A New Approach To Address Light Sensitivity In Patients Recovering From Concussions

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Overview

Concussions are life-changing injuries that affect the lives of more than four million people in Canada and The United States. The rate of concussion prevalence and diagnosis has increased steadily over the past 20 years, but little has been done to address the growing need for post-concussion syndrome management in the workplace and in classrooms. Each day, many patients are forced to take time off of work or school and focusing on recovering from their traumatic brain injury.

Computers and smartphones with Liquid Crystal Display (LCD) screens are more frequently used in 2017 than at any point in history, and their prevalence in society will only continue to expand. However, the use of LCD screens can be incredibly challenging for people trying to return to work or school following a concussion, as their high flicker rate and backlit screen triggers headaches in patients who suffer from light sensitivity symptoms during their recovery. Without the ability to use LCD screens, patients recovering from concussions have difficulty being productive throughout the work or school day as they are unable to contribute as they were accustomed to prior to their injury. Currently, there is no product available that helps people suffering from light sensitivity return to productivity by aiding the use of their computer screen.

Iris Technologies has developed a new monitor that connects directly to your personal or work computer to reduce symptoms caused by light sensitivity. Using the Iris Monitor, patients recovering from concussions can use their computers without triggering severe symptoms. This means that patients can keep up with their schooling or job, which will improve their overall health, happiness, and lifestyle following their injury.

Background

The incidence rate of mild traumatic brain injuries (mTBIs), colloquially known as concussions, across North America has increased rapidly over the last decade. From 2004–2014, the prevalence of sport-related concussions in Canada—primarily caused by head trauma occurring during contact team sports such as hockey, soccer, and football—has increased by more than 40% (Government of Canada, 2017). If you walk into any classroom, coffee shop, office space, or dressing room, it is likely that you will observe people struggling with the long-term effects of mTBI. According to the most recent NPR–Truven Health Analytics Health Poll conducted in 2016, nearly one-in-four Americans have self-reported having suffered a concussion in their lifetime (Truven Health Analytics–NPR, 2016).

WHAT IS A CONCUSSION?

A concussion is a type of traumatic brain injury—or TBI—caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth. This sudden movement can cause the brain to bounce around or twist in the skull, creating chemical changes in the brain and sometimes stretching and damaging brain cells.

The rapid rise in concussions has caught the attention of government bodies, researchers, and healthcare advocates across North America, who are searching for ways to reduce and treat these injuries. The United States Center for Disease Control classified concussion prevalence as an ***epidemic*** (National Center for Injury Prevention and Control, 2003), further highlighting the importance of management, research, and technological advances necessary in the fight to better prevent, diagnose, and treat concussions.

In 2013, the Government of Canada launched a multimillion-dollar initiative aimed at studying the impact of concussions on the developing brain (Barton, 2013). Additionally, the National Collegiate Athletic Association in collaboration with the United States Department of Defense allocated $30 million to fund the largest comprehensive clinical study of concussion and head impact exposure (National Collegiate Athletic Association, 2014). In 2015, researchers at McGill University developed a state-of-the-art MRI scanner that will improve the ability to identify concussions by allowing doctors and researchers to observe and analyze the inflamed brain, an ability that was not previously possible using standard MRI scanners (Seidman, 2015). Across Canada, high schools are now required to evaluate and treat concussions through the "Return to Learn" program piloted by St. Michael's College in Toronto in 2011. The increased dedication to providing funding, resources, and investment opportunities in concussion research, management, and advocacy has led to an increase in

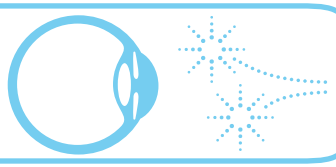
symptom reportage and has reduced the stigma surrounding mTBIs. For example, there was a 371% increase in work-related concussion time loss claims in Ontario between 2004–2013 (Canadian Centre for Occupational Health and Safety, 2015).

Recovering from a concussion can be a strenuous, frustrating, and mentally debilitating process. Recovery time following a concussion can last many months, and can even possibly span several years. Nearly half of all individuals impacted by traumatic brain injuries suffer from depression within the first year following their injury. Within seven years, the rate of depression rises to nearly two-thirds of individuals (Fann & Hart, 2009). These statistics illustrate the importance of utilizing different approaches to ease recovery, and highlight the significance of aiding patients in their return to work or school following their injury.

Concussions occur when trauma to the head—usually the result of a fall, motor vehicle accident, or athletic injury—causes the brain to shake inside of the skull. Concussions can cause immediate symptoms, such as loss of consciousness, memory, and wakefulness; or can occur with no immediate indicators of injury. In many cases, however, patients must deal with long-lasting complications resulting from their mTBI. These post-concussion symptoms vary from patient-to-patient, but often include: constant and recurring headaches, nausea, dizziness, blurred vision, and increased sensitivity and processing of light (Tator, 2015).

LIGHT SENSITIVITY

Behind only headaches—light sensitivity is the most commonly symptom reported after a concussion or mTBI.



Following headaches, increased light sensitivity is the second most common symptom reported after a concussion or mTBI. Currently, it is unclear why patients suffer from light sensitivity following concussions, but it is believed that high levels of light cause increased visual stress that may result in inappropriate neuronal stimulation required for visual processing and perception, causing discomfort to the patient recovering from a concussion (Chang, Ciuffreda, & Kapoor, 2007). Although concussion recovery guidelines can be inconsistent between sources, they consistently recommend that patients avoid bright lights and screens. Modern LCD screens, which are the most prominent type of computer screen used in the world today, are backlit using bright lights and refresh at a rate of 60 frames per second. These qualities of LCD screens, while desirable for the general population, are intolerable to individuals suffering from post- concussion symptoms and they contribute to considerable fatigue and eye strain symptoms.

Recommended avoidance of LCD screens leads to a critical conundrum for many post-concussion syndrome patients. Due to the increased reliance on technology powered by LCD screens in our society, the debilitating effects of increased light sensitivity can result in disastrous consequences for patients in their academic, employment, and social lives. It is estimated that the average American spends between 8–11 hours each day staring at one of their many screens, including their computers, smartphones, and televisions (The Nielson Company, 2017). However, patients suffering from light sensitivity are incapable of spending even minutes looking at an LCD screen before they begin to suffer from post- concussion symptoms including cognitive fatigue, headaches, and eye strain. Thus, patients are often required to make a critical choice:

Should I continue to use my LCD screens to contribute at school or at my job, even though LCD screens exacerbate my light sensitivity symptoms and slow down my recovery process, or should I take time off of school or work and fall behind?

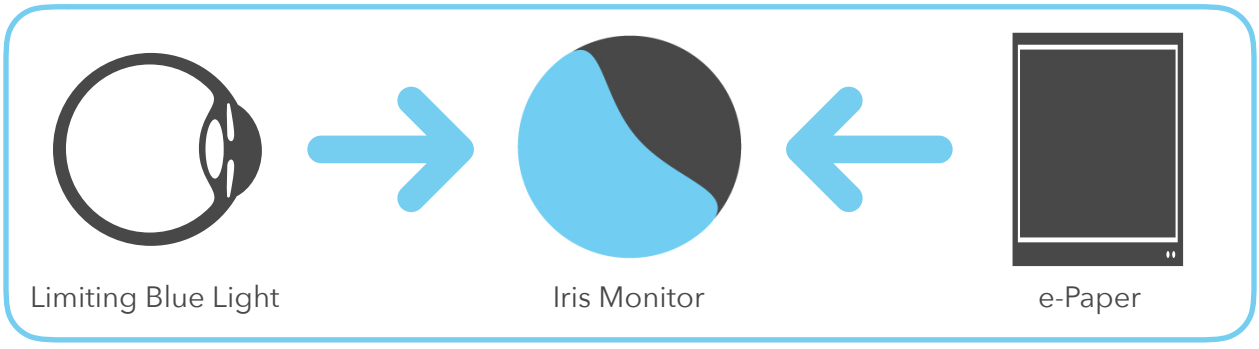
This choice is only available to those with mild concussion cases, as often times the pain associated with light sensitivity is so bad that patients have no choice but to drop out of school or go on a disability leave from work. Currently, there are no alternatives to LCD screens for many computer-based tasks, which means that individuals recovering from concussions are forced to reduce their engagement in their academic, work, and social lives which rely on consistent use of LCD screens. There remains a need to use technological advancement to complement existing treatment and recovery strategies utilized in hospitals, schools, and the workplace to ensure that post-concussion patients can return to the workplace or classroom symptom-free, as soon as possible.

Iris Technologies understands that it is important for recovering patients to use their devices each day. Instead of insisting that individuals recovering from concussions avoid their computers entirely, Iris Technologies has tackled this underserved problem by developing their Iris Monitor that helps patients in their recovery by limiting post-concussion symptoms resulting from light sensitivity, thus allowing patients to lead a more productive life throughout their recovery.

Adjusting to Light Sensitivity

Currently, there are only a few other approaches used to reduce the effects of light sensitivity. However, many of these approaches are unfit to serve the concussion recovery market because they were not designed to improve productivity in the work or school setting for these patients. The first approach is aimed at modifying the way that the user stares at their existing LCD screen. Products such as anti-glare screen overlays, specialized computer glasses, and software applications such as F.lux have been introduced to limit the effects of harmful blue light emitted through the LCD screen to the user. However, these approaches do not directly aid patients suffering from concussions because they do not address the problems associated with the rapid pixel flicker rate, or the backlit screen, of LCD monitors. These products have a limited impact on improving computer tolerance for concussed individuals.

On the other end of the spectrum, e-Paper readers such as the Amazon Kindle are excellent tools that allow recovering concussion patients the ability to read documents symptom-free, as e-Paper screens, which attempt to mimic paper, does not emit light, and do not refresh at the rate of LCD screens. However, these screens are unfit for workplaces or classrooms activities as they have limited functionality. Current e-reader software only permits users to read ePub or PDF documents, and do not allow users to edit or create new documents, go on the internet, or access one's existing files. E-reader screens are also significantly smaller than traditional computer screens and do not enable the use of a keyboard. Therefore, they have limited use as an alternative to LCD screens in post- concussion recovery, as individuals are forced to switch back to their LCD computer screens to complete even the most basic tasks.

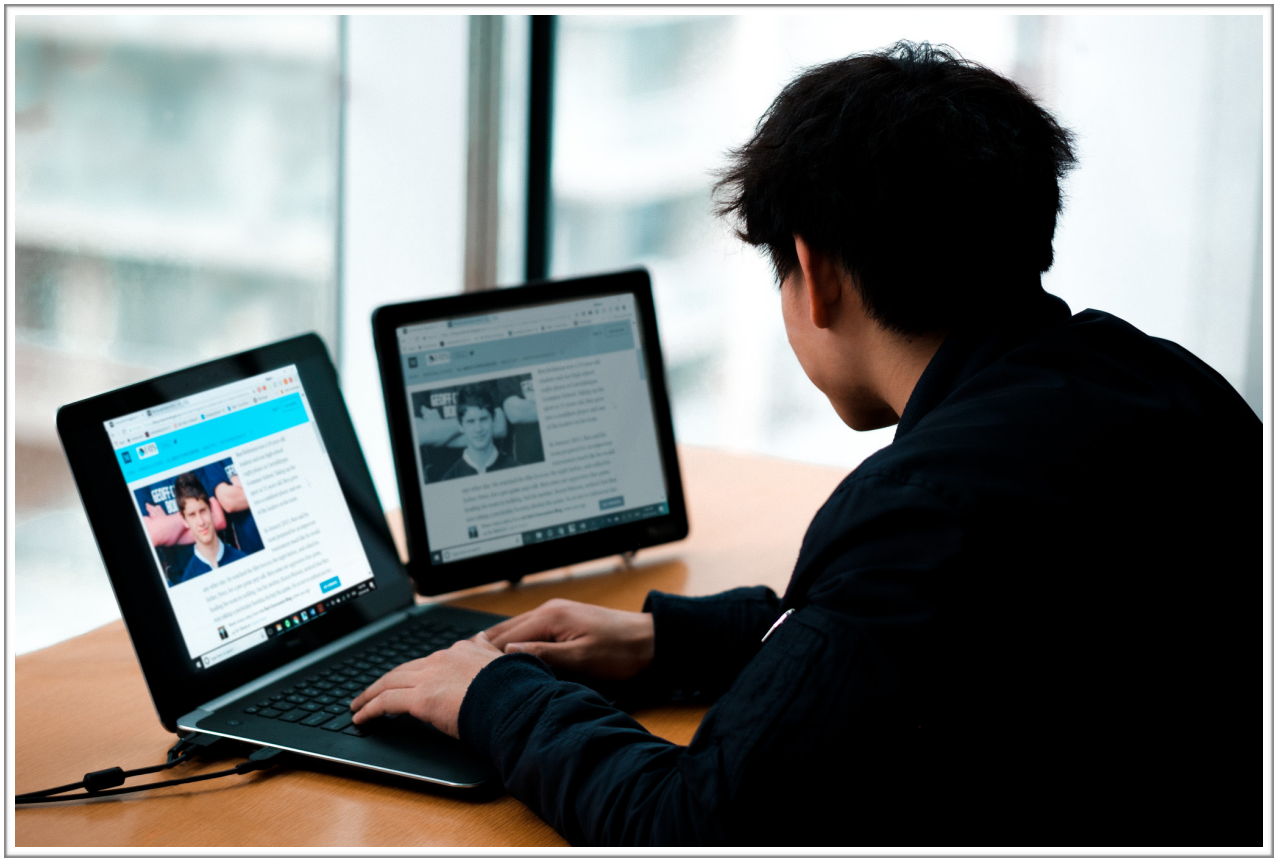


Iris Technologies has developed an approach that bridges these two strategies. Our Iris Monitor was specifically designed and tested to aid in post-concussion recovery. The Iris Monitor allows users the full functionality of their personal or work computer, with the benefit of a symptom-limiting computer display.

The Iris Monitor

The Iris Monitor specifically addresses the needs of patients suffering from post-concussion symptoms triggered by the flashing pixels and bright backlights of standard LCD screens. The Iris Monitor is an alternative external monitor that uses a magnetized polymer to display static images on its screen that are ideal for reading and typing. As opposed to LCD screens, on which images refresh at a rate of 60 frames per second, the static images on the Iris Monitor refresh only in response to the user's inputs. The Iris Monitor is not backlit, thus reducing light sensitivity symptoms experienced during regular computer use.

The Iris Monitor is a 13.3-inch e-Paper display that is designed to be used simultaneously with your regular computer display or as a substitute to it. The Iris Monitor is compatible with both PC and Mac computers, and connects via the HDMI or Mini Display port of your desktop or laptop computer. Our monitor is light-weight and portable, and can be transported easily to-and-from work or school, allowing the user to increase their productivity throughout the day, whenever and wherever they need to use their computer.



The efficacy of the Iris Monitor as a post-concussion recovery tool was tested in collaboration with Dr. Charles Tator, a neurosurgeon and Director of the Canadian Concussion Centre. Dr. Tator is one of Canada's leading clinical researchers in the field of brain injury and concussion.

Dr. Tator's study, which was presented at the American Academy of Neurology's Sports Concussion Conference, showed that 29 participants suffering from post-concussion symptoms and light sensitivity who read a narrative for 30 minutes on the Iris Technologies e-Paper monitor experienced less symptom exacerbation, and less symptoms triggered, compared to when doing the same exercise on a standard LCD screen. Importantly, the Iris Monitor screen does not reduce functionality compared to a standard LCD screen, as there was no significant difference in reading performance between the two screens. Furthermore, participants reported that their experience performing the test with the Iris Monitor was more favourable than with the standard LCD screen because they found it easier on their eyes and easier to focus.

"These results are very encouraging as they indicate there may be a technology that allows PCS sufferers with photophobia and screen intolerance to return to work or school faster."

– **Dr. Charles Tator**
Director, Canadian Concussion Centre

These results indicate that the Iris Monitor limits the effect of screen-time on post- concussive symptoms, thus allowing concussion patients to more quickly return to the workplace or classroom with limited symptoms. As a result, our e-Paper solution helps meet the Public Health Agency of Canada's "Return-to-Learn" protocol's stated goal of decreasing return time of concussion patients to their productive lives. The Iris Technologies e-Paper monitor can also serve as an indirect solution to improving the mental health of individuals recovering from traumatic brain injuries. The Iris Monitor allows recovering individuals to once again connect with their friends and family through the social tools once available only on devices with LCD screens, thus limiting social isolation that happens during recovery that ferments and expands into depression and other mental health problems for people during their recovery.

The Iris Monitor Advantage

13.3 inch display

PC & Mac compatible

16 ounces

HDMI or Mini Display Connection

Magnetized polymer display

Refreshes in response to user inputs

Testimonials

"My worst concussion symptom to date has been my severe sensitivity to light, which has made the use of a computer next to impossible. Iris' secondary computer monitory allowed me to use my computer again and go back to work. It allowed me to increase my work day from a couple hours to a full day. I would recommend this device to anyone who has difficulty viewing a computer screen caused by light sensitivity."

David Goldband
Senior Manager,
Grant Thornton LLP

"Assistive technology on the market related to eyestrain is limited and the costs associated with medical absences related to concussions, migraines and musculoskeletal disorders continues to rise partly due to the large amount of computer usage required by the typical job at Queen's. I see this product as a valuable resource to assist employees in staying more connected to the workplace and reducing our operational costs associated with prolonged absences."

Sydney Downing,
Queen's University
Human Resources

"After suffering a concussion, I was unable to tolerate traditional screen time for even a short period. Any use of a traditional computer screen immediately aggravated my symptoms (primarily headaches), which would last at least the rest of the day. Given the importance of a computer to my job, it meant that I was unable to work for extended periods. The screen was instrumental in me being able to reintroduce screen time and increase my work hours back to full-time. I have no doubt that this device facilitated my successful return to work full-time and would not hesitate to recommend this device to anybody who is unable to tolerate a traditional computer screen as a result of a concussion."

E. L.
Government of
Ontario

Summary

The Iris Monitor addresses the concerns of post- concussion syndrome patients affected by the inability to function in the workplace due to the unbearable symptoms caused by increased light sensitivity.

Our product helps recovering patients by providing them with the symptom-limiting advantages of a non-backlit magnetic polymer display while offering full functionality of their personal or workplace computer. The Iris Monitor is the first such solution in the North American market that specifically addresses the needs of patients recovering from light sensitivity following concussion with specially-designed hardware, allowing individuals to lead their daily lives more actively, productively, and happily.

Even though the Iris Monitor was developed and tested specifically with post-concussion symptoms in mind, its solution to address light sensitivity will be broadly effective at assisting individuals with light sensitivity, broadly. Light sensitivity is a widely pervasive symptom of many conditions such as computer vision syndrome and ADD. Perhaps most prominently, light sensitivity greatly affects people who suffer from chronic migraines. Nearly 80% of all individuals who suffer from migraines report strong light sensitivity symptoms, as flashing or glaring lights can exacerbate or even trigger migraine symptoms in this segment of the population. These additional populations affected by light sensitivity could also benefit from using the Iris Monitor.

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