gracias