THE WORLD'S FIRST FUNKY OPTOMETRY MAGAZINE

Cookie magazine

06
THE GAMING ISSUE
February 2022
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DON'T 'LAG' BEHIND

The pros and cons of using AI and VR devices in optometry P16

PROTECT THEIR VISION FOR THE FUTURE

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†Compared to a single vision 1 day lens over a 3 year period.

[1]Chamberlain P, et al. A 3-year randomized clinical trial of MiSight® lenses for myopia control. *Optom Vis Sci*. 2019; 96(8):556-567.

[2]0.25D or less of change.

[3] Data on file CV 2019

AI and Smart Optometry? APP-solutely!

My late father hated the introduction of autorefractometer (AR) in optometry clinics. He taught me that nothing beats retinoscopy in objective refraction.

Fast forward to June 2019 and I was part of the organizing team for the Asia Pacific Optometric Congress which was held in Manila with the theme *Optometry Refocused: Adapting to Disruptive Technologies and Heightened Consumerism.*

Was this theme prescient? Did we predict that optometry, especially with COVID-19, would undergo a technological transformation and slowly emerge in a radically different form than what our forebears — my father included — knew?

This issue of COOKIE magazine, which focuses on the role of virtual reality (VR) and artificial intelligence (AI) devices in optometry, dwells on this theme of technology's impact on the profession.

Who would have thought, just a few years ago, that certain debilitating diseases such as heart ailments could be detected by peering through the eyes? Or that "smart optometry" would provide ODs with online tools for basic optometry tests?

I was attending a webinar on binocular vision (BV) with colleagues, trying to digest, understand, and practice simple BV assessments on patients, when out of the blue came the announcement that an app had been developed for ODs to do BV tests and management for patients.

My 18-year-old daughter also aspires to be an optometrist, and I honestly don't know what form or shape the profession will be when she starts practicing. But one thing is sure, technology's march will inevitably transform how — and by whom — optometry will be practiced.

This inevitability has been the thesis of Richard and Daniel Susskind in their book *The Future of Professions* where optometry was identified as one of the professions in technology's shortlist for obsolescence.

For now, let this edition of *COOKIE* magazine intrigue and inspire you in equal measure.

From interesting news on optometry's AI and VR devices — hot off the press — to breakthroughs in smart glasses and contact lenses and the latest strategies in myopia management, this issue of *COOKIE* magazine has got you covered!

What's more, with the prevalence of VR gaming amid the pandemic, we especially curated compelling features on how gaming and excessive screen time affect the eyes. Or do they, really? Read on to find out!

As always, we hope you enjoy this issue.

Best,

Carmen Abesamis-Dichoso
OD, MAT, FIACLE, FPCO, FAAO

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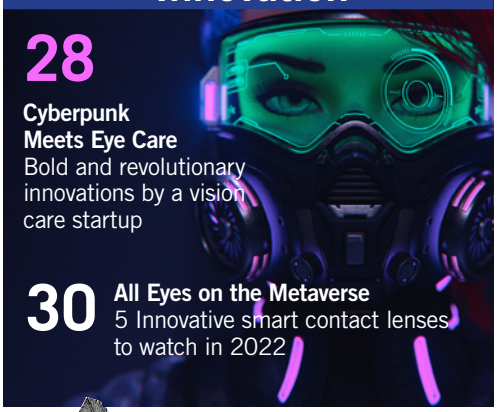

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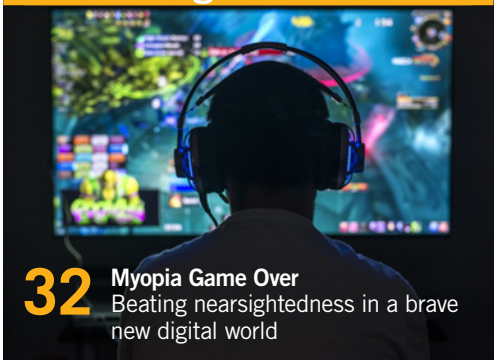

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Dr. Kristie Nguyen

OD

Dr. Kristie Nguyen is a board-certified optometrist. She currently serves as a contract doctor for Perez and Associates and Phan-Tastic Eye Care in Altamonte Springs, Florida, USA.

After graduating in the top 10 of her high school class with honors, she went on to obtain her Bachelor of Science degree from the University of Houston, Texas. While at U of H, she volunteered at a local hospital and worked as an optometric assistant. Dr. Nguyen obtained a Doctorate of Optometry (O.D.) in 2005 from Nova Southeastern University College of Optometry in Fort Lauderdale, Florida. She conducted her medical internships at the Chickasaw Nation Health Clinic in Ardmore, Oklahoma and the Lake Mary Eye Care in Lake Mary, Florida. Dr. Nguyen is a member of the American Optometric Association, the Florida Optometric Association, Young ODs of America, OD Divas, Optometry Divas and the Central Florida Optometric Society.

In addition, she has been an executive board member for Optometry Divas for the past two years. She is also a brand ambassador for an independent eyewear brand called Kazoku Lunettes and director of business development for an online optical company called Optazoom. She is also an independent consultant for Rodan+Fields, which is a global clinically tested skincare brand.

Dr. Nguyen is married and has two beautiful daughters. She enjoys going to the beach, hanging out at Disney, and reading.

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Dr. Oliver Woo

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Dr. Oliver Woo graduated from the School of Optometry, University of New South Wales, Australia in 1994 and established an independent optometrist practice in Sydney, Australia in 1997. In 2007, he became the first Australian Fellow of the International Academy of Orthokeratology (FIAO) and mentor. Dr. Woo has special interests in pediatric optometry, myopia prevention and control contact lens fitting of orthokeratology and specialty contact lenses.

He opened an Orthokeratology and Myopic Control Clinic in 2010. Dr. Woo uses and provides a variety methods in myopic management.

Dr. Woo has been actively participating in the continuing education conference of the IAOA (International Academy of Orthokeratology Asian Branch) as an instructor and mentor for FIAO of Chinese ophthalmologists, as well as in many local and international optometry and ophthalmology conferences as a lecturer and mentor.

He served on the board of directors of the Oceania Society of Orthokeratology (Australia and New Zealand) from 2014 to 2020. He was the FIAO Section Chairman (Oceania — Australia and New Zealand), senior member examination chair and examiner from 2014 to 2017. Dr. Woo actively participates in many local and international optometry and ophthalmology conferences as a lecturer, mentor and coach, with more than 90 international presentations.

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Dr. Carmen Abesamis-Dichoso

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Dr. Carmen Abesamis-Dichoso received her Doctor of Optometry from the Central Colleges of the Philippines in 1989, and earned her Master of Arts in Teaching from the Central Colleges of the Philippines in 2001. Her specialties include special contact lens design for keratoconus, children and high astigmatism; and visual assessment of the mentally challenged, autistic, ADHD, cerebral palsy and learning disabilities. In addition, Dr. Abesamis-Dichoso has been an orthokeratology practitioner in the Philippines since 2005. Since 1998, she has been self-employed in a private practice at Medical Plaza Makati.

She was awarded "Outstanding Optometrist of the Year" in 2017 by the Optometric Association of the Philippines. Currently, Dr. Abesamis-Dichoso serves as the International Affairs Committee chair of the Optometric Association of the Philippines; director of the Special Olympics Opening Eyes in the Philippines; program manager of Optometric Association of the Philippines Vision Screening Program and provision of eyeglasses with the United Nations Development Program in 10 areas and four Regions in the Philippines; and chairperson of the Special Olympics Healthy Athletes Program in the Philippines.

Dr. Abesamis-Dichoso is a fellow of the American Academy of Optometry; a founding fellow at the Philippine College of Optometrists; a fellow of the International Association of Contact Lens Educators; an Asia-Pacific Regional advisor for the Special Olympics Opening Eyes; treasurer at the Asia-Pacific Council of Optometry; and is an Asia-Pacific Council of Optometry (APCO) representative for the World Council of Optometry, in addition to being a member of the Legislation, Registration and Standards Committee. She has also authored numerous published papers and is a popular lecturer at industry meetings.

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Not Just a Game Anymore

AI as a detection tool in optometry

by Nick Eustice

One of the first places many of us encountered AI, or artificial intelligence, was in video games. The thing that made (and still makes) them fun is the way that machines seemed to solve problems and react in ways that presented new challenges. The lifelike problem-solving abilities of quite simple computers is what led millions of *Pac-Mans* and *Ms. Pac-Mans* to keep running from smart-seeming ghosts in video arcades.

Many adept young chess players have experienced the humbling feeling of being checkmated by their home PC. It didn't take long before chip manufacturers got really competitive with chess, and in 1997, the IBM computer known as Deep Blue defeated the world chess champion, Gary Kasparov. With that news story, many of us realized that computers could do more than just store data or solve basic arithmetic.

Today, 25 years later, AI is being put to use in many areas throughout our lives. AI is no longer a game — it is a bigger part of data analysis in our world. We've covered some of the exciting breakthroughs that have come through the use of AI in detecting optical conditions before, and now a new study is beginning to explore more exciting ways that AI can be used by optometrists in front-line detection of serious eye conditions.

Detection at the first point of contact

Though optometrists do not always have a role in treating some of the most dangerous and debilitating diseases of the eye, like age-related macular degeneration (AMD) and diabetic retinopathy, they are usually in the best position to diagnose such conditions. When a patient begins to manifest symptoms that would require care from an ophthalmologist, it is most often the case that the condition is already at an advanced stage, and those symptoms are likely to remain permanent.

On the other hand, optometrists use many of the diagnostic tools in the course of their own diagnosis and treatment of patients for less threatening conditions. These include optical coherence tomography (OCT) scans and color fundus photography (CFP). As a regular visit to the optometrist is a normal part of life for most eye care patients, it is at this point where dangerous conditions can be detected before they have advanced

to a stage where they threaten a patient's vision.

It is at this early point of detection, in the optometrist's office, that a growing number of experts believe AI can and should begin to play a vital role.

Contemporary AI tools in early detection

The first FDA-approved device for optical diagnostics was approved in 2018. The device, IDx-DR, uses CFP images of the retina taken with the Topcon NW400 camera. Those images are then uploaded to the cloud, where the IDx-DR software uses AI to cross-reference them with other such images to detect signs of diabetic retinopathy. Based upon this analysis, the device is able to determine whether a diabetic patient should be referred for immediate care, or should be rescreened one year later.

The FDA noted in its press release[1] that a unique and, indeed, defining feature of the IDx-DR is that it functions completely autonomously once the data has been uploaded. This makes it the first device released to the market that provides a screening decision without the need of interpretation by a medical doctor, or in this case, an ophthalmologist.

Another similar technology, RetinaLyze Glaucoma, aims to provide similar early detection opportunities for glaucoma, one of the leading causes of blindness in the world. While RetinaLyze Glaucoma is not yet approved by the FDA, it has been made widely available in the EU. This process is quite similar to the IDx-DR platform, also using cloud-based AI to analyze CFP images, but seeks to identify biomarkers associated with glaucoma rather than diabetic retinopathy.

A study[2] published two years ago in the *British Journal of Retinopathy* found that RetinaLyze Glaucoma delivers comparably accurate results to those provided by a stand-alone OCT scan. While at first this may not seem significant, the fact that these results are achieved entirely by AI, without the need for analysis by a clinician, is a substantial achievement that could provide greater availability of diagnosis at a far lower cost.

New research in Australia

A robust new cooperative study currently underway in Australia is set to release a paper in the coming months, detailing what may be the next steps in implementing new diagnostic strategies with AI in optometry.

Called the Cooperative Research Centre Project (CRC-P), the initiative is a result of the combined efforts of the Schools of Optometry and Vision Science and Computer Science and Engineering at the University of New South Wales (UNSW) and the global technology company Big Picture Medical, a leading innovator in information management in the medical field.

This project aims to tie together different data sets in order to streamline diagnostic tools and eliminate false positives at the diagnostic level. One of the project's directors, Prof. Michael Kalloniatis, is quoted on the UNSW website identifying misdiagnosis as a primary motivator for this project, with the goal of improving patient outcomes and more efficiently using the time and resources of eye care professionals.[3]

"AI algorithms can provide guidance to the clinicians, particularly in early diagnosis of eye disease, thereby reducing the significant false positive referrals to public hospital eye departments and also help detect disease early before irreversible vision loss occurs," said Prof. Kalloniatis.

This program is also unique in that it seeks to incorporate other patient factors into its diagnostic data set. This includes multiple images, vision tests, and patients' clinical histories. Utilizing these other factors in the AI's diagnostic capabilities will increase the software's accuracy, and subsequently lead to a more effective allocation of resources.

Another goal that sets this project apart is the degree of involvement that optometrists are expected to have in the analysis. While IDx-DR and RetinaLyze Glaucoma platforms deliver their results completely autonomously, the UNSW article notes that this has actually served to slow adoption of AI systems in the Australian optometry community. This, they suggest, is due to concerns over the comprehensive capabilities of AI in a fully automated system.

Such concerns are, of course, not without valid reason. As experts in their field, optometrists are interested in solutions that incorporate their knowledge and experience as part of the diagnostic process. This program intends to utilize the evaluative input of the optometrist along with the digital data, which they receive from the server-based AI analysis as part of a holistic diagnostic approach.

This method proposes to address concerns about adopting AI platforms and, at the same time, incorporate a wider field of information into the diagnostic process. A broader spectrum of data, coupled with the assurances of a professional optometrist, could be a big step forward in the development of diagnostic tools.

Working together for winning results

Optometrists, who are at the front line of detection for dangerous conditions, want to be involved in the process of using AI detection systems. After all, as professionals in the healing field, they want to do their utmost in assessing avenues for patient care. At the same time, AI is a growing and already powerful tool for detection. By combining these two together, we may find our way toward more effective and efficient detection of eye diseases.

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CURRENT FoV

A 'far-sighted' look at AI in myopia management

by Joanna Lee

Without a doubt, the gaming industry has leveled up during the pandemic. On Roblox alone — one of the top online gaming platforms worldwide — more than half a million American kids played video games in 2020.

Without proper regulation, chances are, these children will develop myopia in time to come, thanks to prolonged screen time. However, there may be hope through means of artificial intelligence (AI).

Let's survey our current field of view (FoV).

The role of AI in myopia control

The advancement in AI capabilities in the field of genomics, along with environmental factors, could potentially spur the development of tools that help bring about individualized and precision medicine for myopic patients, according to a group of researchers.[1]

From their review of AI trends in myopia, the researchers suggested that future innovative works should emphasize developing "generalizable predictive models" to control or prevent the development of myopia, especially between the period of childhood and adulthood.

Although recent molecular technologies like genome-wide association (GWAS) trials and next-generation sequencing (NGS) have detected novel risk-associated loci in myopic patients,[2,3] the interpretation of the findings remains a challenge because of the multiplicity of genetic variables and environmental factors.

The review stated that there are still significant challenges to overcome toward achieving models of prediction, which are more holistic in preventive

eye care for myopia.

The medical team from Singapore National Eye Centre (SNEC) and Singapore Eye Research Institute (SERI), together with the National University of Singapore's DUKE-NUS Medical School, undertook the review to explore AI as a more sustainable, scalable solution to ease the burden of early detection, treatment, and prevention of myopia.

We reached out to the review's corresponding author Associate Professor Daniel Ting who roped in lead author, SNEC Consultant Ophthalmologist, and myopia specialist Dr. Li Lian Foo, for more insight.

The trouble with myopia

"Myopia is a lifelong ocular disease, starting from childhood and extending into adulthood," shared Dr. Foo.

> "Currently, AI in myopia is at a nascent stage with several schools of approach, without a single dominating focus, compared to diseases such as diabetic retinopathy [and its] screening."
>
> **— Dr. Li Lian Foo, SNEC Consultant Ophthalmologist and Myopia Specialist**

The review highlighted its prevalence in East and Southeast Asian countries, where adults form 15 to 49% of those affected and 20 to 90% of children and adolescents are near-sighted.

Current studies are showing potential within the subfields of AI, specifically in machine learning (ML) and deep learning (DL) for myopia.

In ML, which zeroes in on pattern recognition, promising results have been seen in myopia prediction (such as in the development of myopia among schoolchildren, growth of physiological axial length, and myopic status among teens) and biometry for cataract surgery among individuals with high myopia.

"Currently, AI in myopia is at a nascent stage with several schools of approach, without a single dominating focus, compared to diseases such as diabetic retinopathy [and its] screening," Dr. Foo said.

"This is mainly due to paucity of robust longitudinal data available for algorithm development and collation that requires a significant investment of time and effort. Hence, most efforts are currently directed at data collection, which will lay the foundation required to accelerate future AI development," she added.

On the beat of algorithms

There may be hope. "Once these datasets are available in the upcoming years, there will likely be an influx of various AI algorithms directed at myopia management, possibly translating into clinically relevant and viable solutions," enthused Dr. Foo.

> "We recognize that implementation of AI algorithms into clinical practice is currently still challenging."
>
> **— Dr. Marcus Ang, SNEC Associate Professor and Senior Consultant Ophthalmologist**

Recently, studies have suggested that DL algorithms may be able to detect pathologic myopia from fundus images or automatically detect myopic maculopathy based on OCT images.

However, associate professor and senior consultant ophthalmologist Dr. Marcus Ang from SNEC feels that while these studies are promising, future AI algorithms that can predict which individuals are at greater risk of myopia progression or higher risk of developing myopia-related complications would be of greater clinical significance.

"We also recognize that implementation of such algorithms into clinical practice is currently still challenging," Dr. Ang said.

VR in myopia management? Game on!

Recent interest has been found in virtual reality (VR) or augmented reality (AR) devices for myopia.

But video gamers, children, parents, researchers, and anyone working on screens may want to take note of Dr. Foo's take on these devices. "Near work is known to induce myopia progression. On the other hand, applications related to greater outdoor exposure and near work reduction would have potential towards individualized precision medicine for myopic patients," he said.

Early research have examined the use of VR devices that can maintain peripheral defocus and simulate an outdoor environment for myopia prevention.[4] However, substantial research is needed to confirm that these devices actually reduce myopia progression.[5]

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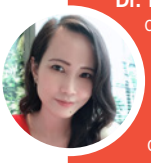
Contributing Doctors



Dr. Li Lian Foo is a consultant ophthalmologist at the Singapore National Eye Centre and Myopia Centre of Excellence Singapore, subspecializing in the field of myopia, focusing on childhood myopia control as well as refractive and cataract surgeries. She is the first ophthalmologist who has completed the Myopia Fellowship in Singapore National Eye Centre and in the whole of Singapore. She also holds an academic position of clinical instructor at DUKE-NUS Department of Ophthalmology and Visual Sciences, Myopia Program Lead of the Singapore National Eye Centre Fellowship Coordination Committee, physician faculty member of SingHealth Ophthalmology Residency Program, and honorary committee member of the SingHealth Cluster Artificial Intelligence Program. Dr. Foo is also actively involved in innovations and research in the field of artificial intelligence and myopia. She is currently a scholar of the Khoo Scholars Programme at Duke-NUS Graduate Medical School and has also been awarded the Duke-NUS Nurturing Clinician Researcher Scheme (clinician innovator). Besides having her work published in various major scientific journals, she has been invited as a panelist and speaker at multiple conferences both locally and globally.

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Assoc. Prof. Dr. Marcus Ang is Senior Consultant Ophthalmologist at the Cornea, Cataract and Refractive Service, Singapore National Eye Center (SNEC). He is the Clinical Director of the SNEC Myopia Center. His academic work includes more than 170 peer-reviewed publications (H-index=44), majority of which are first or corresponding author with JIF>2.0, focusing on translational research, such as corneal transplantation studying prognostic factors to improve outcomes. He has published a few important articles in the LANCET, PRER and Ophthalmology; and book chapters such as the seminal textbook CORNEA. He also serves as Secretary of the Asia Pacific Academy of Ophthalmology (APAO) YO Committee. He currently serves on the APAO LDP Standing Committee and AAO Committees such as the YO International Committee and AAO Myopia Taskforce. He is a regular invited speaker at international conferences recognized by his international awards such as the APAO Achievement Award (2018) and AAO Achievement Award (2019). His contributions and achievements as a young ophthalmologist have led to him being awarded the Artemis Award from the American of Ophthalmology in 2019 and Vision Excellence Award (IAPB) in 2020.

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Dr. Daniel Ting is a vitreo-retinal surgeon working at the Singapore National Eye Center, and a tenured-track associate professor at the Duke-NUS Medical School. He is also the director of Singapore Health Service (SingHealth) AI Program, head of AI and Digital Innovation in Singapore Eye Research Institute (SERI), and was a Fulbright Scholar at School of Medicine Johns Hopkins University. Dr Ting's research focus is related to AI and digital health-related applications for eye and retinal diseases that span across machine learning, deep learning, privacy preserving technology, such as blockchain technology, federated machine learning and generative adversarial network, satellite technology (4G and 5G), conversational AI chatbot using natural language processing and cybersecurity. To date, he has published 200 peer reviewed publications in high-impact journals. One of his COVID-19 articles was published in Nature Medicine, entitled "Digital Technology and COVID-19" has so far been cited for 842 times with 100,000 views, and also been referenced by the US Center for Disease Control and Prevention.

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The Future Is Here

Predicting myopia risk with the OCULUS Myopia Master

by Hazlin Hassan

Myopia or short-sightedness is on the rise, especially among school-aged children. It is estimated that nearly half of the world's population will be affected by myopia by the year 2050.

The OCULUS Myopia Master is the world's first device to combine the three important measurement parameters for myopia management: refraction, axial length and central corneal radii, making myopia management easier and more reliable than ever.

With myopia prevalence increasing in children, adolescents and young adults and growing exponentially overall, it is becoming more and more important to monitor for myopia early on in life. The earlier myopia is discovered, the better for its management.

To date, there has been no single device that was capable of measuring refractive error, axial length and corneal radius of curvature. Additionally, none of the instruments provided any feedback to the practitioner on whether the values fell within the expected range. The only option was to purchase at least two devices or more, but without any software that provided feedback.

Prof. Padmaja Sankaridurg and colleagues from the Brien Holden Vision Institute, Australia, and the Shanghai Eye Disease Prevention and Treatment Center, China, have created percentile charts incorporated into a software for evaluating whether a child's axial length is normal, a useful and important tool for eye practitioners.

In a ground-breaking study on typical axial lengths in children from Shanghai, China, they looked at the eyes of 14,127 Chinese children and adolescents aged four to 18 years. The purpose was to develop age-specific and gender-specific reference percentile charts for axial length (AL) and AL/corneal radius of curvature (AL/CR) and, to use percentiles to determine probability of myopia and estimate refractive error (RE).

Prof. Sankaridurg said axial length nomograms are useful in determining the probability of myopia, to monitor patterns of eye growth and to determine if these are within expected ranges. "This helps to determine appropriate monitoring and treatment strategies and if the child is already on a myopia control strategy, then to evaluate the efficacy of the treatment," she said.

Results of the study showed that the estimation of a one-year change in AL using percentiles correlated highly with actual AL (ICC=0.98). Concordance of estimated to actual RE was high (ICC=0.80) and within ±0.50D and ±1.0D of actual RE for 47.4% and 78.9% of eyes, respectively.

In conclusion, age-specific and gender-specific AL and AL/CR percentiles can be used to provide reference data, aid in identifying and monitoring children at risk of myopia and can be used as part of screening for the condition.

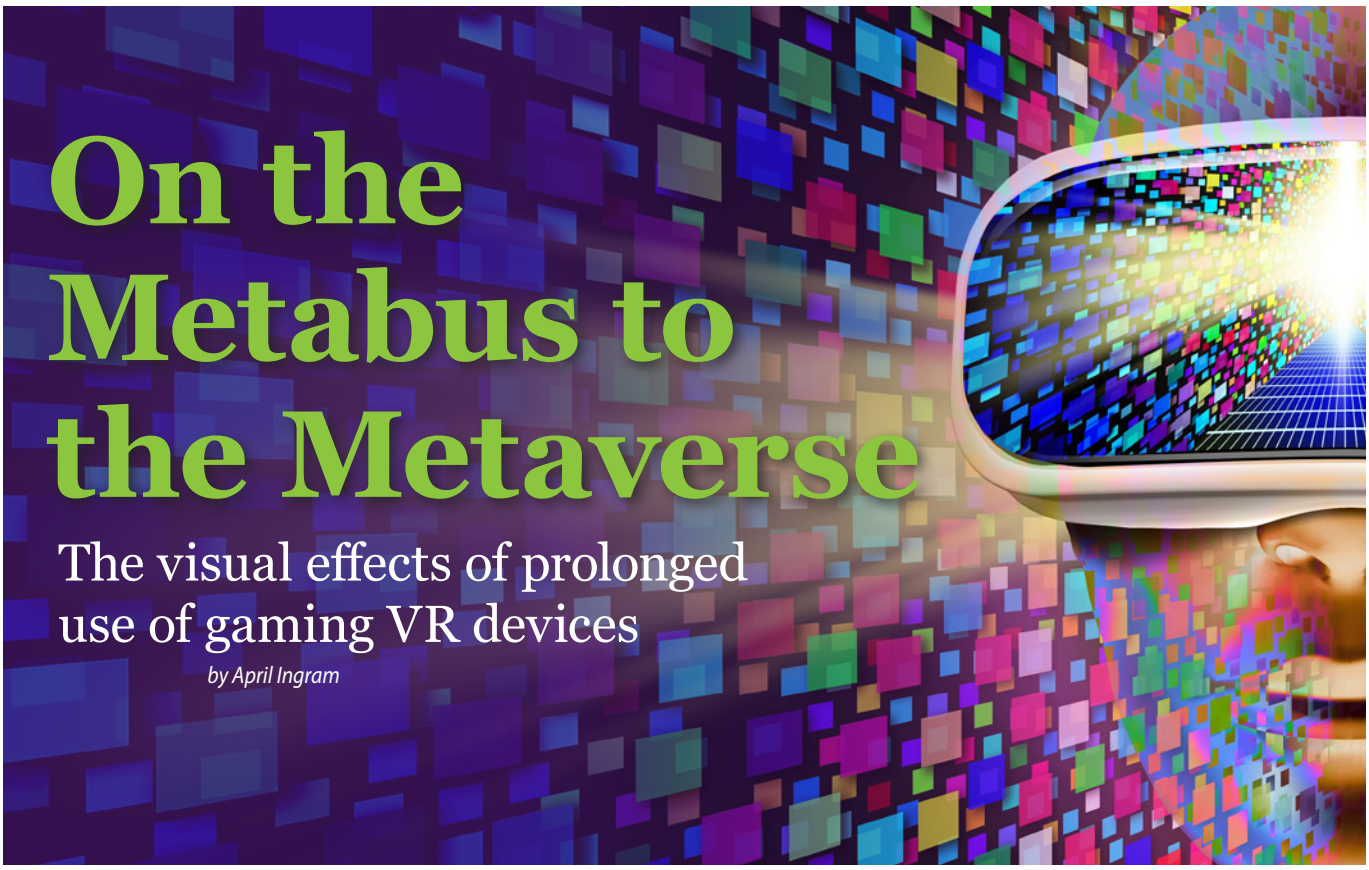
The OCULUS Myopia Master, which is a quick, painless and contactless system, not only predicts the risk of progression but can also take into account other risk factors such as the number of parents with myopia and time spent on outdoor activities, added Prof. Sankaridurg.

In myopia, the eye length is usually extended beyond the eye length resulting in emmetropia causing a mismatch between the optical components of the eye, such as the cornea and the eye length. This results in blurred distance vision.

While the majority of cases of myopia are mild and easily controlled with eyeglasses, contact lenses or refractive surgery, the axial elongation often continues well into teenage years and in a number of cases, into adulthood, leading to further progression of myopia. In some rare cases, more severe disorders develop.

Any level of myopia poses an economic and health burden, and progression to higher levels may lead to uncorrectable vision impairment as well as sight-threatening complications such as myopic macular degeneration.

High myopia may also increase the child's risk of developing more serious sight conditions later in life, such as cataracts, detached retinas and glaucoma. Left untreated, high myopia complications can lead to blindness. Prof. Sankaridurg said that while the database features Chinese subjects, the researchers are planning to work on predictive models for other populations. "We do hope to develop nomograms for other ethnicities fairly soon," she said.



On the Metabus to the Metaverse

The visual effects of prolonged use of gaming VR devices

by April Ingram

Are you ready to escape reality and jump into the virtual world? If so, you are certainly not alone. It is estimated that standalone virtual reality (VR) devices will sell $29 million units this year, and those that use phones or other gaming platforms will sell $18 million. To say the least, there are tens of millions of people jumping on the metabus on their way to the metaverse!

No doubt about it, spending time in the virtual world can have its benefits: relaxation, exploration, competition, and even opportunities for social connection. But there are also downsides to having an entire metaverse positioned so close to your eyes.

Most users report visual fatigue as one of the strongest negative effects. Although visual fatigue is a common complaint, users are unlikely aware of the other impacts, especially long-term effects, that prolonged VR device use can have on their eyes.

For the love of gaming

Dr. Hwan Heo, associate professor in the Department of Ophthalmology at Chonnam National University Medical School in South Korea, and his colleagues were curious about the potential effects of prolonged use of virtual reality devices on the eyes. Hence, they conducted a randomized controlled trial* to investigate exactly that, and the findings of this trial were published in the *Scientific Reports* journal.

"Recently, the term 'metabus' has become popular, and with the increase in VR headsets' sales, VR user and VR usage time have also increased significantly," said Dr. Heo, explaining the rationale for conducting this trial. "Although VR devices are positioned very close to the eyes, there has been little research on the impact of VR devices on eye function. Thus, we conducted this study."

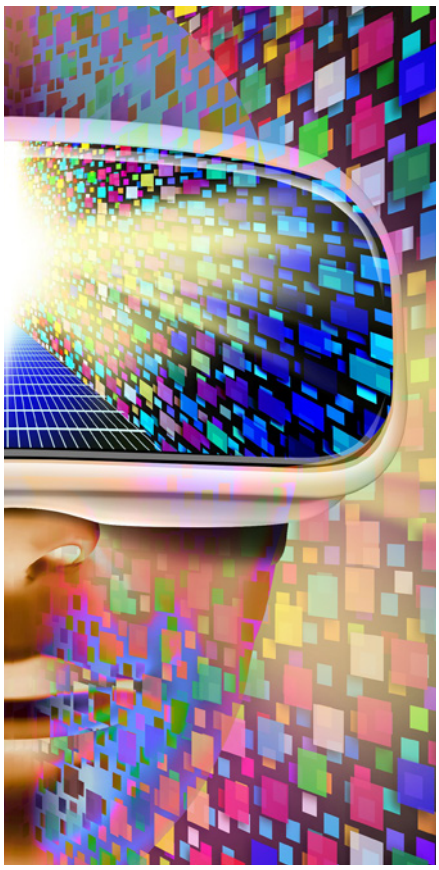
The team investigated the effects of using a virtual reality smartphone-based head-mounted display (VR SHMD) device over a period of two hours on multiple visual parameters. The study recruited 58 healthy volunteers who were asked to play games on either a VR SHMD platform or a smartphone for two hours on different days.

As compared to other clinical trials in eye care that involve a commitment of numerous visits over the years and recurring painful treatments, this study was likely far easier to recruit participants: "Come and play some video games for a couple of hours and contribute to important scientific knowledge!"

VR SHMD vs. smartphone gaming

The participants were asked to use a VR SHMD and a smartphone, each for two hours, with a day in between, with the smartphone group acting as the control. Half were randomized to use the VR SHMD first, and the remaining participants used smartphones first.

The devices used in the study were the Samsung Gear VR SHMD (Gear VR Innovator Edition; Samsung, Suwon, Korea) with participants playing a VR game (Lands End, Ustwo Games, United Kingdom), and the smartphone Galaxy S6 (Samsung) with a fixed-degree convex lens in front of each



eye to play Tetris (Electronic Arts, California, USA).

The distance between the screen and the front of the subject's eyes measured approximately 50 mm to 65 mm, and inter-pupillary distance could be adjusted by a control wheel at the top of the headset.

"After adults play a two-hour game using a VR device, the changes in eye function were investigated compared to the smartphone gameplay," Dr. Heo said, sharing what participants were asked to do.

The visual parameters that Dr. Heo and his colleagues evaluated included refractive error, accommodation, convergence, stereopsis, ocular alignment, and measurement of choroidal thickness, both before and after the use of VR SHMD or smartphones. They also had participants complete questionnaires to assess subjective symptoms.

The analysis looked at the differences in visual parameters both before and after VR SHMD or smartphone use and any correlations between baseline visual parameters and those after the use of the devices.

Visual changes associated with immersive VR gaming

Some of the findings were surprising, and others not as much, as Dr. Heo described.

"After playing VR games, accommodative and convergence functions were decreased, and exophoria was aggravated in the adults who had exophoria before playing the VR game compared to the smartphone game," he said.

"Specifically, there were significant changes observed in near-point convergence and accommodation, exophoric deviation, stereopsis, and accommodative lag after VR SHMD. But with the smartphones, the participants reported more severe subjective discomfort associated with dry eye and neurologic symptoms in the VR group," Dr. Heo added.

The symptoms included headache, dizziness, and nausea. No significant changes in refraction or choroidal thickness were observed after either device.

There have been earlier studies that have looked at visual changes associated with VR, but most have not fully explored the immersive VR environment associated with gaming and not for prolonged periods.

Warning: Game over!

Manufacturers of VR platforms are aware of some of the impacts of their offerings on our eyes, with warnings reflected in packages and labels. But let's be real… when you are immersed in the metaverse with the hottest new technology in your hands, would you stop to heed all the warnings and recommendations?

Either way, there are existing health and safety warnings from manufacturers that discourage continuous use of VR HMD for more than 30 minutes and advise age restrictions for children. However, the average duration of entertainment-based VR HMD sessions in the U.S. in 2018 was 38 minutes; while Sony PlayStation VR users spent 49 minutes of playing time per session.

We all know someone who is a VR gamer, and even 49 minutes seems a little short to be realistic. Our researchers must have thought so, too, as their study had participants playing for two hours.

There is also an increasing trend to use VR platforms as an engaging way to educate children, but this needs to be regulated and closely supervised.

"Above all else, the impact on children who play VR games is crucial because their eyes are still developing," said Dr. Heo, reiterating a key message that he wants everyone to understand. "Manufacturers recommend that the use of VR devices under the age of 13 should be restricted, but many children are playing VR games now," he added. "I think more studies should be conducted to develop guidelines to protect eye health from VR use for both children and adults," he concluded.

Dr. Heo and colleagues continue to investigate the clinical use of virtual reality devices, as well as their impact on ocular function.

* Yoon HJ, Moon HK, Sung MS, Park SW, Heo H. Effects of prolonged use of virtual reality smartphone-based head-mounted display on visual parameters: a randomised controlled trial. Sci Rep. 2021;11(1):15382.

Contributing Doctor

Dr. Hwan Heo is an associate professor in the Department of Ophthalmology at Chonnam National University Medical School in South Korea. His field of expertise is pediatric ophthalmology and strabismus. Dr. Heo's clinical and research interests include virtual reality devices as eye examination instruments (https://youtu.be/7FH54lyVxBk), and also in their impact on eye functions.

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Easy on the Eyes

Top 5 gaming glasses from 2021

by Ben Collins

If — like me — you've never been much of a gamer (or don't spend a lot of time staring at a computer screen, in general), it might come as a surprise to learn about gaming glasses and their eye health benefits. In fact, there's a plethora of them available on the market, all offering different specs and design features depending on your requirements.

Combating digital eye strain

First, let's have a look at why you might want gaming or computer glasses to begin with. Although research is ongoing and inconclusive to some degree in this area, you probably don't need to be an eye doctor to realize that prolonged device use and excessive screen time are going to have some effect on your vision.

You may have heard of (or experienced) digital eye strain, also known as computer vision syndrome. Symptoms can include headaches, blurry vision, fluctuating vision, red eyes, dry eyes, tired eyes, burning eyes, double vision, and even twitching eyes.[1]

Our eyes are simply not designed to focus on close objects for long periods of time (especially a glowing, flickering computer screen), and computer vision syndrome is often the result.

What to look for in gaming glasses

So how do gaming (or computer) glasses help to resolve some of these issues? And what are we looking for in a "good" pair?

Computer glasses help to mitigate eye strain during digital screen-based, near-work activities — such as computer gaming — by reducing the amount of focusing the eye has to perform. They can also help reduce glare or reflection coming off your digital screen and filter both blue and ultraviolet (UV) light.

Although blue light is a natural phenomenon (e.g., the sky is blue because blue light waves hit nitrogen and oxygen particles in the atmosphere), people are increasingly exposed to more blue light than ever due to the widespread use of devices that rely on light-emitting diode (LED) technology.[2]

A good pair of gaming glasses should correct any pre-existing vision problems. It should also work well in filtering out blue light and reducing glare as well as the amount of focusing our eyes have to do. But it doesn't make a lot of sense if the user still has to deal with near or farsightedness.

Research shows that uncorrected refractive issues can lead to computer vision syndrome-related problems and decreased productivity.[3]

Gaming glasses: Our top 5 picks

So, now that we've got some kind of idea of what we're looking for, let's dive into our first review!

1. Gamma Ray Blue Light Blocking Glasses

Affordable, non-gender specific, and available in a variety of styles, these glasses are a great option for the fashion and budget-conscious consumer! The amber tint lenses block blue light, and they also have an anti-reflective coating plus a UV filter, to boot! Customizable magnification (from 0-4X) is also a great feature. Durable, lightweight, and comfortable frames complete the package. Unfortunately, they are not available in prescription and, again, only come in the one-frame size.

Pros: Budget-friendly, non-gender specific, fashionable, durable, lightweight, anti-reflective, blue light protection

Cons: Not available in prescription, one-frame size

2. Gunnar Razer RPG Gaming Glasses

Featuring a stylish, lightweight aluminum-magnesium frame, adjustable nose pads (ergonomics is everything!), and anti-reflective scratch-resistant UV and blue light blocking lenses — it's no wonder Gunnar Optiks is a leader in the gaming glasses field. Their lenses also have a very subtle magnification feature (Gunnar Focus) and are available in prescription. The only downside to these glasses is they just come in one rather large frame size

Pros: Anti-reflective, blue light protection, lightweight, adjustable, scratch-resistant, magnification feature, available in prescription

Cons: Big frame

3. Swanwick Classic Day Swannies

Although not specifically designed for gaming, these elegant glasses provide a point of difference in the computer glasses genre. You'll be the talk of the office in the choice of stylish black, tortoise, or two-tone colored frames. The frames are the most environmentally sustainable on the market to date — made from acetate — which is a plant-based hypoallergenic plastic without nasty chemicals like bisphenol A (BPA). Available in a range of sizes (small, medium, and large), you

can be assured of a comfortable fit. The lenses have an anti-reflective coating, blue light blocking attributes, and a UV filter. The unique thing about these glasses is they have an (almost) entirely clear lens (most blue-light-blocking lenses are amber). They achieve this by only blocking blue light in the more dangerous range of the spectrum. What's more, you can get these glasses with prescription lenses! The only thing lacking is a magnification option.

Pros: Stylish, environmentally friendly, comes in a variety of sizes, blue light protection, anti-reflective, ultra-clear lenses, available in prescription

Cons: No magnification option

4. GAMEKING Clip-On Computer Glasses

We like the concept of computer-specific eyewear that's compatible with your existing prescription glasses. These innovative specs feature the usual suspects in terms of blue light blocking lenses, a UV filter, and an anti-reflective coating. They come in two models — flippable and not, have a lifetime warranty, a 30-day money-back guarantee, and are extremely lightweight. Of course, these clip-on-style gaming glasses are only useful if you already have an existing pair of specs. However, this pair will only fit frames up to 39 mm.

Pros: Clip-on, blue light protection, UV filter, anti-reflective, lifetime warranty

Cons: Limited frame sizes

5. Hyper X Gaming Eyewear

These are designed for more serious gamers. Despite the clear lenses, they offer great protection from excessive blue/UV light and have an anti-reflective coating. A key feature of these glasses is they are designed to be worn comfortably beneath a VR/gaming headset. There are four different frame styles, including a youth-specific option. They are available with prescription lenses, and one model even offers clip-on polarized sunglasses (for when you're done defeating the big boss and are headed to the beach to celebrate)!

Pros: Blue and UV light protection, anti-reflective, can be worn beneath a VR headset, different frame style options, available in prescription

Cons: Slightly pricier than other options

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DON'T 'LAG' BEHIND

The pros and cons of using AI and VR devices in optometry

by April Ingram

IN CASE you missed it), virtual reality (VR) gaming gadgets such as VR goggles were among the most popular big-ticket gifts last Christmas. It's not surprising, given that the technology behind these high-tech glasses allows us to leave the confines of our locked-down, pandemic-filled reality and transports us to an immersive virtual world — complete with exotic tropical beaches, interactive tours of Paris… or a visit to the optometrist's office?

Virtual reality aims to simulate a realistic environment using computer technology by applying three key components: immersion, sensory feedback, and interaction. As VR platforms and devices have become more and more advanced, affordable, and mainstream, their applications reach beyond gaming and entertainment and make an inevitable foray into education, commerce, military, and healthcare.

(Virtual) reality check!

For years, optometry has embraced advanced technology for more effective and efficient eye care, earlier disease detection, and prevention of vision loss. After all, the goal is to provide the best care for patients. And for technology to succeed, it must seamlessly integrate with current management care systems and improve the services provided to patients.

The next generation of optometrists is on board with the addition of virtual reality to their training. Many are getting a boost in the development of their clinical skills, accelerated by training on VR platforms.

Students can get a near-to-authentic experience simulating hundreds of patient eyes to practice slit-lamp and indirect ophthalmoscopy, recognizing ocular and systemic diseases, and supplementing their real-life training.

Virtual reality applications are proving to be a valuable asset for patient assessment and even treatment. For example, VR technology has been a tremendous asset in improving the understanding of how vision loss impacts function and aspects of daily living.

An important application of VR technology has been to assess the visual deficits in glaucoma patients. Dr. Christopher Leung and colleagues at the Hong Kong University of Science and Technology assessed glaucoma patients as they navigated through multiple activities in different lighting (safely — because it was all virtual!), collecting visual acuity, contrast sensitivity data, and visual field deficits along the way.[1]

They were able to fully appreciate the specific ways that glaucoma impacts the vision and daily function of patients, noting that the simulations lend context, bridging the disconnect between clinicians and the patient experience.

To play or to patch, that is the question

As for treatment, are the days of struggling with patches behind us? Let's see: Would a child prefer to wear a patch for four hours per day as part of his eye care? Or would he rather play a virtual reality game, explore space, or play sports?

Cost comparisons aside, gaming would probably be the overwhelming choice. Research has shown that effective treatment of convergence insufficiency, stereo depth perception, amblyopia, and strabismus — either in the clinic or at home — can be achieved using VR headsets.

The system allows for separate images to be presented to each eye, and clinicians monitor and control the aspects of the patients' experience, manipulating their visual system to correct the dysfunctions. As we mentioned, VR is becoming more affordable and proving to be an engaging alternative to conventional treatments, such as patching.

AI in optometry: Noob but bold

Hand-in-hand with VR, there are new artificial intelligence (AI) platforms that help enhance optometrists' ability to accurately diagnose, efficiently manage, and appropriately refer patients.

The technology brings together clinical expertise with the capabilities of AI to perform critical and complete analyses of multiple imaging modalities, combined with associated patient characteristics and risk factors. Evidence already exists supporting the development and use of AI algorithms for large-scale screening programs to detect diseases like age-related macular degeneration (AMD) and diabetic retinopathy.

> "I think that clinical decision support systems, including AI-based diagnostic assistance, are the way of the future for the treatment of sight-threatening diseases."
>
> **— Dr. Fiona Stapleton**

AI can be immensely powerful, and developments within eye care — particularly in deep learning — harness mathematics, medicine, computing, statistics and research methodology, challenging many clinicians and leaving various questions about the clinical impact and implications.

Scientia Professor Dr. Fiona Stapleton from the School of Optometry and Vision Science at UNSW in Sydney, Australia, believes that AI systems are an opportunity whose time has come.

"I think that clinical decision support systems, including AI-based diagnostic assistance, are the way of the future for the treatment of sight-threatening diseases," Prof. Stapleton shared. "There is huge literature and enormous excitement about the technical capabilities of different AI systems and their ability to diagnose and monitor eye disease."

The guidance provided by AI can be particularly useful in early detection and diagnosis of sight-threatening diseases. It could also streamline the referral process by potentially limiting the number of false-positive referrals — critical in regions with limited availability of specialist services.

It's a "bot" after all!

"AI programs to test the eyes are already here," explained Dr. Mahnia Madan, an optometrist in Vancouver, British Columbia, Canada, and vice president for the British Columbia Doctors of Optometry. "They are becoming more and more accurate at testing the eyes. However, while technology greatly helps with data collection, it cannot replace a doctor's clinical judgment," she added.

In order to be useful in day-to-day practice, the AI system must be fully trained to consider the entirety of the patient's data, including multiple images from multiple modalities, visual acuity, visual function, and the patient's current and previous medical history.

The optometric profession may be a bit hesitant when it comes to the comprehensiveness of AI automation. There is no doubt, however, that optometrists recognize the potential of these platforms and are strong adopters of technology. They are more comfortable with solutions that incorporate their clinical experience and expertise into any final analysis.

Remember, AI algorithms are only as good as the data they were trained on — meaning that if a clinical scenario is different from the algorithm's training, or if perhaps pertinent data is inadvertently filtered out, then the predicted level of accuracy cannot be achieved. However, superior results have been shown when algorithmic decisions are combined with human decision-making.

Dr. Madan shared her impression of implementing technology into practice. "We should expect AI to have a significant impact on the eye and medical care of the future," she said. "But we don't need to be scared of it. Just as we embraced AI in other parts of our lives — think Google Maps — we need to look at how AI can enhance the quality of care we provide. I don't view it as a resource to replace an eye exam by a doctor, but as an opportunity to enhance patient care."

Less glitch, more grinding

As we move full steam ahead, some challenges and concerns remain with implementing technology into practice.

Where do they fit into clinic flow? What training is required? How can the practice afford to stay on the cutting edge? Will technology purchased today be obsolete tomorrow? Will health insurance reimburse new technology?

> "The world around us is changing — we can't stop that! We are seeing telehealth optometry services and other virtual options being available. Instead of being afraid to let go of some of the old, hold on to the desire to provide good patient care and a deeper mission of improving the quality of human life. When we keep those core values, the way we deliver care can evolve and help us grow."
>
> — **Dr. Mahnia Madan**

Although studies have been conducted to demonstrate the efficacy and safety of virtual reality and artificial intelligence in practice, longitudinal studies that would examine things like practical feasibility, cost-effectiveness, and medical/legal considerations are still needed.

Dr. Stapleton shared her thoughts: "Beyond these amazing scientific breakthroughs, challenges remain — including incorporating

the perspective and preferences of all stakeholders, most importantly that of the patient, cost and reimbursement, as well as integration of new decision support systems within existing patient pathways."

Advancing the profession seems to mean jumping on the technology train, without fear. Which is greater, the fear of technology or the fear of being left behind?

Dr. Madan said she sees these advancements as an evolution, a positive one. "I believe optometry is a profession that is full of opportunities for new growth through creating new products, services, and markets," she said.

"The world around us is changing — we can't stop that! We are seeing telehealth optometry services and other virtual options being available. Instead of being afraid to let go of some of the old, hold on to the desire to provide good patient care and a deeper mission of improving the quality of human life. When we keep those core values, the way we deliver care can evolve and help us grow," she enthused.

All about enhancement, not replacement

So, what does this all mean for today's optometry practice, and how can clinicians develop the skills they need?

Very recently, Tariq Aslam from the School of Pharmacy and Optometry at the University of Manchester in the United Kingdom published a paper[2] in *Ophthalmology and Therapy* that discussed the broad range of skills that clinicians should develop or refine in order to be fully ready to embrace the opportunities that this technology will bring.

They also explored whether the abilities of AI systems may eventually replace human expertise, making the profession redundant. Their findings were more to the contrary — that there are critical services beyond the capacity of current AI that only human intelligence can provide.

The authors also highlight that as impressive as published reports of AI applications may appear, many are significantly flawed and lack any real-world context, and have not addressed any of the legal or ethical matters. As statistically powerful as an AI algorithm appears in its published reports — deriving decisions from patients' history, examination, and investigations, they do not take the more vague parts of patient care into consideration.

Clinicians know which patients are more willing to adhere to or be more tolerant of certain treatments, the lifestyle issues that play an important role, as well as their verbal and non-verbal cues. With integration of all of the human factors, there are nuances that can only be balanced by clinicians.

Details from a VR output or AI algorithm should be considered a report, a decision-making tool, to which all the other clinical information and patient-external factors are combined, and a clinical decision (in agreement or disagreement with the algorithm) is made by a clinician. Besides, how many patients would accept to hear that despite a doctor's training and clinical judgment, the decisions come from the computer?

Finally, patients can be anxious or unsure and they want a well-trained, confident, empathetic human professional to explain their condition and treatment options, as well as answer their questions.

GG (good game)! But nothing beats the human touch

It's an exciting time, VR applications and AI are more mainstream than ever. And when combined with advancements in imaging modalities and treatments, it's a transformative era, indeed.

There are certainly pros and cons and bumps along the way as this new clinical journey is navigated. But for now, technology can enhance decision-making, and perhaps some tasks can be delegated to automation. However, human interaction, empathy, and recognizing the subtleties of individualized patient care cannot be replaced.

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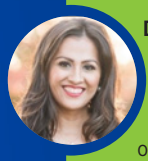
Contributing Doctors



Dr. Mahnia Madan is a graduate of Pacific University College of Optometry. She did her residency in ocular disease and surgical co-management at the Eye Center of Texas in Houston. Dr. Madan is a fellow of the American Academy of Optometry and has lectured on the management of ocular diseases across North America. She practices in Vancouver, BC, focusing on the use of innovative treatments for advanced dry eye diseases, such as platelet rich plasma (PRP) and intense pulse light (IPL). She and her team developed the technique to make PRP eye drops in her Vancouver clinic. She also currently serves as vice president for the BC Doctors of Optometry in BC.

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Dr. Fiona Stapleton, Scientia Professor at the School of Optometry and Vision Science, UNSW Sydney, Australia, was awarded her PhD from City University and Moorfields Eye Hospital in London, U.K., and undertook a postdoctoral fellowship at University College London. She moved to Australia and was the first female head of School of Optometry and Vision Science in Australia and New Zealand (2007-2019). She is a Scientia Professor and recently associate dean (Enterprise) in the Faculty of Science (2018-2021) at UNSW Sydney. Dr. Stapleton is a clinical scientist with expertise in basic and translational research in the fields of corneal infection, ocular microbiology, dry eye and contact lens-related diseases. Her research has improved the understanding of the epidemiology and pathophysiology of sight-threatening ocular diseases.

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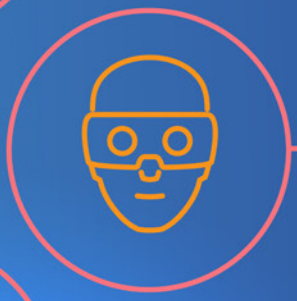
From Crafting to Cooldown

Notable facts and events from the young history of AI and VR in eye care

Virtual reality: 'Modding' its way to optometry

1962

Sensorama Machine: The earliest known example of immersive, multi-sensory technology, considered one of the earliest virtual reality (VR) systems.



1987

The term "virtual reality" was first used.

1997

VR was first used in post-traumatic stress disorder (PTSD) therapy.

From 23.95 to 10.62

When wearing a VR headset, blink rates were reduced from 23.95 blinks per minute down to 10.62.*

Luminopia One

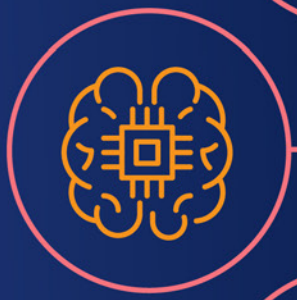
In 2021, the FDA approved Luminopia One, a VR headset to treat amblyopia. Children can watch modified TV shows from Sesame Street, Universal Kids, PBS Kids, NBCUniversal, Dreamworks, Millimages and Nelvana to improve their vision.

* Turnbull PRK, Wong J, Feng J, Wang MTM, Craig JP. Effect of virtual reality headset wear on the tear film: A randomised crossover study. Cont Lens Anterior Eye. 2019;42(6):640-645.

Artificial intelligence: Noob kid in town

The 1950s

The term "artificial Intelligence" (AI) originated in the 1950s.



2017

The Seeing AI app was released by Microsoft. Seeing AI uses a device's camera to identify people and objects, and then the app audibly describes those objects to people with visual impairment.

2018

IDx-DR is the first FDA-approved autonomous AI to detect diabetic retinopathy (including macular edema) from retinal images. It is also the first ophthalmic implementation of AI for diabetic retinopathy screening that does not require an eye care professional to interpret the results.

Pegasus

This AI platform by Visulytix assesses stereoscopic optic disc photos for glaucoma. Diagnostic accuracy and repeatability are equivalent to the diagnostic accuracy of both ophthalmologists and optometrists in the early detection of glaucomatous optic neuropathy.

Google's DeepMind

An AI system that can accurately identify 50 different types of eye conditions from OCTs 94.5% of the time.

Dr. Shalu Pal

Driven by passion and dedication

by Chow Ee-Tan

In a world where the paycheck is a big consideration for choosing a career, Dr. Shalu Pal — optometrist, volunteer, and founder of Dr. Shalu Pal and Associates in Toronto, Canada — took the road less traveled. Her career motivation? The joy she gets from helping others improve their vision.

"I love what I do because I know it can have an impact on the lives of others," shared Dr. Pal. Although her road to optometry did not come easy, she believes she is on the right path.

Dr. Pal, whose parents originated from Rajasthan, India, shared she was still unsure of what to do when she was in her final year of a double major in biology and mathematics. "I decided to shadow some professionals, including doctors from many different specialties. The one question I asked each of them was if they were happy with their life. Sadly, most were not," she recalled.

However, when she visited her optometrist, she didn't have to ask. "It was clear he was happy, his staff was happy, his patients were happy, and I knew that I wanted to replicate that environment for my future life," Dr. Pal enthused.

An optometrist at heart

Dr. Pal graduated from Southern California College of Optometry (SCCO) at Marshall B. Ketchum University and did her Cornea and Contact Lens Residency at Northeastern State University Oklahoma College of Optometry, followed by her Fellowship in the American Academy of Optometry.

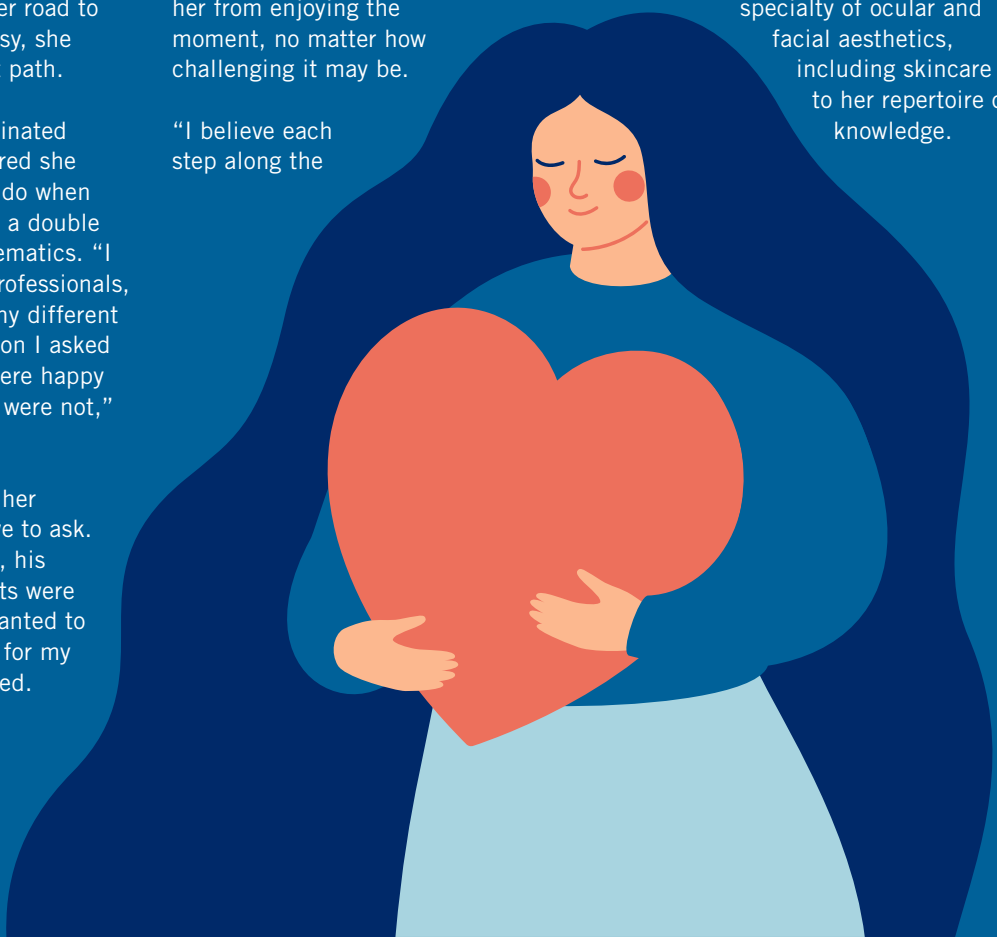
One thing about Dr. Pal is she never lets difficult situations prevent her from enjoying the moment, no matter how challenging it may be.

"I believe each step along the way was designed to help me reach the next level. No matter how tough the task was, there is always a way to enjoy it," she said. "I look back at the start of my practice and how many challenges were thrown my way, but I took each challenge in stride, did my best, and had fun going through the process."

After she graduated, Dr. Pal wanted to return to Canada to be with her family — but at that time, optometry in Canada was still quite limited. Therefore, she decided to study further and gain specializations that are not confined to Canada so that she could provide better care and services to her patients.

In the span of 17 years, she took up a residency and several fellowships and went on to gain specialties in fitting scleral lenses, GP lenses, prosthetics, and orthokeratology lenses. She also built her dry eye practice, followed by learning about myopia management and creating a clinic around it.

Most recently, she added the specialty of ocular and facial aesthetics, including skincare to her repertoire of knowledge.



Building a business around her passion

Dr. Pal confessed to not knowing anything about running a business when she started her optometry practice.

"I had many ideas of what I wanted my practice to be like," she shared. "I wanted to make patients happy in a beautiful space that is constantly evolving with the newest technology, while providing education to our patients, staff, doctors and myself."

Knowing she couldn't do all of this alone, Dr. Pal looked for mentors that she aspired to be like and learned from them, and they gave her much guidance and advice. To this day, Dr. Pal said she still learns from her mentors.

"The learning never stops and that keeps my life and my day-to-day practice very interesting," she shared. To help her patients fully, Dr. Pal has brought in doctors who have additional skills, such as vision therapy, concussion and traumatic brain injury (TBI) rehabilitation, and sports vision.

The joy of volunteering

Aside from being a volunteer doctor for the Pan Am and Para Pan Am Games, Special Olympics and other local charities, Dr. Pal also works with other organizations that provide help in El Salvador and in parts of Africa.

"The joy and happiness that I gain by helping others gives me a greater reward than anything else," she said. "But besides helping people in the work that I have done with our local communities, the Pan Am Games, and clinics around the world, I have personally gained so much from all of those opportunities." According to Dr. Pal, volunteering is a very rewarding and humbling experience for her.

"I have incredible memories and gained wonderful friendships and experiences from volunteering. I have visited so many parts of the world, I have improved my professional skills, and I learned so much about optometry and life, which helped me grow personally. I am also reminded of how grateful I am and that I should never take my life for granted," she added.

Closing the gender gap in optometry

As a female of Indian descent, Dr. Pal never let her gender or ethnicity be a hindrance in her career.

"When I was in college, minorities and women did not make up a good proportion of our profession in North America. Facing such circumstances, you have to prove yourself and you have to gain the respect of those who stood before you, forging a new path for those like me," she said.

Dr. Pal had held herself to a high

Dr. Shalu Pal on Gaming and Visual Health

Especially for younger patients, screen time and device use are creating two major issues in society today: myopia progression and dry eye.

Gaming is one of the main reasons that children (and adults) are spending more time on digital devices, including smartphones, tablets, laptops, and computers.

A pandemic within a pandemic?

During the pandemic, when so much of our entertainment was taken away, many turned to video gaming to fill that void. But that doesn't come without risk: In children, more than three hours of screen time per day results in a four-times higher risk for myopia compared to those who do not use screens. Those under the age of seven, spending three hours or more per day on screens have a five-times higher risk of myopia. Now, with the increase in VR device use, we expect to see an even greater number of hours spent gaming in the years to follow.

When we intently stare at screens, blinking tends to stop. When we don't blink, the meibomian glands don't function or secrete oils appropriately, leading to a poor tear film and lack of protection of the cornea. All these lead to damaged, dry, and uncomfortable eyes.

The key to mitigating the concerns with myopia progression, dry eye, and computer vision syndrome is to start conversations early with parents and patients. We must help them understand the correlation between screens, blinking, dry eye, fatigue, prescription changes, and the strategies to avoid these outcomes.

Following the 20:20:20 rule

A few key tips include taking breaks every 20 minutes and looking 20 feet away for 20 seconds. This is also known as the 20:20:20 rule. The emphasis is relaxing the accommodative system by looking out a window or down a hallway and blinking during these breaks. I also recommend projecting the video game onto a large TV screen to create further distance. This increases comfort and reduces long periods of over-accommodation.

Other simple things to follow include sitting as far back as you can, working with the lights on, increasing the fonts to reduce strain, and using prescription computer glasses with special coatings, including blue light filters and anti-reflective lenses.

standard so that her gender and ethnicity were never questioned. She made her work and commitment shine and be seen before anything else.

"I have been in situations where I had to stand up for equality in the gender pay gap," she shared. "I had to prove that women know as much as men and that our skills match and rival those of our male counterparts."

Breaking stereotypes and breaking barriers have now turned into the most fun challenges. "In every part of life, pushing boundaries is how we grow, improve, and learn as a society and as individuals," she added.

Beyond restoring vision

For Dr. Pal, vision is naturally the most precious sense. Beyond restoring vision, providing vision care for her also means helping her patients calm their fears and providing support and advice on other aspects of their health.

"It is very rewarding, knowing that we can provide the support and guidance to patients on a daily basis," she said. "Seeing the joy in my staff when they realize the importance of what we do and the impact we have in the lives of others is incredible."

The challenge, however, is when they do not have enough time or resources to execute the many things they want to do.

"My goals for the year ahead include tackling these two aspects of more time and more resources to be able to accomplish more in both my professional and personal life," she enthused.

Achieving a healthy work-life balance

Due to her work commitment, achieving some semblance of work-life balance is something Dr. Pal said she needs to work on all the time.

"When you have your own business and are responsible for the livelihood of so many families, it's hard to not think about work all the time," she admitted. "And if you are passionate about the work you do, then it is even more difficult to separate yourself from your work."

To achieve a balance, she carves time out of her busy schedule for the things that make her happy. She "forces" herself to take breaks to enjoy time with her family and friends. She sets limits to the number of hours she works and delegates more responsibilities to her team members. On top of that, she keeps herself healthy so she can continue to be helpful to others.

"We are constantly evolving and improving. Knowing that I am building a space that I love, with a team that shares the same passion for making the lives of our patients better, makes it all worth it," she added.

"Life is ongoing and full of so many challenges and changes. I have realized that once I achieve a certain goal, the journey doesn't end there. A new journey begins because a new goal is set. The secret is to enjoy every step of the journey," Dr. Pal concluded.

Clockwise from top: Dr. Shalu Pal with her team at her clinic, Dr. Pal with her Dad, and Dr. Pal with her family and her dog

Contributing Doctor

Dr. Shalu Pal is an SCCO graduate who did her Cornea and Contact Lens Residency at NSU. Dr. Pal is a member of the Global Myopia Symposium committee, co-editor of the *Mastering Myopia Newsletter*, advisor for the Global Council of Myopia Management, advisor for Review of Myopia Management, and research member of the study, Myopia in Practice. Dr. Pal is a member of the Innovations Council for the AAO, past chair of the AOA, Contact Lens and Cornea Section, board member of the CAO, Cornea and Contact Lens Section, and co-founder of the Canadian Contact Lens Academy. She is also a member of the Continuing Education Committee for the OAO, CE advisor for the AOE and Latin Americas, Global Ambassador for GLOW, and co-founder of the STAPLE program. She volunteers her time globally while running a group practice in Toronto, specializing in specialty contact lenses, myopia management, concussion rehabilitation, vision therapy, dry eye management and ocular aesthetics.

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A Beacon of Light

Philanthropist Donald K. Johnson's $50M gift to help fight vision loss

by Matt Herman

Standing outside his home in Toronto on September 21, 2021, Canadian investment banker and philanthropist Donald K. Johnson cast a ray of light on the fight against eye disease.

On the occasion of his 86th birthday, Mr. Johnson announced a CAD$50 million donation[1] to the eponymous Donald K. Johnson Eye Institute, a patient care and clinical research institution located on the campus of Toronto Western Hospital.

Representing the single largest gift of its kind in Canadian history, this mammoth contribution hopes to transform the lives of patients in Canada and across the globe facing the dark reality of vision loss.

A titan of Canadian philanthropy

Having made his name in business and investment banking on Toronto's Bay Street, Mr. Johnson is now widely recognized as one of Canada's most prominent philanthropists.

His involvement with a diverse range of charitable endeavors across his native Canada led to him being honored with an appointment to the Order of Canada in 2005. He was later elevated to Officer of the Order in 2009 for contributions to healthcare research and the arts and for his successful campaign to eliminate capital gains taxes on registered charities.[2]

Mr. Johnson's passion for philanthropy in eye care has a deeply personal element. According to Jordana Feldman's article *A Champion of Eye Ingenuity*,[3] his own life has been changed by the sight-saving treatment he received at the Institute that now bears his name.

Having been diagnosed with myopia, glaucoma, cataract, and macular degeneration, Mr. Johnson credits doctors at the Institute for catching his previously undiagnosed glaucoma at an early stage and preventing its progression.

His generosity ensures that there will be many more across the globe with success stories like his.

Furthering the standard of eye care and education

Under the umbrella of the University Health Network (UHN) and Krembil Research Institute, the Donald K. Johnson Eye Institute (DKJEI) is a leading eye institute in Canada and one of the top five vision programs in North America.

As Canada's largest ophthalmological

care center, the DKJEI is currently home to more than 54 researchers, clinicians, fellows, and residents; performs more than 6,000 surgeries every year; and hosts over 120,800 patient visits across its nine specialty clinics and services.[4]

Mr. Johnson's donation will go a long way toward ensuring the elite standard of ophthalmological care available at the Institute spreads to other hospitals and treatment centers throughout Canada and around the world by endowing three named clinical fellowships.

These fellowships will be named for the doctors who have helped restore and preserve Mr. Johnson's sight as a patient of UHN's glaucoma, cornea and retina programs.

"The endowments ensure that future generations of trainees will continue to receive the opportunity to develop their expertise as ophthalmological specialists and/or clinician-scientists focused on vision science," a spokesperson for the UHN Foundation shared. "They will be named for each of the doctors who have been involved in his care and create a perpetual legacy for them at the Donald K. Johnson Eye Institute. The glaucoma fellowship will be named after Dr. Graham Trope, the cornea fellowship after Dr. Allan Slomovic, and the surgical retina fellowship after Dr. Robert Devenyi."

Through the creation of these endowed clinical fellowships, Mr. Johnson's gift will create an outsized impact on training and educating the next generation of ophthalmological specialists, sending a clear message to sufferers of blinding diseases all over the world: Help is on the way.

Expansion of clinical trials program

However, Mr. Johnson's support of the top-level care and ophthalmology education provided at the Institute is only the beginning.

The DKJEI already hosts a formidable research program focused on expanding the horizons of human knowledge in the fight against eye disease. The goal, according to the Institute, is "converting fundamental knowledge about cells and their actions into sight-saving treatments."

A significant part of Mr. Johnson's donation will provide the seed funding for the expansion of the current clinical trials program into a new clinical research unit (CRU) to accelerate the process of translating advances in understanding to patient outcomes.

The clinical trials program has already completed a staggering 70 trials to date and currently hosts more than 50 active trials with subspecialties, such as retina, medical retina, cornea, glaucoma, low vision, general ophthalmology, and ocular oncology.

The establishment of the CRU will enable the program to aggressively expand the number of trials in progress and jump-start the race to develop new therapies and techniques to treat and even potentially reverse vision loss.

The new CRU will be a state-of-the-art research facility dedicated to the advancement of ground-breaking clinical trials in eye care. Planned for a new 1,000-square-foot space with the ability to triple in size, the CRU aims to unify all clinical research activities in one location outfitted with cutting-edge research equipment. By doing this, the new CRU can achieve previously impossible economies of this scale and allows for sharing of ideas across subspecialties in the search for novel treatments.

Another goal of the new CRU is to act as an incubator where specialists from around the world come to learn best practices. By taking the skills learned at the CRU back to their home countries, medical students and fellows trained there will play a major role in elevating the effectiveness and standard of vision care worldwide.

With this expansion of the already-elite clinical trials program, the Institute is sure to see a steady stream of discoveries for years to come. And to the over five million Canadians confronted with the prospect of losing their vision, this is welcome news.

A vision for a brighter future

For those living with the reality of losing their sight, Mr. Johnson's gift is a revelation. According to the Institute's Winter 2020 *Vision* magazine, a Canadian is diagnosed with a visual impairment every twelve minutes, and sufferers of vision loss are three times more likely to experience depression.

With the Institute calculating a whopping 8 million Canadians affected by sight-robbing eye disorders by 2030, Mr. Johnson's donation is a beacon of light to many who are faced with the eternal darkness of vision loss.

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Cyberpunk Meets Eye Care

Bold and revolutionary innovations by a vision care startup

by Roman Meitav

Futuristic video games in genres like sci-fi or cyberpunk allow us to see what technological advancements our future may hold. Commander Shepard from the *Mass Effect* series, for example, was quite literally blown to bits and shot into space. But with advanced medical capabilities, he was brought back from sure death. Not only that, he made a full recovery and continued messing around the galaxy.

In a more bleak depiction, *Cyberpunk 2077* offers a variety of cybernetic implants to not only replace damaged limbs and organs but also greatly enhance them. Lost an eye or two? No problem, just slap a cybernetic ocular implant in there and you're good to go. You'll even see better than ever. What's more, you have the implant monitoring your vitals and eye health in real-time! Although we're not there yet, NovaSight's innovations in eye care hope to bring us closer.

Founded in 2016 and currently led by CEO Mr. Ran Yam, NovaSight is an Israeli medical startup that has already made several noteworthy developments in ocular care. The two current flagship technologies developed by the company are EyeSwift® and CureSight™, which modernize vision assessment and treatment. Both technologies are aimed at children, not only advancing the technological standard but doing so with a patient population that is notoriously difficult to work with accurately and consistently.

A fully developed assessment technology

On a broader scale, the two product lines NovaSight technologies offer are assessment and treatment, with EyeSwift being the first assessment technology fully developed, distributed by Essilor, and implemented by ophthalmology specialists worldwide.

The kick with EyeSwift is that its technology allows quick and precise assessment of 11 different ocular parameters and conditions through the use of glasses that combine two different types of lenses — red-blue and electronic — with the onboard software able to automatically control said lenses. This way of testing is not only incredibly fast, taking only several seconds, but also removes factors of human error both on the side of the examiner and patient.

EyeSwift®Pro

Children are notoriously difficult to work with at times. But with EyeSwift, all of that can be factored out. I mean, what child wouldn't enjoy watching a short video with a cool pair of glasses on?

The future of the EyeSwift technology is just around the corner, with Mr. Yam stating that a newer version, the EyeSwift®Pro, will be launching in the second quarter of this year. "The more advanced version will also be able to perform protocol testing for myopia monitoring, amblyopia monitoring, and digital health," he shared.

No more eye patch, kid!

On the treatment side of NovaSight technologies,

CureSight is the current flagship advancement that is at the very final stages of its development. This technology is aimed at providing a modern solution to amblyopia, to which the golden standard up until now was slapping an eye patch on for months, or even years at a time.

Aside from the hit to self-confidence that kids experience from the eye patch treatment, and the discomfort of having to function day to day with your "better" eye covered, it is known from literature that said treatment has a success rate of only 50% at best. In more severe cases, atropine drops are administered to forcefully blur the eye, with no option for the child to "take it off" like with an eye patch.

It's about time we used a more technologically savvy solution for a problem that 3% of the population suffers from, and that could lead to many complications down the line if not treated properly early on.

A cool, child-friendly way to treat amblyopia

With NovaSight's CureSight treatment, the patient wears plastic red-blue glasses and can watch a video of their choice. While watching said content, which is altered by CureSight's systems, receptors track the patient's eye movements and can selectively blur out the center of vision of the stronger eye, thus achieving an effect in visual acuity improvement similar to what an eye patch could do. Apart from being a lot less frustrating than using an eye patch, this method still works with both eyes, strengthening the 3D perception.

In 2019, NovaSight performed a clinical trial involving 20 children tested at Sheba medical center in Israel. The trial showed that not only did their vision sharpness and stereo vision improved, but said improvement persisted at the half-year mark check-up.

Today, NovaSight is in the final stages of performing a pivotal FDA trial involving 100 children with half undergoing the CureSight treatment and half with an eye patch treatment.

A few weeks ago, Mr. Yam was delighted to point out that the interim point was successful with 90% of patients finishing their treatment. "Although the official results will only be known to NovaSight in a month, the favorable interim results signal the trial to be successful and joining the three current procedural terminology (CPT) codes we already obtained," he said. "The product will be released to European markets in about a month and U.S. markets in approximately September this year."

CureSight™

Setting eyes on the future

Even with the release of CureSight just around the corner and the already successful EyeSwift, NovaSight is not slowing down. Mr. Yam pointed out that the company has a lot of future developments in various stages of research and development. Following the success of EyeSwift, a newer version, the EyeSwift Pro, is set to hit the market in the second quarter of the year, as mentioned above.

Following NovaSight's two lines of products — assessment and treatment — Mr. Yam gave us examples of future products in each line. On the assessment side of things, NovaSight is working on a software-only solution, TrackSight, which could monitor the user's eyes in real-time while sitting in front of a screen.

"TrackSight would be able to perform eye assessments similarly to EyeSwift, but there will be no need for additional hardware," Mr. Yam shared. "More prominently, the technology could track eye movement in real-time to detect eye fatigue and prolonged screen usage, which could damage the user's eyes and alert the user."

While the focus would be on children, anyone who spends long periods in front of a screen, like office workers or even gamers, could benefit from TrackSights capabilities to minimize eye damage from screen usage.

On the treatment side, NovaSight is working on a wearable device for myopia treatment, called ActiveGlass. This device will work similarly to other wearable treatment options for myopia and on the same principle of blurring the patients' peripheral vision and sharpening the center to help lessen the impact of myopia. While said treatment is viable, it has the issue of having fixed blurred and sharpened areas, heavily limiting the patient's full scope of vision.

"ActiveGlass resolves this issue by having cameras track the patients' eyes in real-time and adjusting the blurred area in accordance, greatly increasing the possible vision range," shared Mr. Yam. ActiveGlass is still a few years away but is already patented and has a working lab prototype.

Novasight is currently at Stage B funding, with the goal of acquiring $15M.

Contributor

Mr. Ran Yam holds a Mechanical Engineer (BSc) degree from Technion and has years of experience in ocular innovations, complex multi-disciplinary products, and a rich history of successfully working and elevating startups. On the heels of his success as VP of R&D at Visionix, Mr. Yam showed interest in not only joining a fresh startup but creating and leading one on his own. Together with Dan Oz and Dr. Michael Belkin, the initial idea of using cutting-edge technology to better treat and assess ocular issues was created. In 2016, the idea was made real with the creation of NovaSight, with Mr. Yam at its helm.

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All Eyes on the Metaverse

5 Innovative smart contact lenses to watch in 2022

by Joseph Schreiber

In the last few months, smart contact lens manufacturers have made several major announcements, hoping to build on the foundation of an augmented reality/virtual reality (AR/VR) world, called the metaverse.

The metaverse is a representation of the internet in a single virtual world, with gaming and VR activities at the helm. However, other entertainment activities, such as concerts, are being held in VR with stars as big as Ariana Grande.

Microsoft recently purchased Activision/Blizzard in the hopes of expanding to this virtual world. Facebook named their parent company Meta. And Google and Apple already have their own investments.

The year of the eye OS?

Market research groups and lens manufacturers have projected that 2022 will be the year that smart contact lenses will start to see market growth. Big news from Mojo Vision, InWith, and Innovega were announced in early January this year at the Consumer Electronics Show (CES).

On the medical side of the smart lens world is the ACUVUE OASYS with Transitions Light Intelligent Technology (Johnson & Johnson Vision Care, Jacksonville, Florida, USA). They adapt and transition like eyeglasses, reduce halos and starbursts, filter blue light, improve color contrast, reduce bright light, and block nearly 100% of UV light.

While they have no augmented reality (AR) or Internet of Things (IoT) applications, gamers who find themselves staying up late to grind out one more level will benefit from reduced eye strain and blue light filtering.

And for a truly smart lens, the SENSIMED Triggerfish records ocular changes throughout the day and night and has been FDA approved and on the market since 2016.

Smart contact lenses: Our top 5 picks!

1. Mojo Vision's Mojo Lens

Mojo Vision (Saratoga, California, USA) announced that they have completed their first series B funding and raised $45 million this year, bringing their total funding to $205 million. While Mojo Vision's original goal was to create lenses for the visually impaired, they have made partnerships with sports companies, focusing on hiking, biking, skiing, golf, and even yoga. And most importantly, they announced their largest partnership yet at the CES: Adidas.

They coined the term "Invisible Computing" for their platform, called the Mojo Lens. Its goal is to provide information when you need it and is not disruptive when you don't.

They surveyed 1,300 athletes, half of whom stated a preference for being able to receive live data during an activity as long as it is not intrusive, with 80% stating they already look at data during an activity. Most people would agree, as they find themselves more likely to push

for an extra mile when they're on an elliptical or treadmill.

Mojo Vision's product uses a scleral lens — not soft — with tech embedded inside linked to what they refer to as a "relay" around the neck. They hope to receive FDA approval by the end of 2022.

2. Innovega's iOptik®

In contrast to the Mojo Lens, the iOptik from Innovega (Bellevue, Washington, USA) is a soft contact lens that can also be paired with specialized eyeglasses as a processor and display, called the eMacula system. The full system creates 3D perception through binocular vision by delivering images to each eye.

Innovega recently released a phase II clinical study by Dr. Jennifer Fogt from Ohio State University, which showed very positive results with 15 normally sighted subjects. The subjects reported their experience as "very good" and were measured as having a visual acuity slightly above 20/20.

The company wants to create an affordable contact lens with applications for both the normal sighted and visually impaired, but both Innovega and Mojo Vision plan to appeal to the visually impaired first and the masses second, offering a product that increases performance, is gas permeable, and biocompatible.

3. InWith's AR/XR lens

Where Innovega and Mojo Vision focus on medical applications first, InWith (Irvine, California, USA) is all about AR, XR (extended reality), and the metaverse — even though they will still offer benefits for presbyopia and myopia patients. They also skip the relays used by others and link the lenses to a mobile device.

Their dedication to AR capabilities was surprisingly not on display at the CES. The presentation instead focused on continuing to have the world's first and most advanced stretchable soft hydrogel lens integrated with a display chip and sensors planned to first apply to augmented and tunable vision.

They plan to have FDA breakthrough clearance in 2022 and bring early iterations to the market for developers to create their own groundbreaking applications from VR to visual enhancement.

4. Azalea Vision's Alma

Azalea Vision (Gent, Belgium) is a spin-off from Gent University and Interuniversity Microelectronics Centre, which focuses entirely on medical applications for light sensitivity and other ocular disorders, such as aniridia, coloboma, keratoconus, and ocular albinism.

They refer to their system as Alma, which is Spanish for soul and an acronym for active light management. Alma reacts in real-time to light variance and modifies brightness and depth-of-field, while compensating for myopia and astigmatism.

Last summer, Azalea secured €8 million in series A funding and was granted €1.8 million from Flanders Innovation and Entrepreneurship (VLAIO).

5. StickTronics Lab's soft lens

StickTronics Laboratory (West Lafayette, Indiana, USA) specializes in creating methodologies that 'change the form factor of electronics from rigid and stiff to flexible and stretchable'.

We spoke with Prof. Chi Hwan Lee, head of the Lee Research Group and StickTronics Laboratory at Purdue University, about the development and applications of smart contact lenses. He believes that both medical and AR lenses must ensure "on-eye safety" before progressing to the market.

According to Prof. Lee, "lenses should provide a sufficient level of softness, air permeability, wettability, flexibility, and ergonomic curvatures" that commercial lenses have. "These lenses should also avoid the use of electronic chips (which are like a piece of glass) to prevent any risk of eye damage," he added.

Prof. Lee said there is a critical gap between commercial and smart lenses. "They have been extremely well developed over the past decades and optimized for long-term wear, but medical smart lenses are built upon custom-made contact lenses and thereby limited in their biocompatibility, durability, comfortability, and long-term wearability," he said.

"The future of smart lenses should incorporate functions directly into commercial contact lenses without significantly affecting their intrinsic properties," Prof. Lee shared.

But first, beat the first level!

Despite optimism from manufacturers, Prof. Lee believes it could take years for lenses to achieve the long-term safety required for regulation. But after the industry beats that first level, there should be rapid acceleration.

As far as trying on an AR or VR lens, Prof. Lee has no interest. Beyond his safety concerns, he suffers from an impairment himself: dry eye. These lenses also need to address the concerns of the vision impaired.

Personally, I'd love to see any of these. But in the unlikely event an ad pops into my eye while I'm driving, I'm out!

Contributing Doctor

Prof. Chi Hwan Lee began his academic career as an industrial engineering student at Ajou University in Korea and completed a mechanical engineering degree at Illinois Tech through a dual-degree partnership. He continued his studies with an MS and PhD in mechanical engineering from Stanford. He is a Leslie A. Geddes associate professor of biomedical engineering at Purdue University. He is also affiliated in mechanical engineering and materials engineering. He leads the development team of StickTronics, which turns any thin film device into a sticker that can be used for application in wearable and flexible electronics. These electronics can be built directly into a standard wearable hydrogel soft lens that have none of the wearability issues of a plastic smart lens.

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Myopia

GAME OVER

Beating nearsightedness in a brave new digital world

by Ben Collins

With a rapid rise in myopia cases globally over the past 50 years — seemingly coinciding with technological advances and the prevalence of digital devices — it's easy to assume a direct correlation between the two.

Although experts agree that increased screen time affects vision, research still lacks as to the extent of its effects. Nevertheless, with around 50% of the global population predicted to suffer from myopia by 2050, there seems to be a general consensus that, indeed, we are now facing a worldwide epidemic.

As concerning as that sounds, we don't necessarily need to be resigned to the fact that our increasingly digital lives are always going to adversely affect our vision. Effective treatments already exist and advances are continually being made. In fact, a growing awareness of the problem appears to be fueling essential research and education programs to tackle the issue.[1]

Different Medical Treatments

Myopia sufferers have a range of treatment options available to them. Choosing the right control method (or methods) depends on several factors, and each has its pros and cons.

1 Prescription glasses vs. contact lenses

Perhaps the two most widely used myopia correction tools are spectacles and contact lenses. Often pitted against each other in terms of effectiveness, practicality, and preference — in reality, many myopia sufferers use them in conjunction with each other.

The main advantages of wearing glasses include a reduced chance of eye infection or irritation (keratitis) and affordability. You don't need to touch your eyeball to put on a pair of spectacles. And over time, you'll save money, as glasses don't need replacing as often as contact lenses.

The key benefits of contact lenses, on the other hand, are the way they conform to the curvature of your eye, allowing for better peripheral vision, and their practicality in terms of more active use. People who play sports often prefer contacts as they are less likely to fall off or break.

Fashion and ergonomics also play a role in people's preferred myopic treatments. Some don't like the look of glasses, whereas you would hardly know if someone was wearing contacts. Patients with sensitive eyes may find contacts uncomfortable. And by the same token, glasses can rub behind the ears or create pressure across the bridge of the nose.

2 Orthokeratology and multifocals

Newer technologies such as orthokeratology (ortho-k) and multifocal lenses are also doing their bit in the fight against myopia.

Ortho-k treatment involves the use of special gas-permeable contact lenses, which reshape the cornea and temporarily relieve refractive errors, such as myopia. The beauty of these contacts is that the patient only needs to wear them at night, allowing for correction-free vision during the day.

Multifocal lenses (available in contacts or glasses), on the other hand, are lenses with varying areas of magnification. Although research is ongoing, initial studies show these lenses can help reduce myopia progression, especially among children.[2]

3 Topical pharmaceutical treatments

Low-dose atropine has been shown to have a clinically significant effect on myopia progression. Generally used in conjunction with prescription eyeglasses, this is a good option for those who don't want to use contact lenses.

Ask the Expert!

Ophthalmologists and optometrists are the best source of reliable information regarding anything vision-related. We spoke to Dr. Jeffrey Walline, associate dean for research at The Ohio State University College of Optometry, and Dr. Shalu Pal, optometrist and founder of Shalu Pal & Associates in Toronto, Canada, to get their thoughts on the current myopia situation.

COOKIE: What are the effects, if any, of screen time and device use in myopia progression?

Dr. Walline: Scientific evidence indicates that screen time plays a role — albeit a small one — in myopia development and progression. While nearly every study of myopia development asks questions related to screen time, few find a meaningful effect and many find no effect at all.

Dr. Pal: I do believe that screen time and device use are creating two major problems in our society today, especially among our younger patients: myopia progression and dry eye.

We have been discussing the visual impacts and fatigue associated with computer vision syndrome for many years. But the connection between device use and progression of myopia has been lacking in research until recently. The pandemic also caused a massive increase in digital device use.

Studies conducted during the COVID-19 pandemic around the world, including China and India, are showing that the rate of myopia progression was double that of normal progression.[3,4] The average progression of myopia is 0.50D per year.[5] It was shown during the pandemic that a total of 45.9% of children had an annual progression of greater than 1.00D of myopia; while during pre-pandemic, it was was as low as 10.5%.[3] The Lancet published a study[6] showing that a high level of smart device screen time was associated with an almost 30% higher risk of myopia. And if computer screens were used in addition to smart devices, the risk increased to nearly 80%.

I have spent the last year and a half imaging the meibomian glands of my patients and have found that our teenagers and young adults, who have spent most of their life in front of devices, have not developed good blinking habits compared to our adults and seniors. As a result, these children have very damaged meibomian glands, causing poor tear quality and dry eye. Our seniors, who have spent far less to no time at all on devices during their lifetime have perfect glands.

COOKIE: Is there a correlation between gaming and myopia progression?

Dr. Walline: While gaming has not consistently been shown to have a meaningful effect on myopia, it has been shown to lead to eye fatigue and visual symptoms. When gamers stare at the screen, they tend to blink less often, which can lead to dry eye symptoms. People also have to focus their eyes to see near, so that close vision can lead to eye strain and headaches. None of these problems are permanent, and they can be helped with treatments prescribed by an eye doctor.

Dr. Pal: Gaming is one of the main reasons why children (and adults) are spending more time on digital devices. During the pandemic, we were all required to remain in our homes, and the number of hours spent on devices increased as a result. The number of video games played on our phones and devices was one of the activities that increased.[7]

When so much of our entertainment was taken away, many turned to video gaming to fill that void. Those that played video games before now had more of an opportunity to play longer. Children using a screen more than three hours per day have a four-times higher

risk of myopia than those who do not use screens.[8] Those under the age of seven have a five-times higher risk of myopia when they spend three hours or more per day on screens. Now, with the increase in virtual reality, we are going to see an even greater number of hours spent video gaming in the years to come.

Experts Tips for Myopia Prevention

Both Dr. Walline and Dr. Pal agree that education and increased awareness of the issue are key in the fight against myopia progression. Each also has some great practical tips for looking after your vision while using devices. This includes spending time outdoors and following the 20-20-20 rule: Look at least 20 feet away for 20 seconds every 20 minutes. The breaks encourage blinking, reduce eye strain, and help relax the accommodative system.

Dr. Walline's advice: Time spent outdoors is consistently found to affect myopia development. The more time children spend outdoors, the less likely they are to become nearsighted. The outdoor effect is not simply due to spending more time indoors looking at screens. Instead, it is believed that more light experienced in the outdoor setting reduces the likelihood that myopia will develop.

Dr. Pal's advice: The key to mitigating concerns with myopia progression, dry eye, and computer vision syndrome is to start the conversation early with parents and patients. We must help them understand the correlation between screens, blinking, dry eye, fatigue, and prescription changes, and the strategies to avoid these outcomes.

I also recommend projecting as many tasks as possible onto a large TV screen across the room to create more distance between the patient and the devices. This increases comfort and reduces long periods of over accommodation.

Activities that can be done on a TV include watching webinars during homeschooling, watching videos and movies, surfing the net, playing games, and even doing emails or work. Other simple things include sitting as far back as you can, working with the lights on, increasing the fonts to reduce strain, and using prescription computer glasses with special coatings, including blue light filters and anti-reflective coatings.

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Dr. Shalu Pal is an SCCO graduate who did her Cornea and Contact Lens Residency at NSU. Dr. Pal is a member of the Global Myopia Symposium committee, co-editor for the Mastering Myopia Newsletter, an advisor for the Global Council of Myopia Management, advisor for Review of Myopia Management, and research member of the study, Myopia in Practice. Dr. Pal is a member of the Innovations Council for the AAO, past chair of the AOA Contact Lens and Cornea Section, a board member of the CAO Cornea and Contact Lens Section, and a co-founder of the Canadian Contact Lens Academy. She volunteers her time globally while running a group practice in Toronto, specializing in contact lenses, myopia management, concussion rehabilitation, vision therapy, dry eye management, and ocular aesthetics. Reports, presentations and emails are the major things that Dr. Pal finds herself doing on a computer or smartphone. But every once in a while, you can catch her playing Bejewelled, Candy Crush or the new version of Tetris, Block Puzzles, on her phone.

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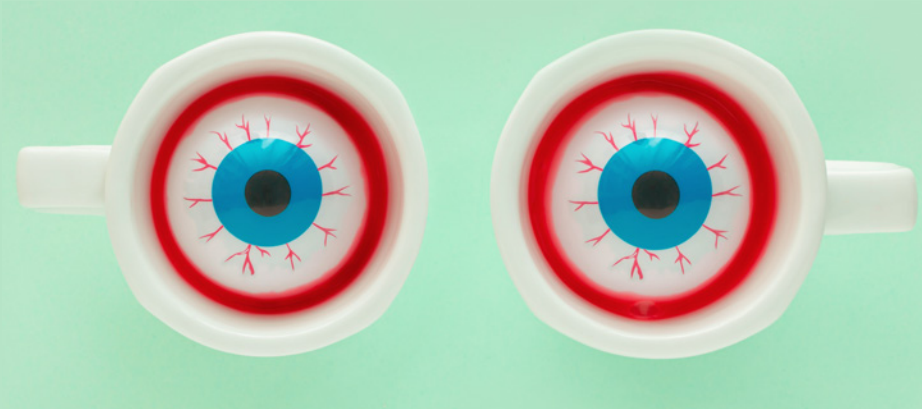

What's Brewing

Is coffee affecting your eye health?

by Leon Ash

Those of us familiar with the dubious merits of the *MailOnline* can cite article after article about the cancer-causing properties of some food and drinks. It's a bottomless shopping cart that any hack can throw an ingredient in and wheel to the checkout marked: "here be clicks!"

So, when coffee's morning-affirming name is dragged through the proverbial mud, there's a metaphorical crossing of arms. Oh yeah? Prove it. Show us how coffee influences glaucoma, or more scientifically put: "Does a daily intake of caffeinated coffee influence intraocular pressure (IOP)?"

Let's pop the kettle on and see if we can get to the bottom of it all.

Caffeine and IOP

With glaucoma, one of the most important metrics is IOP. If caffeine has a short- or medium-term effect on IOP, it could well contribute — so the theory goes — to the development of the condition. Additionally, if caffeine exasperates or accelerates the disease, patients must be advised to reduce or eliminate their caffeine intake.

With coffee coming only second to tea in worldwide popularity, these studies are critical explorations of potential dietary causation. Glaucoma is one of the leading causes of irreversible blindness worldwide, so the stakes are high.

One study[1] observed: intravenous caffeine seems to possess a possible mechanism of action that involves an increase in aqueous humor formation, the clear fluid filling the space in the front of the eye between the lens and the cornea. Blood pressure rises precipitated by caffeine could increase IOP by increased production of aqueous humor.[2] This is contradicted by another paper,[3] concluding that caffeine has no clinically significant effect on aqueous humor flow in the normal human eye.

Further, a research[4] from 2011 said caffeine didn't have any effect on IOP and, therefore, any effects reported in coffee drinkers may be related to other constituents in coffee. This study's methodology, the application via eyedrops of pure caffeine (and who isn't partial to an ocular espresso?), is a departure from the more conventional delivery methods of the others.

Another study[5] from the Massachusetts Eye and Ear Infirmary (MEEI) investigated the relationship between caffeinated coffee consumption and IOP, ocular perfusion pressure (OPP), and ocular pulse amplitude (OPA) in patients with or at risk for primary open-angle glaucoma (POAG) and who are at least 40-years-old. This notably thorough study concluded: "Consuming one cup of caffeinated coffee (with 182 mg caffeine) statistically increases but likely does not clinically impact IOP and OPP in those with or at risk for POAG."

Can a cuppa a day keep the doctor away?

All well and good but the average American is said to drink 3.5 cups of coffee a day — that's 637 mg of caffeine daily! Another study,[6] conducted by the Icahn School of Medicine at Mount Sinai, said those who consumed more than 321 mg of caffeine and were in the genetically high-risk category showed a 3.9-fold higher glaucoma prevalence in comparison with those who weren't genetically susceptible and didn't drink coffee.

It appears more studies are necessary to further investigate the effects of caffeine on glaucoma, as well as the anomalies and conflicting results. But for now, provided one doesn't have a family history of glaucoma, coffee is back on the menu. Just to be on the safe side, glaucoma patients or those predisposed may want to eliminate or severely cut back on caffeine. And dare I say it… there's always decaf!

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From Projectile to Hitscan

Know your best weapons and strategies against myopia

by Nick Eustice

"You're going to ruin your eyesight!"

Parents have been saying this to their children for longer than any of us can remember. This was also a common complaint from parents during the Victorian era, who were worried about their children straining their eyes by reading too many books.

With the advent of television, this concern moved from books to screens. Video games came next, boosting screen time even more dramatically. And with each transition, parents have been worried about the same thing: Is all this near-field focus harming childrens' vision?

Today, screens have gotten smaller and more personal, and have consumed more and more of childrens' time. Over 2 billion people play video games worldwide, and that number is expected to increase to 3 billion by next year.[1]

Though games are not just for kids anymore, it's the vision of younger gamers that causes the greatest concern among eye care specialists. Phones and tablets have expanded the availability of video games across the world, and studies have shown that, even if parents weren't necessarily right about the television or books in decades past, screen time among children has been linked to a growing epidemic of myopia.

While gaming is far from the only cause of myopia, it is a contributing factor. In 2019, the *British Journal of Ophthalmology* reported that children who spend more than three hours per day in front of a digital device are four times more likely to develop myopia. Younger children are at greater risk, with those aged six to seven being five times more likely to develop myopia than children who are not exposed to digital screens.

So, what can we do to level up and beat myopia? Here are a few strategies to follow...

1 Analyze your enemy

Myopia has always been one of the most common visual ailments, and its onset typically comes early in life. Affecting more than 30% of children and adolescents worldwide, it is the most widespread refractive error in the world. While myopia has been a known problem throughout history, it is very aggressively on the rise. It is anticipated that between 2000 and 2050, myopia's worldwide prevalence is projected to increase from 23% to 54%.[2]

While the technologies that have led to gaming could be a contributing factor in this enormous increase, new technologies have also been introduced in recent years to combat the harmful effects of the condition. While the onset of myopia is not reversible, there are several treatments available to stall the worsening of myopia in patients.

Myopia is an elongation of the eye, leading to a misalignment of the lens, the cornea, or a combination of the

two. While surgical options exist in some cases, and glasses have been the traditional remedy for improving patients' vision, various types of contact lenses have been growing in popularity, and are frequently the preferred treatment option.

2 Familiarize yourself with the different weapons

"Focusing light in front of the retina effectively retards axial length growth in humans," writes Dr. Melanie Frogozo in *Contact Lens Spectrum*.[2] "Contact lenses for myopia control function by simultaneously focusing light onto — and in front of — the retina. This provides acute vision for daily activities and also a defocus stimulus that slows axial length growth."

This ability to correct the deformations brought on by myopia makes contact lenses a strong treatment option for the condition. Some contact lenses prescribed for myopia, called soft multifocal (MF) lenses, function primarily by shifting the eye's focus to clarify vision and limit growth of the eye. These are among the most common variety on the market and have widespread application and ease-of-use.

On average, soft MF contact lenses with center-distance design optics slow myopia progression by 46%. This strong number, along with the relative ease-of-use associated with soft lenses, and their ability to slow the condition while at the same time correcting the patient's vision, make them a very popular and widespread option.

Another type of contact lens is orthokeratology (ortho-k). Unlike soft MF lenses, ortho-k lenses are worn overnight and seek to reshape the eye's elongations directly while the patient is asleep. These lenses often correct the symptoms of myopia to a sufficient degree that patients often do not need glasses or other types of contact lenses upon awakening the following day.

3 Never be afraid to "mod"

In special circumstances, especially those where patients have one or more co-malignancies in addition to myopia, other lens types offer a combination of MF lens benefits with those designed to treat other visual conditions. Gas-permeable (GP) lenses, often used to correct astigmatism, can be fitted with MF properties to address myopia in patients with both conditions. Alternatively, hybrid GP lenses feature a GP center surrounded by an MF skirting. In extreme cases, such as where high myopia is present, scleral lenses are yet another option.

In addition to the varieties of lenses available, there are also pharmaceutical and surgical options for the treatment of myopia. Typically, and especially when treating younger patients, eye care professionals prefer to avoid surgery without a compelling reason to do so.

Pharmaceuticals, on the other hand, are frequently implemented in conjunction with contact lenses. The antimuscarinic agent atropine is often prescribed in conjunction with contact lenses, and this combination has shown very positive results.

4 Don't "lag" behind

Dr. Frogozo suggests that two factors are of the utmost importance when considering fitting contact lenses for a patient.

The first of these is the timing of myopia progression. "The younger that children become myopic," Dr. Frogozo writes, "the faster myopia progresses, thereby increasing the likelihood of developing high myopia."

As high myopia is a far more dangerous and debilitating stage of the condition, threatening to cost a patient their vision rather than merely impair it, addressing this concern is of utmost importance.

The Correction of Myopia Evaluation Trial (COMET) study has shown that myopia progresses at twice the rate among six- and seven-year-old patients as it does among 11-year-old patients. Consequently, early treatment is of paramount importance, as treatment is the best hope to avert a young patient's loss of vision.

The second consideration Dr. Frogozo identifies as crucial is identifying which patients to treat. This factor pertains to family backgrounds, in more than one sense. In one sense, East Asian children are far more likely to experience rapid myopia progression than those from elsewhere in the world. Dr. Frogozo is quick to point out, however, that this does not necessarily reflect a patient's ethnic background as a consideration, as children of East Asian backgrounds in North America do not show greater instances of myopia.

Family history is also an important consideration. Like many conditions, there is substantial evidence to show that myopia runs in families. When a child's parents and grandparents have shown a history of myopia, especially high myopia, treatment becomes far more urgent.

5 Last but not least, keep grinding

Treatments and preventative measures for myopia go hand-in-hand in many ways. While today, many more effective treatment options exist than ever before, it is important to bear in mind that these treatments are not cures, but only management measures. Though a cure may be found for myopia in the future, all the techniques used to treat myopia are ultimately methods of slowing down a condition that could otherwise advance toward loss of vision.

Though we still do not fully understand what causes myopia, careful management of screen time, including video games, has shown to correlate with instances of myopia. Similarly, a commensurate amount of time spent outside has been shown to mitigate the effects of screen time. While it is not necessarily a sure thing that screen time leads to myopia, perhaps the age-old parental advice that children go outside and play is itself good medicine.

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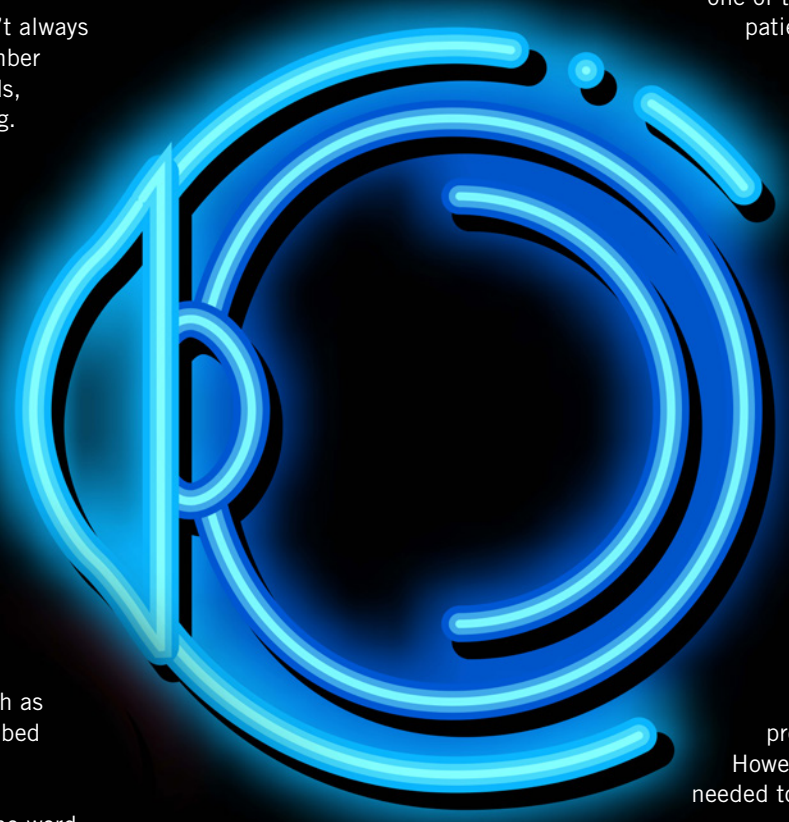
Doctor's Orders

Tips to improve patient adherence in glaucoma medication

by Sam McCommon

Some patients don't always want to (or remember to) take their meds, which can be frustrating. But it's something that doctors are aware of and have to deal with. Specifically, glaucoma medication adherence has always been more than a small problem for ophthalmologists, as *CAKE* magazine has reported[1] previously.[2] So, doctors need to get wise to patients' ways and find the best path forward to ensure their patients adhere as much as possible to their prescribed medicine.



Note that we're using the word "adherence" here rather than "compliance," a word that gives the image of a policeman wielding a baton. Doctors are here to help patients with their conditions, after all, and not enforce rules. Encouragement is far more valuable than coercion, especially since patients can't be monitored 24/7 to ensure they're taking their meds.

Taking a cue from *Patient Preference and Adherence* magazine, we've put together a list of ways for doctors to help patients adhere to their medications. After all, controlling intraocular pressure (IOP) is the best-known way to control glaucoma, and getting patients to follow their prescriptions is tantamount to success.

Let's dive right in and see how we can improve patient adherence.

1 Switch to preservative-free eye drops

One frequent complaint about glaucoma eye drops is they often lead to dry eye. This is largely due to the presence of preservatives in IOP eye drops, and it's hard to blame patients for not wanting to take something that makes them feel lousy.

Most notably, benzalkonium chloride (BAC) has been noted to be a frequent cause of ocular surface disorders — notably dry eye. This is no laughing matter: A French study noted that 62% of patients taking topical glaucoma medications suffered at least one ocular surface disorder, and 19% had four or more. That's a significant number, and one of the most major obstacles to patient adherence.

A switch to a preservative-free (PF) topical medication could be the answer both doctors and patients are looking for in this case. One study3 suggested that 72% of patients who were prescribed a PF tafluprost preferred it to preserved latanoprost. Many other studies back up this claim, indicating that patients generally prefer PF drops and that these PF drops appear to be as effective as their preservative-laden cousins. However, more long-term data is needed to ensure these claims.

2 Take time to explain the situation

One simple reason patients may not follow their doctor's orders when it comes to glaucoma meds is a simple lack of understanding of how glaucoma works. It's a common problem that affects medicine of all kinds: How many patients stop taking their antibiotics as soon as they feel better rather than

finishing the course as required? If your answer is "a lot," you're on to something.

So, naturally, having a robust set of literature available for patients and clearly explaining to them just what glaucoma is and how it works is a key step in getting patients to follow their prescriptions. For doctors, the main issue here is time. If an ophthalmologist was to spend time educating patients on the mechanisms of glaucoma and just why they need to take their meds as prescribed, they'd end up doing little else.

In general, those with overall good health and a poor understanding of the mechanisms of glaucoma tend to be those who are the least adherent. If you feel fine, after all, why continue the meds? That's how many patients think.

To help patients understand their condition, consider providing them with literature on the subject and pointing them to well-researched websites to help them grasp the full picture. Glaucoma.org is a good place to start, as is the U.S. National Eye Institute.

3 Consider changing delivery mechanisms

For patients who struggle to administer eye drops themselves or for those who are just forgetful, implantable glaucoma medication-releasing devices are on the market. To wit, Allergan's (An AbbVie company, Dublin, Ireland) DURYSTA™ made its mark as the first biodegradable sustained-release implant for open-angle glaucoma. As a relief, it relies on good ol' bimatoprost.

Backed up by the ARTEMIS study,4 DURYSTA appears on all counts to be a viable and valuable alternative to bimatoprost drops. So, for patients who are forgetful, have shaky hands, or just don't like eyedrops, this provides a great way forward.

Other delivery mechanism alternatives include gel or spray formulations like Nyogel® (Novartis, Switzerland), which requires only a once-daily treatment.

Many glaucoma patients are older, and older people often have many medications to take at various intervals. Making their lives easier by minimizing their schedule or giving them one less thing to remember will likely make for a popular doctor.

4 Customize your adherence strategy

Whatever a doctor can do to ensure their patients adhere to their glaucoma meds is a positive step toward reducing the long-term effects of the condition. Whether this includes switching delivery methods, changing to preservative-free drops, or simply switching to tele-reminders via an app or other adherence tracking tool, any way forward is better than forgetfulness or omission.

Because glaucoma is such a multifactorial and personalized condition, getting to the core of the issue with each individual is key. That's why a greater understanding of glaucoma is a good thing worldwide — and it's something we're happy to play a role in as much as we can. After all, what wouldn't be better than a grassroots movement of glaucoma patients reminding each other to take their meds?

A wise man once said: "From understanding comes wisdom. From wisdom comes action." That wise man is me, and I made that up just now, but you can feel free to tell your patients you made it up yourself. Whatever gets them to take their meds is groovy, baby.

Editor's Note:

A version of this article was first published on *CAKE magazine website.*

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