VISUAL COMFORT

A Key Factor in Contact Lens Wearing Success

JANE HASELDINE
JENNIFER PALOMBI, OD, FAAO
US Professional & Academic Affairs

Key Points

- Asthenopia is driven by both internal (visual comfort) and external factors (ocular discomfort) and requires a solution that can help address both in order to maximize patient outcomes.[1]
- Visual comfort plays an important role in a patient's daily life, in addition to representing an equally important factor in a patient's overall contact lens wearing experience and satisfaction in lens wear.[2-7]
- Screen time hasn't slowed since the COVID-19 pandemic but instead continues to rise in the U.S.,[8] along with more individuals experiencing symptoms related to digital device use.[9]
- CooperVision has developed innovative contact lens design and material technologies that, in combination, may help address asthenopia from both internal and external factors in digital device users.
- To help address dryness,[10] Aquaform® Technology allows MyDay Energys® and Biofinity Energys® contact lenses to deliver a high level of oxygen combined with high moisture retention and optimal modulus to help support a healthy and comfortable lens wearing experience—even during times of reduced blinking such as when using digital devices.[10]
- To help combat eye tiredness, CooperVision created DigitalBoost™ Technology which is found in both MyDay Energys® and Biofinity Energys®.*[10,11] DigitalBoost™ Technology is a single vision aspheric lens design that delivers a +0.3D boost, which may help reduce ciliary muscle stress from overworked muscles during digital device use.*[11]
- CooperVision's Digital Eye Strain Report details the latest findings in screentime habits, digital device use trends, and innovative treatments to help combat digital eye strain.[12]

*Based on a statistically significant difference of the mean change in Accommodative Microfluctuations and when compared to a lens without DigitalBoost™ after reading on an iPhone 5 for 20 minutes held at a distance of 25 cm. Study conducted with Biofinity Energys and sphere.

Introduction

Comfort is key in a successful contact lens wearing experience, and conversely, discomfort is a primary reason often reported by patients for discontinuing lens wear.[13-15] Numerous studies have delved into the role of physical comfort in contact lens wear, with detailed analysis on related symptoms, contact lens material and designs, and how contact lenses interact with the ocular surface and tear film, to name a few.[16,17] Unlike perceptions of physical comfort, visual comfort has been described as the subjective impression of comfort caused by visual stimuli[18] and is often associated with environmental factors and daily tasks and activities.[19] Other studies suggest accommodation and binocular vergence are predominant ophthalmological factors that may influence eye strain and visual comfort.[20,21]

Asthenopia describes any discomfort sensation experienced in or around the eyes[1] and is often used in conjunction with ocular pain, headache, photophobia, diplopia, difficulty changing focus at various distances, burning, irritation, blur, dryness, and itch.[1] In cases of eye strain, asthenopia is not limited to contact lens wear.[22] Frequent and severe eye tiredness has been found to be highly prevalent in soft contact lens wearers and even non-wearers.[22]

The Tear Film and Ocular Surface Society (TFOS) defined contact lens discomfort as, "a condition characterized by episodic or persistent adverse ocular sensations related to lens wear, either with or without visual disturbances, resulting from reduced compatibility between the contact lens and the ocular environment, which can lead to decreased wearing time and discontinuation of contact lens wear."[16]

Rueff et al. describe contact lens discomfort as a misunderstood and difficult to manage clinical condition.[1] Most treatments and strategies aimed at alleviating discomfort focus on optimizing the contact lens fit and its relationship with the ocular surface, but these strategies can fail at relieving discomfort symptoms,[19] Dr. Rueff and her colleagues attest, indicating that there is more involved in patient comfort than ocular surface factors alone.

In clinical practice, managing dryness symptoms alone is sometimes not enough to address symptoms of asthenopia in contact lens patients.[1] Asthenopia is driven by both internal and external factors and requires a solution that can help address both in order to maximize patient outcomes.[1] This paper explores factors affecting visual comfort and strategies to enhance it.

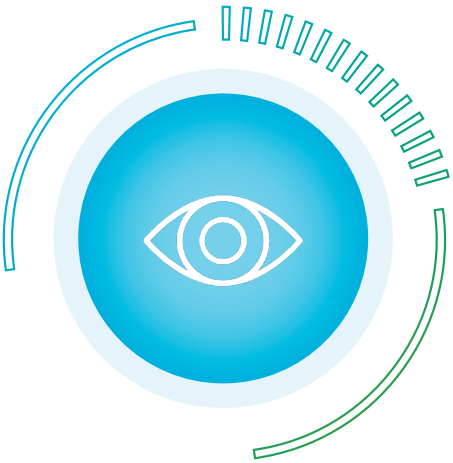
Importance of Visual Comfort

Visual comfort plays an important role in a patient's daily life, in addition to representing an equally important factor in a patient's overall contact lens wearing experience and satisfaction in lens wear.[2-7] Diec et al. examined the relationship between vision and comfort in contact lens wear and found comfort had a significant impact on vision satisfaction, suggesting the two were intrinsically intertwined.[2,7]

Vision and comfort also remain top indicators in contact lens satisfaction and represent key reasons for drop out if either factor fails to meet a patient's expectations.[4,13-15] Research has shown that long-term contact lens wear can improve a patient's life by correcting refractive error, providing social and emotional benefits, and enhancing the ability to enjoy activities with clear, spectacle-free vision.[4] These findings underscore why eye care professionals should maximize comfort and vision, which can help ensure long-term wearing success and provide patients the opportunity to enjoy the benefits of contact lens wear.

Additionally, visual comfort is integral in work[5] and academic performance.[23,24] For patients with asthenopia, their symptoms can adversely impact work and school related activities.[19] Of course, many individuals rely on digital devices for work, and subsequently may experience eye discomfort and vision problems when viewing digital screens for extended periods, which can in turn diminish productivity.[19]

Other investigations have reported that contact lens wearers may be more prone to visual discomfort from digital device use compared to non-wearers, due to possible increased accommodative and convergence demand, in addition to lens material.[25] An investigation by Tauste et al. that included 426 office workers found contact lens wearers were more likely to develop digital eye strain compared to non-wearers after six hours on a computer with a prevalence of 65%.[25] However, 50% of non-contact lens wearers still reported symptoms of digital eye strain.[25]



A Closer Look at Asthenopia: Internal and External Categories

Suspecting that asthenopia could be attributed to more than one source, Sheedy et al. investigated whether all asthenopia was the same.[26] From the findings, Dr. Sheedy and his team determined asthenopia was caused by two different and distinct mechanisms and sets of symptoms: external and internal, and created a classification system around each (Figure 1).[26]

EXTERNAL FACTORS (**OCULAR** DISCOMFORT)	Burning, Irritation, Dryness, Tearing
INTERNAL FACTORS (**VISUAL** DISCOMFORT)	Eye Strain, Headache, Ache, Double Vision, Blur

Figure 1. External and internal symptom categories of asthenopia.[26]

In the study, subjects performed reading tasks while experiencing different induced asthenopia symptoms, including astigmatic viewing, dry eyes, glare, flickering lights, and changing accommodative targets. The participants read until their ocular comfort was "barely tolerable." The individuals then classified their symptoms and rated them on a scale from 0 to 100, with zero indicating no symptoms and 100 equating to severe symptoms. Sheedy noted that symptoms were significantly related to their inducing conditions, and these relationships were notably stronger when symptoms were classified into external or internal symptom categories.[1,26]

Under the classification system, external symptoms were similar to dry eye: burning, redness, dryness, etc., while the internal symptoms were aligned with accommodative and vergence demands such as eye strain, headaches, and eye tiredness.[1,26]

The Sheedy investigation stated that symptoms of eye discomfort can be caused by a disruption of the ocular surface (ocular discomfort) or a strain of the visual system (visual discomfort).[1,26] While these two groups of symptoms originate from different causes, they may be difficult for a patient and/or clinician to differentiate from one another.[1]

One important takeaway to note: If discomfort treatments are only focused on the ocular surface (external factors/ocular discomfort) and not vision-related causes (internal factors/visual discomfort), patients may discontinue contact lens wear.[1,26] To put it simply, if a patient is experiencing contact lens discomfort, but the treatment is focused on the wrong source, the symptoms will not be alleviated, which can be a catalyst for drop out.[1]

Environmental Strategies for Visual Comfort

A recent report from CooperVision found screen time hasn't slowed since the COVID-19 pandemic but instead continues to rise in the U.S.,[9] along with more individuals experiencing symptoms related to digital device use.[9] The recent TFOS Lifestyle Report also affirms the large demand for treatments to relieve symptoms related to digital device use.[27] While interventions focused on modifying digital device behaviors in families have shown some success in limited geographies,[28] in most cases, it is difficult to encourage patients to reduce their digital screen use with effect, the TFOS Lifestyle Report authors note.[27]

Environmental interventions for digital eye strain can encompass the following: adjusting screen brightness and device settings; increasing display size to improve text readability; proper head and neck posture; modifying seating positions; and humidity and air conditioning alterations.[27,29] Modifying room lighting to potentially decrease glare is another environmental intervention that has been explored.[27]

Digital eye strain behavioral strategies have also been suggested, such as taking regular breaks from screens, following the 20-20-20 rule, and ensuring proper hydration and nutrition for eye health.[27,29]

Recent studies have questioned the effectiveness of blue light filters in reducing digital eye strain.[30-32] Many experts suggest that the primary source of discomfort derives from the internal factors such as accommodative burden with prolonged screen time rather than blue light.[30-32]

A recent double-masked, randomized control trial led by researchers from the Department of Optometry and Visions Sciences at the University of Melbourne enrolled 23 symptomatic computer users.[31] Their research team reported that blue-blocking lenses did not alter signs or symptoms of eye strain with computer use relative to standard clear lenses.[21,31] Further, clinician advocacy type had no bearing on clinical outcomes, the researchers stated.[31] Similar outcomes have been observed in other studies on the effect of blue-light filtering on digital eye strain symptoms in the past 5 years (Table 1).[32]

In a 2022 review of the literature on blue light safety as it applies to digital devices, Wong et al. examined the existing evidence in the peer-reviewed literature related to blue light filtering and its effects on the eye.[32] The authors concluded that filtering blue light does not protect against digital eye strain. That same year, two additional published reviews examined digital eye strain and its potential interventions more broadly.[21,33] Both concluded that blue-light filtering has no demonstrable or conclusive effect on the symptoms of digital eye strain.

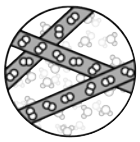
AUTHORS, YEAR, LOCATION	STUDY GROUP	METHODOLOGY	RESULTS	CONCLUSION
Vera J et al., 2022, Spain[30]	N=23	Two reading tasks from computer screen with or without blue-blocking filter on two different days. Orbicularis oculi muscle activity recorded by surface electromyography and digital eye strain symptoms noted during 30-minute reading task.	No change in orbicularis oculi muscle activity with or without using blue-blocking filter. Reading increased visual tiredness and discomfort.	Neither the orbicularis oculi muscle activity nor the visual symptoms altered significantly during 30-minute reading task with blue-blocking filters.
Singh et al., 2021, Australia[31]	N=120	Participants were randomized (1:1) to receive either clear (placebo) or blue-blocking spectacles (test). All participants were led to believe they had received an active intervention. Participants performed a 2-hour computer task while wearing their assigned intervention. The prespecified primary outcome measures were the mean change in eye strain symptom score and critical flicker-fusion frequency (an objective measure of eye strain).	No significant effect was found for intervention type (blue-blocking or clear lens, $p = .304$).	Blue-blocking lenses did not alter signs or symptoms of eye strain with computer use relative to standard clear lenses.
Rosenfield et al., 2020, United States[34]	N=24	20-minute reading task from a tablet computer after wearing either blue-blocking filter lens (TheraBlue 1.67 or TheraBlue polycarbonate) or a CR-39 control lens.	An increase in symptoms was observed immediately after near-vision task ($p=0.00001$), no significant difference in symptoms was found between the lenses ($p=0.74$).	Use of blue-blocking filters as a treatment for digital eye strain is not well proven. Optimal environments for screen viewing are more likely to benefit in minimizing symptoms.
Redondo et al., 2020, Spain[35]	N=19	30-minute reading tasks on computer screen placed at 50 cm, with either commercially available blue-blocking filter or without any filter on two different days.	Blue-light levels had no effect on lag and variability of accommodation ($p=0.34$ and 0.62, respectively). There was no significant change in pupil dynamics or perceived levels of visual discomfort.	Blue-blocking filter had no effect on accommodation dynamics or visual symptoms related to digital eye strain.
Palavets, 2019, United States[36]	N=23	30-minute reading task from tablet, with either blue-blocking or neutral-density filter producing equal screen luminance. Questionnaire to quantify digital eye strain symptoms.	Mean total digital eye strain symptom scores for blue-blocking and neutral-density filters were 42.83 and 42.61, respectively. Between the two filters, no significant differences were found.	Use of blue-blocking filters to minimize near work-induced asthenopia has limited proven evidence.

Table 1. Outcomes of recent clinical studies on the effect of blue light filtering on symptoms of digital eye strain.

Contact Lens Technology to Help Combat Asthenopia Caused by Digital Device Use

CooperVision has developed innovative contact lens design and material technologies that, in combination, may help address asthenopia from both internal and external factors in digital device users.

Aquaform® Technology



To help address dryness,[10] Aquaform® Technology, a CooperVision technological breakthrough, allows MyDay Energys® and Biofinity Energys® contact lenses to deliver a high level of oxygen combined with high moisture retention and optimal modulus to help support a healthy and comfortable lens wearing experience.[10] Aquaform® Technology is an innovative material technology that hydrates contact lenses to twice their weight in water[10] for natural wettability[10] and incredible, all-day comfort.[10]

Aquaform® Technology uses a matrix of long silicone chains with hydrogen bonds to lock water molecules in the lens for incredible, long-lasting comfort and clarity.[10,37] These long chains mean that less silicone is required to achieve the oxygen transmissibility needed to help keep eyes clear, white, and healthy in a lens that is soft and flexible for enhanced comfort and fitting versatility.[10]

Of note, Aquaform® Technology retains water from core to surface without the need for surface coatings or added wetting agents in the lens material[38] and creates a naturally hydrophilic silicone hydrogel lens.[10] The natural wettability of Aquaform® Technology can help eyes feel less dry, even during times of reduced blinking, such as when looking at a digital screen.[10]

Log into CooperVision's Online Success Center to read the Aquaform® Technology White Paper

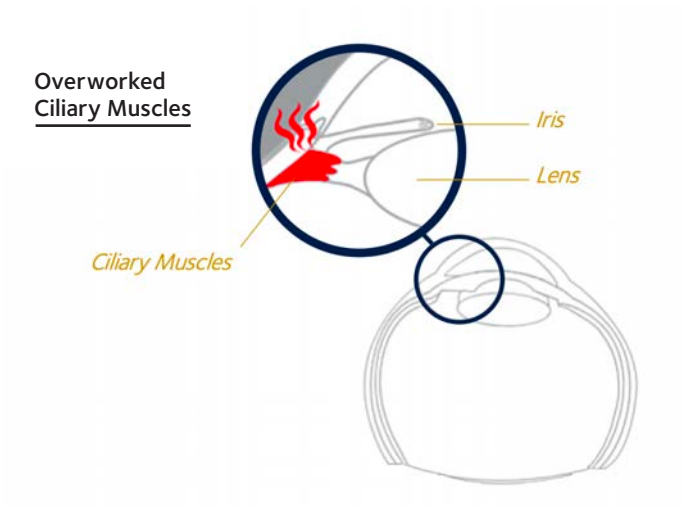
DigitalBoost™ Technology

To help combat eye tiredness, CooperVision created DigitalBoost™ Technology*[10,11] which is found in both MyDay Energys® and Biofinity Energys® contact lenses. DigitalBoost™ Technology is a single vision aspheric lens design that delivers a +0.3D boost, which may help reduce ciliary muscle stress from overworked muscles during digital device use.*[11]

A study by Kajita et al. evaluated and compared changes in accommodative microfluctuations (AMF), which are small dioptric changes during accommodation, in 68 adapted contact lens wearers.[11]

*Based on a statistically significant difference of the mean change in accommodative microfluctuations and when compared to a lens without DigitalBoost™ Technology after reading on an iPhone 5 for 20 minutes held at a distance of 25 cm. Study conducted with Biofinity Energys and sphere.

Participants wore either a Biofinity® or Biofinity Energys® silicone hydrogel lens. The study found the AMF response to a 20-minute reading task differed significantly between the two groups, with the lens design resulting in a much smaller change in AMF compared to Biofinity®.[11] Further, the authors concluded that DigitalBoost™ Technology may help ease ciliary muscle stress and accommodative burden so wearers can shift focus from on-screen to off-screen with less effort.*[11]



A separate, survey-based study that included 240 French ophthalmologists who fit 1,062 patients with Biofinity Energys® found wearers reported good visual comfort and reduced symptoms of digital eye strain when using digital devices.[38] The total respondents (704) wore the lenses for 21–28 days before completing the survey on symptoms that were linked to time spent in front of digital screens.[38]

Another paper by Montani et al. sought to determine if wearing a contact lens with DigitalBoost™ Technology impacted AMF and patient-reported symptoms of eye tiredness or strain related to digital device use.[39] This prospective, cross-over, subject-masked evaluation included 24 individuals who used digital devices for four or more hours per day and wore soft contact lenses with sphere range of +3.00 to -6.00D.[39] Participants were fit in either Biofinity® or Biofinity Energys® for two weeks, followed by a switch to the other lens for two weeks.[39]

The research team reported that subjects wearing DigitalBoost™ Technology (Biofinity Energys®) experienced significantly lower AMF compared to a Biofinity® contact lens.†[39] The study also showed that visual acuity levels were very good with DigitalBoost™ Technology and cited no significant difference in acuity compared to those fit with Biofinity®.‡[39]

At the end of every two weeks of wear, participants in the Montani study self-reported symptoms through a questionnaire.[39] Compared to their spherical wearing counterparts, DigitalBoost™ Technology wearers expressed less eye tiredness during or after working on a computer;§[39] less strain to see well after some time working with a computer;◊[39] less eye pain when working with a computer; less blinking while using a computer at work;¶[39] and less "heavy eyes" symptoms at the end of a working day.**[39]

†Baseline 56.67 ± 2.28 high frequency components; after 2 weeks of daily wear Biofinity 59.38 ± 2.61 HFC and Biofinity Energys 55.47 ± 1.79 HFC; p=0.002.
‡After 2 weeks of daily wear LogMAR Biofinity -0.08 ± 0.05, Biofinity Energys -0.06 ± 0.04; p = 0.142.
§After 2 weeks of daily wear Biofinity 4,5 ± 1,4 and Biofinity Energys 3,1 ± 1,5; p<0.05.
◊After 2 weeks of daily wear Biofinity 2,8 ± 0,8 and Biofinity Energys 1,9 ± 1,0; p<0.05.
¶After 2 weeks Biofinity 2,9 ± 0,6 and Biofinity Energys 2,2 ± 0,6; p<0.05.
**After 2 weeks of daily wear Biofinity 3,0 ± 0,5 and Biofinity Energys 2,0 ± 0,8; p<0.05.

Strategies to Add MyDay Energys® and Biofinity Energys® into Clinical Practice

With the rise of digital device use,[40] patients are clearly looking for ways to address their related symptoms. In fact, CooperVision's recent report on digital eye strain found nearly seven in 10 survey respondents reported experiencing symptoms associated with digital eye strain,[41] with nearly four in 10 saying they experience symptoms multiple times per week or more (Figure 2).[9,12,42]

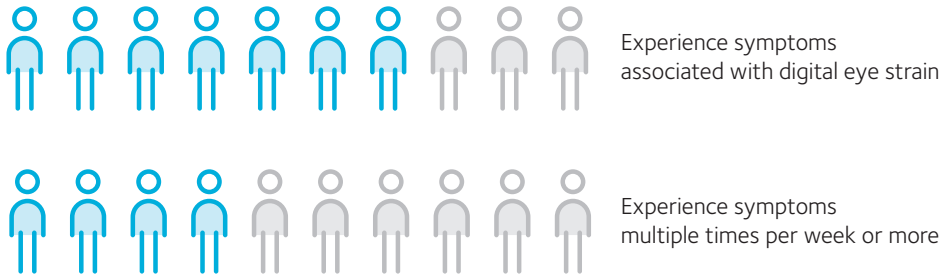
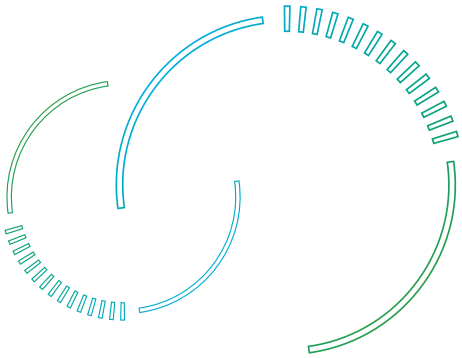


Figure 2. 70% of survey respondents cited digital eye strain symptoms with 4 out of 10 experiencing symptoms multiple times a week or more.[9,12,42]

Additionally, 99% of survey respondents had tried at least one method for reducing symptoms.[12] The report found tools and techniques respondents used to alleviate symptoms varied significantly, and overall, awareness or implementation of each method remained low.[43]

Most patients turn to their eye care professionals for education and insight on the latest innovations in eye care. With digital eye strain on the rise and the treatments now available to help address symptoms related to digital device use, a significant opportunity exists for both the patient and the practice.[40] Just consider: nearly 60% of respondents said they have never talked to an eye care professional about how digital device use affects their eyes.[44] Meeting this opportunity can initiate with a simple conversation in the exam room.[41]



CooperVision's digital eye strain report details conversation starters, which include the patient's lifestyle and experience with digital eye strain, their time spent each day on digital devices, symptoms and their frequency, and past symptom-reducing tools or techniques used and their effectiveness (Figure 3).[12]

Starting the Conversation

1. **Understand the patient's lifestyle and experience with digital eye strain.**
   - How many hours per day do you think you spend using all digital devices (smartphones, TVs, laptops, gaming devices, etc.)?
   - How often do you experience the symptoms of digital eye strain while on digital devices (eye tiredness, dryness, tearing, headaches, etc.)?
2. **Determine what they're doing to cope.**
   - What have you tried to help with these symptoms following digital device use?
   - How effective has this been for you?
3. **Establish a partnership with the patient.**
   - Together, let's find a solution that works best for you.
4. **Be the expert. Provide recommendations for addressing digital eye strain.**
   - Here is what I recommend...
   - Did you know there are contact lenses designed to help with tiredness and dryness associated with digital device use?[8]

Figure 3. Eye care professionals can initiate the digital eye strain conversation in the exam room and offer solutions to help.[12]

Once the digital device use history is established, the eye care professional can provide recommendations for addressing symptoms and specifically letting the patient know there are contact lenses designed to help.

It's important to note that any patient typically fit into a spherical contact lens could be a candidate for either MyDay Energys® or Biofinity Energys®.*[10,11,45,46]

Summary

Visual comfort is a key factor in successful contact lens wear and represents an integral part of a patient's perception of comfort.[1] Conversely, the literature illustrates that visual discomfort influences ocular and contact-lens-related comfort and overall satisfaction, which can ultimately lead to discontinuation of wear.[1,13-15]

Scientific investigations have shed light on the fact that asthenopia is not singular in its root cause but is derived from both external (ocular surface etiologies, dryness, etc.) and internal factors (visual, accommodative, etc.).[26] Even though some symptoms associated with visual discomfort are similar to dry eye, they are notably different in others.[1]

Eye care professionals should place as much focus on evaluating the visual system as the ocular surface to help reduce symptoms.[1] Today, eye care professionals can turn to innovative, highly effective, evidence-based designed treatments that can help with digital device related symptoms.[11,38,39]

Aquaform® Technology creates a naturally hydrophilic silicone hydrogel lens[10] that can help address dryness and provide wearers all-day comfort.[10] The natural wettability of Aquaform® Technology can help eyes feel less dry, even during times of reduced blinking,[10] such as when looking at a digital screen.[10] Also found in MyDay Energys® and Biofinity Energys® is DigitalBoost™ Technology with a +0.3D boost, which may help lessen ciliary muscle stress during digital device use.*[11]

An evidence-based treatment approach such as the one found in MyDay Energys® and Biofinity Energys® is important for addressing asthenopia in spherical contact lens wearers.[11,38,39] Almost every spherical contact lens wearer is a candidate for MyDay Energys® and Biofinity Energys®.[46]

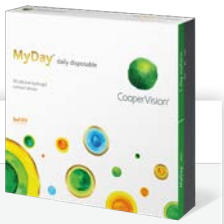
Digital device use is on the rise,[40] which means every patient is likely on digital devices on a daily basis, which also means they are at risk for asthenopia.[8,40] Start having the visual comfort conversation with every patient.

Download the Digital Eye Strain Research Report and discover more digital device use insights and communication strategies for your patients. Routinely ask your patients about digital device use and any subsequent symptoms and provide them innovative solutions by fitting them in MyDay Energys® and Biofinity Energys®. You can also find more resources and learnings about digital lifestyles and CooperVision contact lens technologies, including Aquaform® Technology, at CooperVision's Online Success Center.

Download the Digital Eye Strain Research Report:

*Based on a statistically significant difference of the mean change in Accommodative Microfluctuations and when compared to a lens without DigitalBoost™ Technology after reading on an iPhone 5 for 20 minutes held at a distance of 25 cm. Study conducted with Biofinity Energys and sphere.

MyDay Energys® Product Specifications



Material	Stenfilcon A
Water Content	54%
Dk/t (at -3.00D)	100
Base Curve	8.4 mm
Diameter	14.2 mm
Sphere Power	+8.00D to -12.00D (0.50D steps after +5.00D and -6.00D) No Plano
Technology	DigitalBoost™ Technology and Aquaform® Technology
Center Thickness	0.08 mm at -3.00D
UV Blocker*	Yes
Replacement Schedule	Daily

Biofinity Energys® Product Specifications

Material	Comfilcon A
Water Content	48%
Dk/t (at -3.00D)	160
Base Curve	8.6 mm
Diameter	14.0 mm
Sphere Power	+8.00D to -12.00D (0.50D steps after +/-6.00D) No Plano
Technology	DigitalBoost™ Technology and Aquaform® Technology
Center Thickness	0.08 mm at -3.00D
Wearing Schedule	Daily wear or up to 6 nights / 7 days extended wear
Replacement Schedule	Monthly

WARNING: UV-absorbing contact lenses are NOT substitutes for protective UV-absorbing eyewear such as UV-absorbing goggles or sunglasses because they do not completely cover the eye surrounding area. Persons should continue to use their protective UV-absorbing eyewear as directed.
NOTE: Long-term exposure to UV radiation is one of the risk factors associated with cataracts. Exposure is based on a number of factors such as environmental conditions (altitude, geography, cloud cover) and personal factors (extent and nature of the outdoor activities). UV-absorbing contact lenses help provide protection against harmful UV radiation. However, clinical studies have not been done to demonstrate that wearing UV-absorbing contact lenses reduces the risk of developing cataracts or other eye disorders. Consult your Eye Care Practitioner for more information.

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