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EST. 1939 VOLUME 79 NUMBER 2

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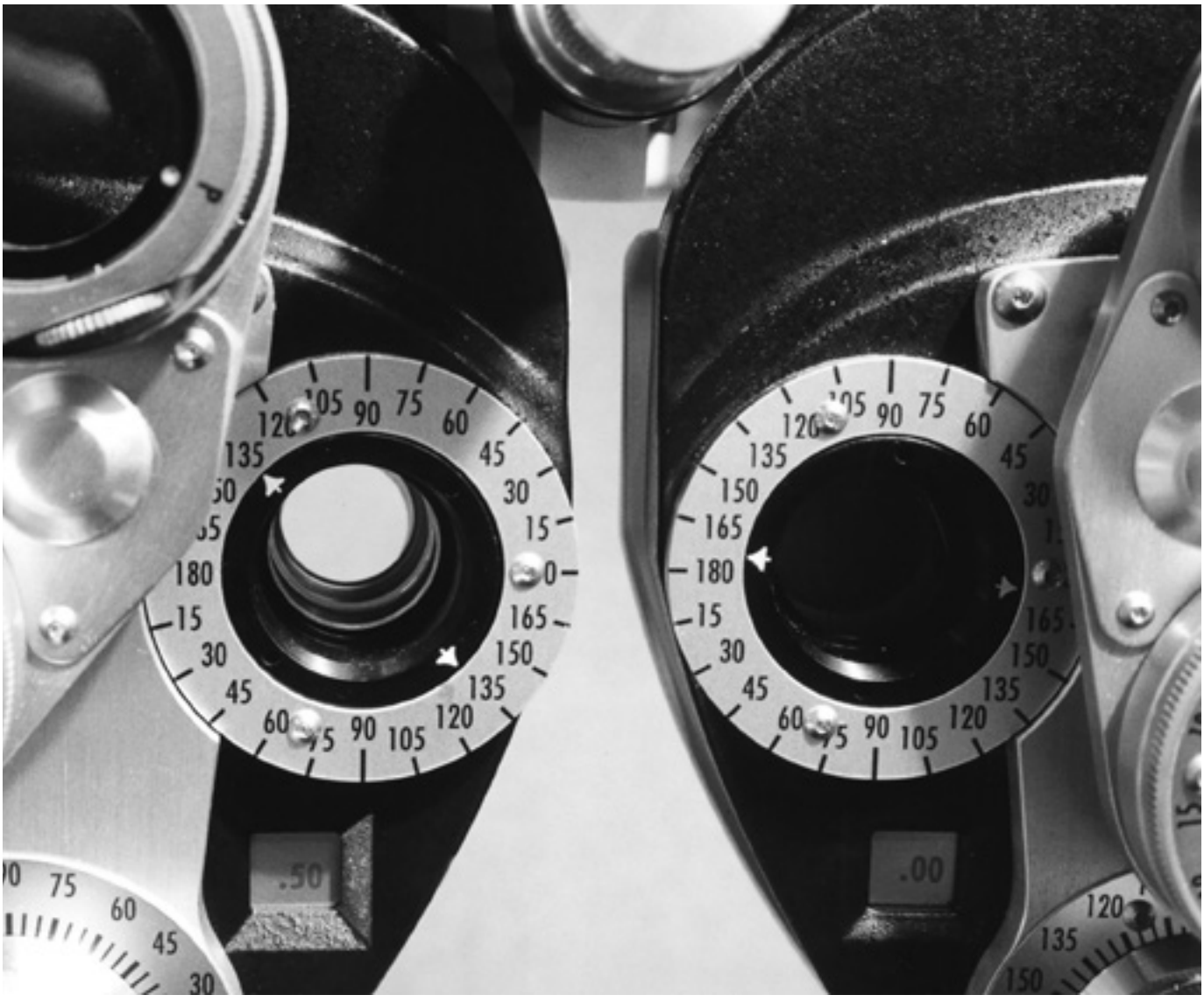

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B. Ralph Chou, MSc, OD, FAAO
Editor-in-Chief/Rédacteur en chef

The reappearance of the UV index in Canadian weather forecasts heralds the beginning of the summer season of outdoor activities. This year, the Canadian Dermatology Association (CDA) has declared June 5 to 11 "Sun Awareness Week", during which it will jointly issue public service announcements with the Canadian Ophthalmological Society (COS) reminding the Canadian public to protect their eyes and skin from damaging solar UV radiation. There is also a website devoted to sun protection for outdoor workers (sunsafetyatwork.ca).

Canadian Optometry has not been left out of the loop. In late April 2017, Canadian optometrists participated in a workshop on UV protection for millennials in Ottawa. This followed participation in a National Steering Committee for Consensus on Content for Sun Safety Messages. The Steering Committee published a paper in the Canadian Journal of Public Health in 2016, which laid out the consensus on sun safety messaging and the process used to get there.

Dr. Ben Giddens, who was the OAO representative, provides a review of the facts on sun safety and the eyes. Although Canadians protect themselves from solar UV radiation in the summer, they really should do this all year. Dr. Giddens reminds us that solar UV radiation isn't only dangerous to the eyes and skin when summer skies are clear. Skiers have tanned or sunburned faces after a day on the slopes, and photochromic lenses activate under cloudy skies for a reason.

Also in this issue you will find the abstracts for the poster session at this year's CAO Congress. The posters reflect the wide range of today's optometric research. I hope to see many of you at the posters. ●

Le retour de l'indice UV dans les bulletins de météo canadiens annonce le début de la saison estivale des activités en plein air. Cette année, l'Association canadienne de dermatologie (ACD) a déclaré la semaine du 5 au 11 juin « Semaine de la prudence au soleil », au cours de laquelle elle publiera des communiqués d'intérêt public de concert avec la Société canadienne d'ophtalmologie (SCO) afin de rappeler aux Canadiens qu'ils doivent protéger leurs yeux et leur peau contre les rayons solaires UV dangereux. Il y a également un site Web consacré à la protection solaire pour les personnes qui travaillent à l'extérieur (sunsafetyatwork.ca).

Le milieu de l'optométrie canadien n'est pas resté à l'écart. À la fin du mois d'avril 2017, les optométristes canadiens ont participé à un atelier sur la protection contre les UV pour la génération Y à Ottawa. Cette participation faisait suite à un engagement au sein d'un comité directeur national dont l'objectif était de parvenir à un consensus sur le contenu des messages portant sur la protection solaire. En 2016, ce comité a publié dans la Revue canadienne de santé publique un article qui présentait ce consensus et le processus ayant permis d'arriver à celui-ci.

Le D[r] Ben Giddens, qui représentait l'Association des optométristes de l'Ontario (AOO) au sein du comité, passe en revue les faits sur la protection solaire et les yeux. Les Canadiens se protègent contre les rayons solaires UV en été, mais ils devraient le faire toute l'année durant. Le D[r] Giddens nous rappelle que les rayons solaires UV ne sont pas seulement dangereux pour les yeux et la peau en été lorsque le ciel est dégagé. On peut voir le bronzage – les coups de soleil même – sur les visages des skieurs après une journée sur les pentes; et ce n'est pas sans raison que les lentilles photochromiques s'activent sous des ciels couverts.

Vous trouverez également dans ce numéro les résumés pour la séance d'affiches du congrès de l'ACO de cette année. Les affiches reflètent la grande variété de sujets sur lesquels les chercheurs en optométrie se penchent en ce moment. J'espère vous voir nombreux à cette séance. ●

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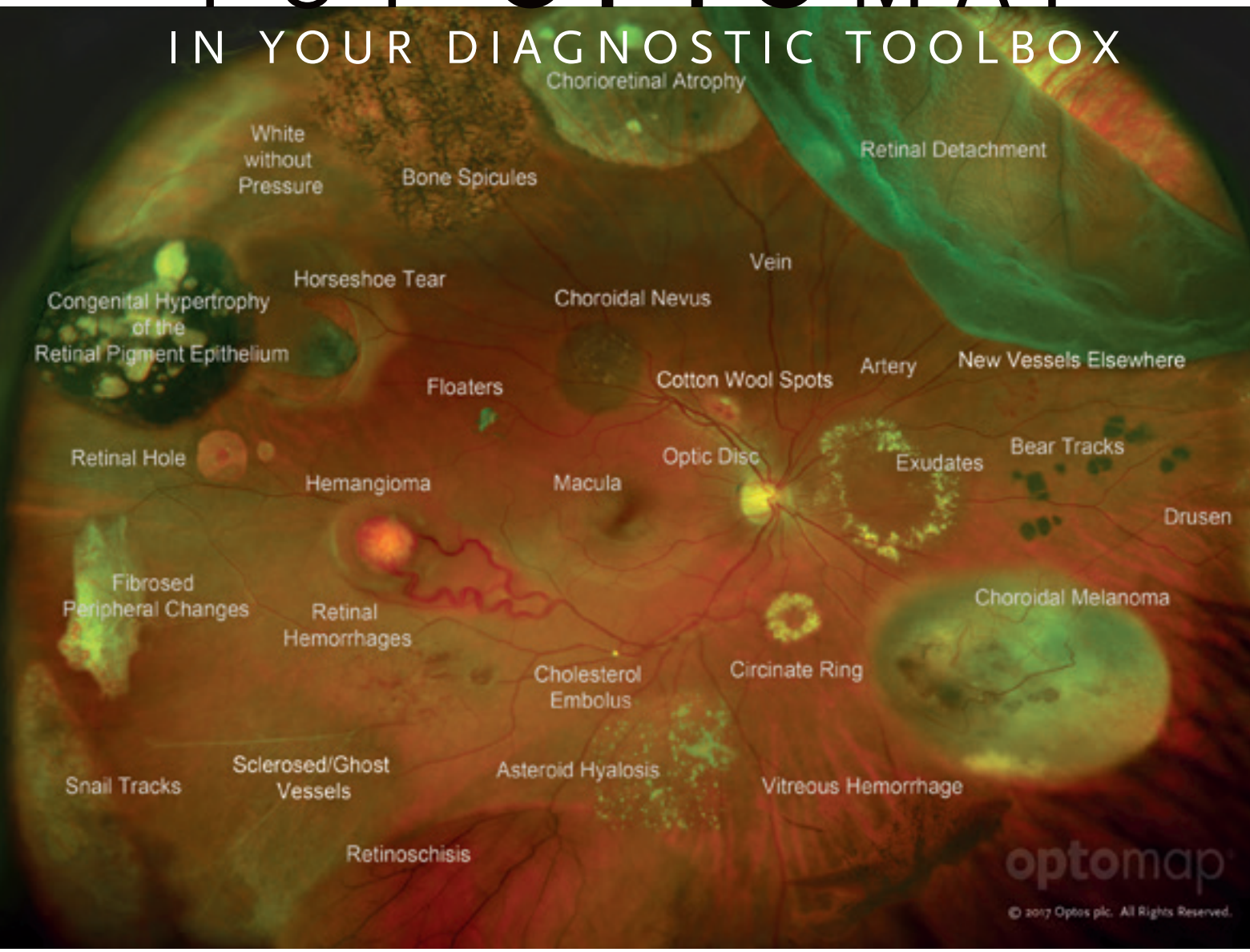

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Sun Safety and the Eyes

Ben Giddens BSc, OD
Optometrist
Family Eye Care Services

Abstract

The profession of optometry has a duty to advise the public about the short- and long-term adverse ocular effects of ultraviolet exposure, and the lifelong protective measures that should be adopted. This paper describes the most common ocular sequelae of, and provides a contemporary understanding of the mechanisms behind, ultraviolet damage. Emphasis is placed on how the eye and eyelids differ from the skin in terms of why and when the eye needs protection.

PURPOSE

Exposure to solar ultraviolet radiation (UVR) can harm the skin, eyes and immune system.[1,2] Although the public should be encouraged to take measures to protect itself from UVR, such measures were last reviewed for consensus by all the relevant health care providers and public health officials in Canada in 1994. As a result, the "National Steering Committee for Consensus on Content for Sun Safety Messages" was formed with the mandate of promoting sun safety to the public. The Committee invited a team of national representatives to establish a common understanding of the science of sun and UVR damage and to provide succinct messaging about UVR protection that all of the participants could accept. Cancer Care Ontario asked the Ontario Association of Optometrists (OAO) to participate, and OAO acted as a national representative for the profession of optometry. In February, 2016, the final consensus statement manuscript was sent to the Canadian Journal of Public Health.

This process led to an awareness that optometry in Canada needs to play a bigger role in promoting sun safety for the eye, beyond the scope of the national consensus statements. This paper aims to present background science and research about the mechanism of ocular and periocular UVR damage to assist primary care optometrists in dispensing sound advice to patients.

In Canada, we do enjoy our sunny days and, as optometrists, casual conversation with our patients usually touches on the weather. However, we don't often discuss the potential harm of UVR, evidence of sun damage to our patients' eyes, or lifelong protective measures to adopt. As a rule, optometrists should habitually discuss these matters with our patients.

WHAT IS UV?

The broader electromagnetic spectrum includes the visible spectrum, which ranges from shorter-wavelength blue light (beginning at around 400nm) to longer-wavelength red light (ending at around 700nm). The wavelength bandwidths of UVR are commonly specified as 220 to 280nm for UVC, 280 to 320nm for UVB and 320 to 380nm for UVA. The World Health Organization (WHO), European Council of Optometry (ECO) and others have adopted 400nm as the upper level of UVA (TS UV EP).[1] The UV that reaches the Earth's surface is comprised of about 95% UVA and 5%UVB. UVC is effectively filtered by the atmosphere, and is not considered a threat to the skin or the eyes because the recognition of stratospheric ozone depletion in the 1980's led to a ban of ozone-depleting substances.[3] Without this ban, it has been estimated that UV indices of 30 (see below) would have been recorded by the year 2060.[4] Although the ozone layer is on track to recovery, estimates vary as to how long this will take, and we are currently still exposed to higher levels of UVB then pre-ozone-depletion.[5]

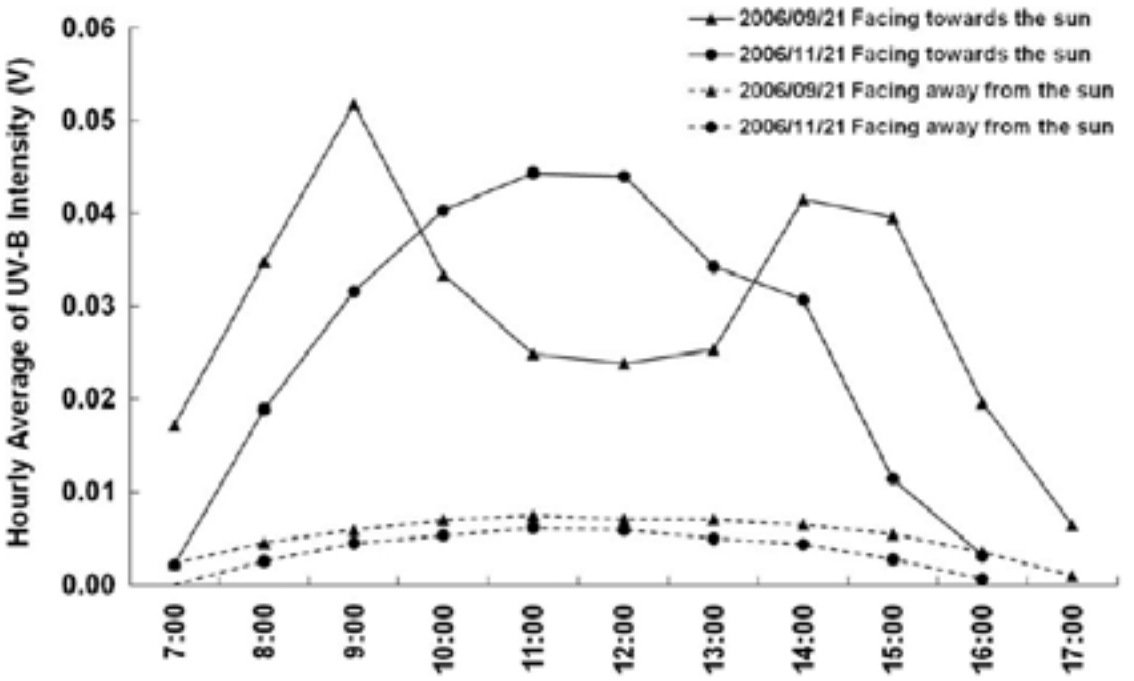
The UV index is used as a daily measure of the UV hazard in Canada. This index is based on the minimal erythema dose (MED) that produces a just-noticeable erythema (reddening) of the skin. Although skin sensitivity varies with skin pigmentation when the UV index is 3 or less, the average Caucasian will have a MED time of about 1 hour. For a UV index of 10, the MED time drops to about 15 minutes.

HOW DOES UV REACH THE EYE?

Since people typically don't look directly at the sun, there has been some discussion as to whether the UV index is a useful guideline for determining ocular risk due to solar radiation on any given day. Sasaki et al.[6] demonstrated that the UV index is not accurate for assessing potential damage to the eye, and that sun protection is probably needed over more hours in a day for the eye than for the skin.

Sasaki used cranial mannequins with embedded sensors and measured the UVB dose from sunrise to sunset on Sept 21st and Nov 21st, 2006. The mannequin heads were maintained in a walking posture, but were moved throughout the day so that they faced (but did not look directly at) the sun as it arced from east to west. The study was done in Japan at a latitude of 36 degrees, whereas Canada's southern border varies from 43 degrees in Ontario, to the 49th parallel, in Western Canada. The study concluded that, for most of the year, the peak exposure time for the eye was between 8 and 10am and 2 and 4pm, not when the sun is at its zenith and UVB is at its maximum (Figure 1). The study also showed that from fall to winter, although the total UV exposure for a flat, horizontal surface drops by 29%, the exposure for the eye drops by only 8%.[6]

Figure 1: *Hourly average of UVB intensity (in Volts) in the central eye when facing towards and away from the sun. From Sasaki et al. 2011 (Ref. 6).*



The sky appears to be blue because blue light is selectively scattered by the atmosphere (Rayleigh scattering). Shorter wavelengths of UVR are more strongly scattered by the atmosphere, and the eye is exposed to varying degrees of UVR from all directions. In fact, more UV reaches the eye from scattered sunlight than from direct sunlight.[7] It is possible to sit in the shade of a tree all day and still exceed a safe amount of (indirect) exposure.[8] Remember, if someone sits in the shade but can still see blue sky, UVR is reaching their eyes. The sense of protection from direct

shade is probably due to the drop in heat. Long-wavelength infrared radiation provides radiant heat, since it comes directly from the sun and does not scatter in the atmosphere as does UV, so people can develop a false sense of safety when they step into the shade. Sliney offered a good way to think about UV exposure: "If one could see only in the UV-B spectrum, a clear sunny sky would appear to be a sun barely visible through a very heavy fog or haze."[7]

Although thick cloud cover can attenuate solar UVB, scattering from the sides of cumulus clouds close to the solar disk can enhance UV exposure by up to 20%.[9] In addition, clouds near the horizon opposite the sun can reflect UV and increase the total exposure to a level higher of UV than if the sky was clear.[10] The influence of clouds on UV is still an important area of study. The amount, height, type and thickness of clouds and their effects on UVA versus UVB are all variables that can either enhance ocular risk or diminish it to almost zero.[11,12]

Reflected UV can be particularly hazardous to the eye in some environments. For example, fresh snow is very reflective of UVB. A study of UVB reflectance at a variety of American locations around the 40th parallel demonstrated that fresh snowfall can reflect between 50 and 80% of the incident UVB. A study in New Zealand at the 45th southern parallel showed that the enhancement of UVB irradiance in midwinter from snow reflectance can exceed 30%.[13] Sand can reflect between 8 and 18% of UVB and concrete paving, wooden walkways and water also enhance the ambient UVB.[10] The relevance of reflectance always needs to be considered with respect to the posture of the eye. As an example, people usually do not get photokeratitis while sunbathing despite the fact that the minimal dose of UVR required to cause photokeratitis is less than that required to cause a sunburn.[10] However, when an individual walks along while looking at the ground in front of them, the reflected UV does more ocular damage than the sun directly above.

If the surrounding landscape is flat and treeless, the eye will be exposed to much more UVR from the sky above the horizon than if the landscape had buildings, trees, or other geographical features that obscured the sky,[10] which suggests that people who live on the Canadian prairie need more UVR protection for their eyes on sunny winter days.

AREAS OF DAMAGE

Spectral energy increases exponentially as the wavelength decreases: the potential for tissue damage with exposure to UVR of 300nm is 600X that at 325nm.[14] Similarly, visible blue light has more potential for harm than visible red light. We recently provided evidence of damage to the skin and retina at wavelengths in the visible spectrum up to 490nm.[15-17]

SKIN

How does damage to the skin occur? DNA readily absorbs the higher energy of UVB; this causes direct and instant structural alterations.[18] UVB is the cause of sunburns and was previously faulted as the main cause of skin cancer. It is now accepted that longer-wavelength UVA is also mutagenic, and research at Yale may have recently identified the mechanism. About half of the DNA alterations due to UV exposure were shown to be caused by energetic by-products of chemical chain reactions occurring in melanocytes that absorb UVA.[19,20] Clearly, we need protection from both UVA and UVB.

The most superficial layer of the skin (epidermis) is comprised of several layers of squamous cells. The junction between the epidermis and deeper dermis is comprised of a layer of basal cells separated by occasional melanocyte cells. The cancers that can occur in these cells are named according to the cells in which they originate: melanomas are much more life threatening than squamous (SCC) or basal cell carcinomas (BCC).

Skin cancer is the most common cancer in Canada, with approximately 6500 cases of malignant melanoma and 76,000 cases of non-melanoma diagnosed in 2014.[21] These figures are approximately equivalent to the number of lung, breast, colorectal and prostate cancers combined. It is estimated that 64% of melanoma and 90% of non-melanoma skin cancer is caused by UV damage.[22,23] Even though skin cancer is one of the most preventable cancers, the incidence of melanoma in Canada is increasing: from 1986 to 2010, the incidence rose by 2% per year in men and 1.5% per year in women.[21]

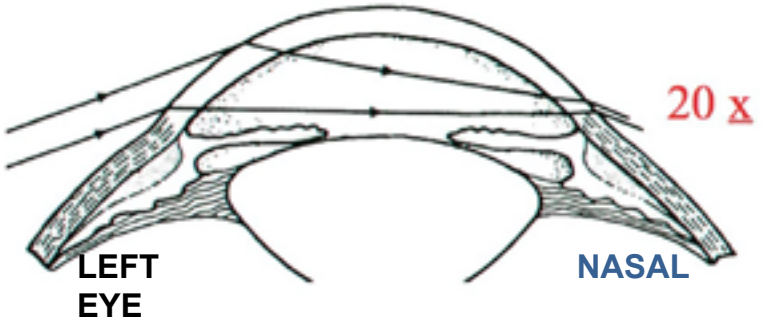
Both melanoma and non- melanoma (NMM) cancers are found on the eyelids; indeed, it is commonly stated that 5-10% of total skin cancers are found on the eyelid .[24] In 2011, 6.5% of all BCC and 1.3% of all SCC diagnosed in Canada were found on the eyelid.[21] In addition, more than 50% of NMM were found from the neck up. It is clear that a proper hat and UV protective eyewear are necessary beginning at an early age.

OCULAR SURFACE INVOLVEMENT

Pterygia

Chronic UV damage to the ocular surface is most commonly seen in the form of pterygia, whereas acute trauma comes in the form of welder's flash and snow blindness from UVB exposure. Coroneo deserves most of the credit for explaining the peripheral light focusing (PLF) effect, also known as the Coroneo effect (Figure 2).[25] UV light incident on the temporal cornea will focus through the anterior chamber onto the internal basal stem cells of the nasal limbus, increasing in intensity by approximately 20-fold. Direct sunlight would not otherwise be able to reach these deeper stem cells because it would be blocked by the superior limbal cells.[25-27] Coroneo postulated that UV-damaged basal stem cells could form several types of new cells that could cross the limbal barrier and invade the cornea. He and others have subsequently produced a large volume of research aiming to establish the pathogenic mechanism by which epithelial cells then become involved in the fibrosis, angiogenesis and hyperplasia characteristic of pterygia.[25] Due to the tumour-like features of pterygia, a histopathological study of 100 excised pterygia was performed. The analysis provided evidence that pterygium is a disease of stem cells and also showed that pre-neoplastic disease such as primary acquired melanosis and ocular surface squamous neoplasia can co-exist with pterygia. The authors concluded that all excised pterygia should be subjected to histological evaluation.[28]

Figure 2: *From Coroneo 2011 (Ref. 25).*



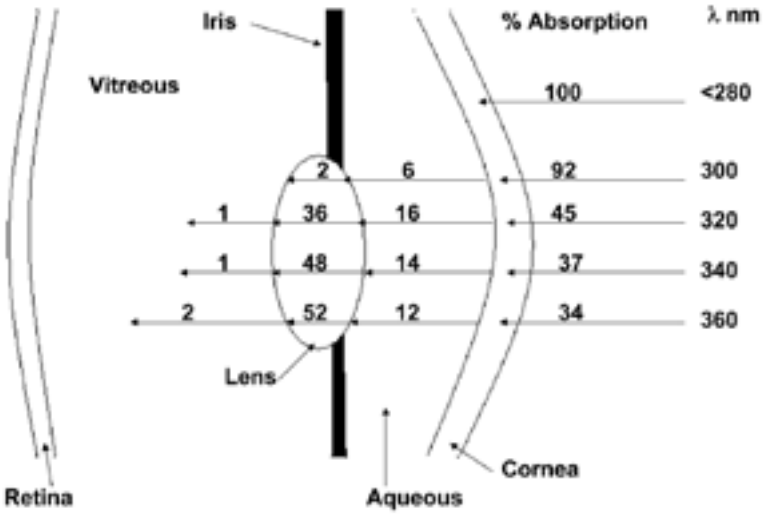
Pinguecula

Although pinguecula are believed to be associated with UVR exposure, a causal relationship has not been established.[2] An important study of people who worked on the water of Chesapeake Bay in Maryland showed a clear association between UVR exposure and an increased risk of pterygium and climatic droplet keratopathy, but only a weak association with pinguecula.[29] However, the known traits of elastoplasia and elastodystrophy found in pterygium and sun-induced skin damage are also found in pinguecula.[30]

Cornea

The human cornea transmits all of the visible wavelengths of the EMR spectrum, but absorbs most of the shorter-wavelength UVB and essentially 100% of UVC.[3] This absorption can lead to two different types of corneal response to UVR (Figure 3).[31] Photo-keratitis is a superficial punctate keratopathy that is due to acute exposure to UVB. Also known as snow-blindness, it usually occurs after excessive exposure to UVB; while skiing, at altitude, or at the beach. Climatic droplet keratopathy is more commonly associated with chronic UVA and UVB exposure. Although it is more commonly seen in the tropics, it is also encountered in the Canadian Arctic where people are exposed to high levels of reflected UV.[3 32]

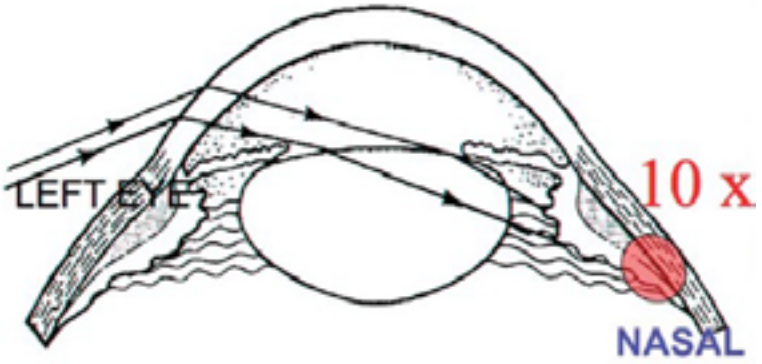
Figure 3: *From Lucas 2011 (Ref. 31).*



Cataract

The most common cataract seen by optometrists is the age-related nuclear sclerotic cataract (ARN). It begins as a yellowing of the lens and ultimately develops a darker smoky appearance that necessitates surgery. Although it is generally accepted that ARN cataracts are caused by oxidation of the lens, the role of UVR in enhancing progression is more speculative. After people reach middle age, a naturally occurring lenticular pigment is slowly converted into xanthurenic acid, which then begins to absorb UVR and forms harmful oxidative particles. At the same time, there is an age-related decrease in the production of anti-oxidant groups that allows lens proteins to become more damaged, causing further clouding of the lens.[33-35] It is well accepted that cortical cataract is caused by UVR exposure. The Coroneo effect, which was established to demonstrate the formation of pterygia, also helps explain the common location of inferior-nasal cortical cataracts (Figure 4).[25] Temporal UV exposure, from a different angle than that which causes pterygium, enables the cornea to focus the UVR through the pupil and onto the inferior-nasal equatorial cells of the human lens. The equatorial region is the germinative area of the lens which likely results in the spoke-shaped cataract.[25,36]

Figure 4: *From Coroneo 2011 (Ref. 25).*



Age-Related Macular Degeneration (AMD)

The initiation and progression of AMD are associated with genetic and environmental risk factors including age, cigarette smoking, white race, female gender, blue iris colour, obesity, nutritional factors and insufficient antioxidants in the diet.[37] A review of 465 articles by Sui et al. in 2012 concerning the association between AMD and sunlight exposure indicated that some individuals with higher levels of sunlight exposure are at a significantly increased risk of AMD.[38] Aging of the retinal pigment epithelial (RPE) cells and Bruch's membrane, impaired blood flow in the choriocapillaris and retinal exposure to UV and blue light have all been implicated in the process of degeneration.[39-41] The loss of RPE cells seems to lie at the core of AMD progression. RPE cells play a vital role in controlling inflammation caused by oxidative stress from various sources including constant exposure to light stimuli.[2 42] Blue light has been shown to be the portion of the visible light spectrum that causes the most photochemical damage in animal RPE cells.[2] There are different types of oxidative particles that are collectively known as reactive oxygen species (ROS).[37 39] The aerobic functioning of all human cells involves the production of ROS, but the retina is especially prone to the generation of ROS due to the high partial pressure of oxygen and exposure to UV and blue light.[37] Under normal circumstances, the retina responds to oxidative stress in part by increasing the production of antioxidants and breaking-down damaged proteins (proteolysis). If this system is overwhelmed, detrimental products such as intracellular lipofuscin and extracellular drusen can start to accumulate and cause visible evidence of AMD.[43]

There is widespread support in the literature that UV and high-energy visible blue light are phototoxic to the retina and contribute to the detrimental process of AMD. However, UV exposure is not strongly touted as a primary cause of AMD because the yellowing of the aging crystalline lens blocks almost all UV transmission and optometrists usually see patients with AMD beyond middle age. A generally accepted figure in the literature is that the human lens will transmit 75% of near-UV light (300 to 400nm) until the age of 10, but by age 25, yellowing of the human lens will reduce the transmittance to 10%.[44] Although the human lens still transmits most of the visible blue light (400 to 500nm) at these ages, there is much greater absorbance with the elderly lens.[33 44] We need to remind ourselves that AMD is usually a slowly progressive disease and generally takes decades before becoming visually disabling. Clearly, the maximum AMD-protective benefit of wearing UV-absorbing and visible blue light-blocking lenses begins in youth and diminishes with age.

A generally accepted figure in the literature is that up until the age of 10, the human lens will transmit 75% of near-UV light (300-400nm), but by age 25, yellowing of the human lens will reduce the transmittance to 10%.[44]

Uveal Melanoma

There is some evidence in the epidemiological literature that UV exposure may be a factor in primary malignant intraocular tumours in adults, although attempts to link outdoor work and chronic UV exposure to the development of uveal melanoma have been inconclusive.[45-50] However, it has been shown that the carcinogenic effect of UV light on children, which can cause cutaneous melanoma, may be more important than that in adulthood.[51] The relevant association is that the pathogenesis of uveal melanoma may be the same as that of cutaneous melanoma.

Eye Protection Considerations

All optometrists in Canada recognize the need for ocular UVR protection, and we need to address this issue routinely with our patients. Although many spectacle lens materials and coatings provide adequate UV blocking, a consideration of the frame in which the lenses will be mounted is also important. The work of Coroneo in demonstrating the damage caused by peripheral light coupled with the human tendency to turn away from the sun's direct rays tells us that we should attempt to fit our patients with close-fitting wrap-around frames as much as possible (Figure 5).[52]

Figure 5: *Close fitting wrap around frames*

K. Clok (2012) Risk of UV exposure with spectacle lenses.

In addition to direct UV striking the eye from peripheral directions there is also a concern about the reflectance of UV from the back surface of lenses that do not wrap the face form and/or sit too far away from the eye. While clear lenses without an anti-reflective coating will reflect 4-6% of UVA and UVB from the back lens surface, lenses with anti-reflective coatings will reflect an average of 25% of most UV wavelengths.[53] This knowledge led Essilor SA (France) to develop and trademark E-SPF™. E-SPF provides a measure of the UV between 280 and 380nm that is transmitted directly through a lens plus the amount reflected from the lens back surface at an angle of 145 degrees:

$$E - SPF = \frac{1}{\tau UVO^{\circ} + Ruv145^{\circ}}$$

For example, an E-SPF of 7 represents a low level of protection and an E-SPF of 50 represents a high level of protection.[14] E-SPF refers only to the property of the lens and coating and does not take away the need for proper frame-fitting.

The same consideration regarding frame fit characteristics applies to pre-manufactured non-prescription sunglasses. Large frames with a wrap that are close-fitting provide the best protection. Canada does not have its own transmittance safety standard for sunglasses, and thus the American National Standard Institute (ANSI) Z80.3 label is seen most often: Class I lenses absorb at least 90% of UVA and 99% of UVB, while Class II lenses block at least 70% of UVA and 95% of UVB.[54] Packaging or labelling should be checked before dispensing any product to patients while remaining mindful that a significant amount of UV can reach the eye without passing directly through the lenses.[55,56]

UV-blocking contact lenses offer good protection for the eye and should always be considered, especially for young patients who are more vulnerable to ocular UV damage, and for those engaged in outdoor activities. Of course, sunglasses would still be needed to protect the skin around the eye but at least the eye itself would have all-day protection while the contact lens is being worn.

OCULAR UV PROTECTION MESSAGE FOR THE PUBLIC

This article previously noted that the Sun Safety Committee sent a final document to the Canadian Journal of Public Health. The primary recommended protective action statements included comments about the UV index being highest between 11 am and 3 pm and that this was the time for maximum skin protection. Despite the urging of the eye care sub-committee representing optometry, ophthalmology, CNIB and other fields, a similar emphasis was not placed on the message that the eye and periocular tissue are most at risk outside these hours.

The American Cancer Society has provided the following statement:
"Ideally, all types of eyewear, including prescription glasses and contact lenses, should protect against UV rays. Some contact lenses are now made to block most UV rays. But, because they don't cover the whole eye and surrounding areas, they are not sufficient eye protection when used alone."[57]

This Cancer Council Australia has provided the following statement:
"UV radiation exposure to the eyes is dependent on a number of factors and is not closely correlated to ambient UV levels and the UV index. Cancer Council Australia recommends protecting the eyes from UV at all times when outdoors during daylight hours."[58]

As primary eye care providers, optometrists need to routinely advocate for better UVR protection for their patients' eyes. We see the deleterious effects of UV exposure and it is up to us to spread the message that the eye is at greater hazard throughout the day than the public would perceive from UV index messaging alone.

The eye care sub-committee as a whole suggested the following broad recommendation: "Under normal daylight conditions, wear sunglasses or prescription eyeglasses with UV-protective lenses when outdoors all year round." Although this recommendation was not included in the final submission to the Journal of Public Health, something to this effect should be endorsed by provincial and national optometry associations, including the Canadian Association of Optometrists (CAO), and embraced by all of its members.

A final and telling observation that deserves consideration is that, of all the children who walk to and from school each day, rarely will a child wear sunglasses during this time. If this group is the most vulnerable due to their age and the time of day they are out walking, then there is much more work to do to protect them. ●

Perhaps one reason that we don't see sunglasses on children and teens more often in Canada is that the ill effects of UV exposure are viewed as an adult disorder, whereas we know that it is a cumulative problem that begins with childhood exposure.

Another reason might be that sunglasses are perceived as merely an expensive status symbol, and parents don't want to encourage consumerism in their children.

To promote the more widespread use of sunglasses, especially within the younger population, it would help if optometrists were to source and provide affordable yet fashionable sunglasses.

If there are any statements within the body of this article that you feel might resonate within your patient population, please feel free to cite them as a quote from the CJO and hang it on your office wall for the public to see.

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La protection solaire et les yeux

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Résumé

La profession optométrique doit informer le public au sujet des effets oculaires indésirables à court et à long termes de l'exposition aux rayons ultraviolets et des mesures de protection qu'il faut prendre durant toute la vie. Cette communication décrit les séquelles oculaires les plus courantes des dommages causés par les rayons ultraviolets et présente une compréhension moderne des mécanismes qui les sous-tendent. On insiste sur la différence entre l'œil et les paupières, d'une part, et la peau, de l'autre, lorsqu'il s'agit de déterminer pourquoi et quand il faut se protéger les yeux.

OBJET

L'exposition aux rayons ultraviolets (RUV) solaires peut causer du tort à la peau, aux yeux et au système immunitaire[1,2]. Même s'il faut encourager la population à se protéger contre les RUV, les fournisseurs de soins de santé compétents et les dirigeants de la santé publique au Canada ont revu ces mesures la dernière fois en 1994 pour dégager un consensus. C'est pourquoi le « Comité directeur national pour un consensus sur le contenu des messages relatifs à la protection solaire » a été chargé de promouvoir la protection solaire auprès de la population. Le Comité a invité une équipe de représentants nationaux à dégager une compréhension commune des connaissances scientifiques sur le soleil et les dommages causés par les RUV et à produire, au sujet de la protection contre les RUV, des messages succincts que tous les participants pourraient accepter. Action Cancer Ontario a demandé à l'Association des optométristes de l'Ontario (AOO) de participer et celleci a joué le rôle de représentante nationale de la profession optométrique. En février 2016, la version finale du manuscrit de l'énoncé de consensus a été envoyée à la Revue canadienne de santé publique.

Cet exercice a fait comprendre que l'optométrie au Canada doit jouer, dans la promotion de la protection solaire pour l'œil, un rôle plus important qui dépasse la portée des énoncés de consensus nationaux. Cette communication vise à présenter des données scientifiques de base et des recherches portant sur le mécanisme des dommages oculaires et péri-oculaires causés par les RUV afin d'aider les optométristes de premier recours à donner des conseils judicieux à leurs patients.

Au Canada, nous aimons bien nous jours ensoleillés et comme optométristes, les échanges que nous avons avec nos patients portent habituellement sur la température. Or, nous ne discutons pas souvent des méfaits que peuvent causer les RUV, des signes des dommages causés par le soleil aux yeux de nos patients ou des mesures de protection à adopter pour toute la vie. En règle générale, les optométristes devraient habituellement discuter de ces questions avec leurs patients.

QUE SONT LES UV?

Le spectre électromagnétique général inclut le spectre visible , qui s'étend de la lumière bleue à longueur d'onde plus courte (à compter de 400 nm environ) à la lumière rouge de longueur d'onde plus longue (jusqu'à 700 nm environ). Les largeurs de bande des longueurs d'onde des RUV se situent habituellement entre 220 et 280 nm dans le cas des UVC, de 280 à 320 nm dans celui des UVB et de 320 à 380 nm dans celui des UVA. L'Organisation mondiale de la Santé (OMS), le Conseil européen pour l'optométrie (CEO) et d'autres entités ont adopté 400 nm comme limite supérieure des UVA (TS UV EP)[1]. Les UV qui parviennent à la surface de la Terre sont constitués à quelque 95 % de UVA et à 5 % de UVB. Les UVC sont en fait filtrés par l'atmosphère et ne sont pas considérés comme une menace pour la peau ou les yeux parce que la reconnaissance de l'appauvrissement de la couche d'ozone stratosphérique au cours de la décennie 1980 a entraîné une interdiction des substances appauvrissant l'ozone[3]. Sans ces interdictions, on a calculé que l'on aurait enregistré des indices UV de 30 (voir cidessous) en 2060[4]. Même si la couche d'ozone est en train de se rétablir, les estimations relatives au temps qu'il lui faudra varient et nous sommes toujours exposés à des concentrations plus élevées d'UVB qu'avant l'appauvrissement de la couche d'ozone[5].

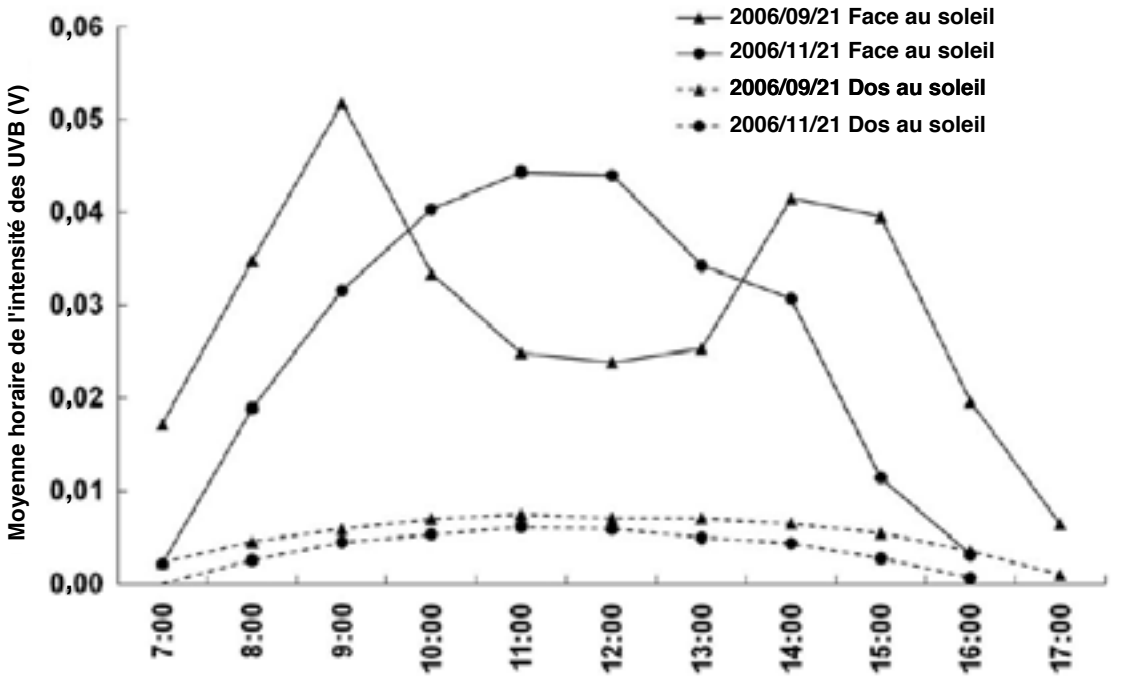
L'indice UV constitue une mesure quotidienne du danger posé par les UV au Canada. Cet indice repose sur le seuil d'érythème minimum (SEM) qui produit un érythème (rougissement) à peine perceptible de la peau. Même si la sensibilité de la peau varie en fonction de sa pigmentation lorsque l'indice UV est de 3 ou moins, il faut environ une heure pour atteindre le seuil d'érythème chez le blanc moyen. Lorsque l'indice UV atteint 10, le temps tombe à 15 minutes environ.

COMMENT LES UV PARVIENNENTILS À L'ŒIL?

Comme on ne regarde habituellement pas le soleil directement, on s'est demandé si l'indice UV est utile pour déterminer le risque oculaire posé par les rayons solaires un jour donné. Sasaki et coll.[6] ont démontré que l'indice UV n'est pas exact lorsqu'il s'agit d'évaluer les dommages que peut subir l'œil et qu'une protection solaire s'impose probablement pendant plus d'heures par jour pour l'œil que pour la peau.

Sasaki a utilisé des crânes de mannequins dotés de capteurs intégrés et a mesuré la dose de rayons UVB du lever au coucher du soleil le 21 septembre et le 21 novembre 2006. Les têtes des mannequins étaient maintenues en position marche, mais on les a déplacées tout au long de la journée afin qu'elles soient face au soleil (sans le regarder directement) à mesure qu'il passait de l'est à l'ouest. L'étude a été réalisée au Japon, à une latitude de 36 degrés, alors que celle de la frontière sud du Canada varie de 43 degrés en Ontario au 49e parallèle dans l'Ouest du Canada. L'étude a conclu que pendant la majeure partie de l'année, l'œil est le plus exposé entre 8 h et 10 h et entre 14 h et 16 h et non lorsque le soleil se trouve à son zénith et que les rayons UVB atteignent leur maximum (Figure 1). L'étude a aussi montré que de l'automne à l'hiver, même si l'exposition aux UV causée par une surface horizontale plate diminue de 29 %, l'exposition de l'œil baisse de 8 % seulement[6].

Figure 1: *Intensité moyenne horaire des UVB au centre de l'œil face au soleil et dos au soleil. Unités en volts. Tiré de Sasaki et coll. 2011 UV-B exposure to the Eye depending of solar Altitude*



Le ciel a l'air bleu parce que l'atmosphère diffuse sélectivement la lumière bleue (diffusion de Rayleigh). L'atmosphère diffuse davantage les longueurs d'onde plus courtes des RUV et l'œil est exposé à des degrés variables de RUV prove-

nant de toutes les directions. Les rayons UV qui atteignent l'œil proviennent en fait plus de la lumière du soleil diffusée que de la lumière du soleil directe[7]. Il est possible de rester toute la journée à l'ombre et de dépasser quand même une exposition (indirecte) sécuritaire[8]. Il ne faut pas oublier que si une personne assise à l'ombre d'un arbre peut quand même voir le ciel bleu, les RUV parviennent à ses yeux. La sensation de protection qu'offre l'ombre directe est probablement attribuable à la baisse de la chaleur. Les rayons infrarouges à longueur d'onde longue produisent une chaleur rayonnante puisqu'ils proviennent directement du soleil et ne sont pas diffusés dans l'atmosphère comme les rayons UV. C'est pourquoi l'ombre donne un faux sentiment de sécurité. Sliney a formulé une bonne façon de penser à l'exposition aux rayons UV : « Si l'on pouvait voir seulement dans le spectre des UVB, le ciel ensoleillé clair ressemblerait à un soleil à peine visible à travers une brume ou un brouillard très épais »[7].

Même si une couche nuageuse épaisse peut atténuer les rayons UVB provenant du soleil, la diffusion produite par les côtés des cumulus qui se trouvent à proximité du disque solaire peut augmenter de jusqu'à 20 % l'exposition aux rayons UV[9]. En outre, il se peut que les nuages à l'horizon qui font face au soleil reflètent les rayons UV et portent l'exposition totale aux UV à un niveau plus élevé que si le ciel était clair[10]. L'influence des nuages sur les rayons UV demeure un domaine d'étude important. Le volume, la hauteur, le type et l'épaisseur des nuages et leur effet sur les rayons UVA par rapport aux rayons UVB sont tous des variables qui peuvent accroître le risque oculaire ou le faire tomber à presque zéro[11,12].

Les rayons UV réfléchis peuvent être particulièrement dangereux pour l'œil dans certains environnements. La neige fraîche, par exemple, reflète énormément les rayons UVB. Une étude de la réflectance des UVB effectuée à divers endroits aux États-Unis situés aux environ du 40e parallèle a démontré qu'une neige fraîche peut refléter de 50 à 80 % des rayons UVB incidents. Une étude réalisée en Nouvelle-Zélande, au niveau du 45e parallèle sud, a révélé qu'au milieu de l'hiver, la réflectance de la neige peut faire grimper de plus de 30 % l'irradiation par les UVB[13]. Le sable peut refléter de 8 à 18 % des UVB et le béton, les trottoirs en bois et l'eau peuvent aussi accroître les UVB ambiants[10]. Il faut toujours tenir compte de la pertinence de la réflectance en ce qui concerne la position de l'œil. Par exemple, le bronzage n'entraîne pas habituellement l'apparition d'une photokératite même si la dose minimale de RUV nécessaire pour causer une photokératite est inférieure à celle qui cause un coup de soleil[10]. Lorsqu'une personne marche en regardant le sol devant elle, les UV réfléchis causent toutefois plus de dommages oculaires que le soleil qui se trouve directement audessus d'elle.

Si le paysage environnant est plat et dénudé, l'œil sera exposé à beaucoup plus de RUV provenant du ciel audessus de l'horizon que s'il y avait des édifices, des arbres et d'autres caractéristiques géographiques qui bloquent le ciel[10], ce qui laisse entendre que les personnes vivant dans les Prairies canadiennes ont besoin de se protéger davantage les yeux contre les RUV au cours des jours ensoleillés d'hiver.

ENDROITS ENDOMMAGÉS

L'énergie spectrale augmente de façon exponentielle à mesure que la longue d'onde diminue. Le risque de dommages tissulaires causés par l'exposition à des RUV de 300 nm est 600 fois plus élevé qu'à 325 nm[14]. De même, la lumière bleue visible risque plus de causer du tort que la lumière rouge visible. Nous avons démontré récemment des dommages subis par la peau et la rétine à des longueurs d'onde du spectre visible pouvant atteindre 490 nm[15-17].

PEAU

Comment la peau est-elle endommagée? L'ADN absorbe facilement l'énergie plus élevée des UVB, ce qui entraîne des altérations structurelles directes et instantanées[18]. Les UVB causent les coups de soleil et on les considérait auparavant comme la principale cause de cancers de la peau. Il est maintenant reconnu que les UVA, dont la longueur d'onde est plus longue, sont mutagènes aussi et des recherches menées à Yale ont peut-être déterminé récemment le mécanisme. Il a été démontré qu'environ la moitié des altérations de l'ADN attribuables à l'exposition aux rayons ultraviolets sont causées par des sous-produits énergétiques de réactions en chaîne chimiques qui se produisent dans les mélanocytes absorbant les UVA[19,20]. Il est clair qu'il faut nous protéger à la fois contre les UVA et contre les UVB.

La couche la plus superficielle de peau (épiderme) comporte plusieurs épaisseurs de cellules pavimenteuses. La jonction entre l'épiderme et le derme plus profond est constituée de cellules basales séparées par des mélanocytes occasionnels. Les cancers qui peuvent faire leur apparition dans ces cellules sont désignés en fonction des cellules d'origine. Les mélanomes sont beaucoup plus dangereux que les carcinomes spinocellulaires (CSC) ou basocellulaires (CBC).

Le cancer de la peau est le plus répandu au Canada, où l'on a diagnostiqué quelque 6 500 cas de mélanomes malins et 76 000 cas de mélanomes non malins en 2014[21]. Ces chiffres équivalent approximativement au total combiné des cancers du poumon, du sein, colorectaux et de la prostate. On estime que les dommages attribuables aux UV causent 64 % des cancers mélanomiques de la peau et 90 % des cancers non mélanomiques[22,23]. Même si le cancer de la peau est un des plus faciles à éviter, l'incidence du mélanome au Canada est à la hausse : de 1986 à 2010, elle a grimpé de 2 % par année chez les hommes et de 1,5 % par année chez les femmes[21].

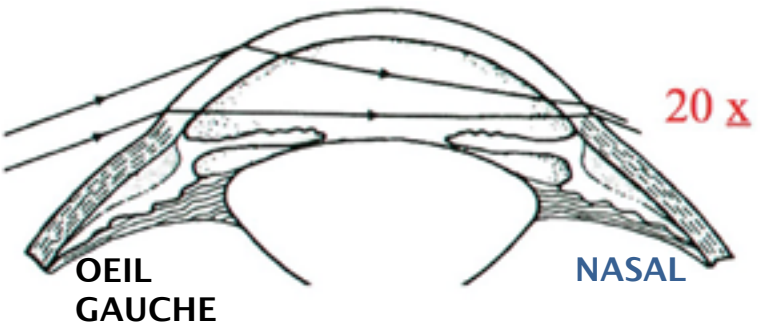
On trouve sur les paupières des cancers à la fois mélanomiques et non mélaniques (NMM) et l'on affirme couramment que de 5 à 10 % du total des cancers de la peau font leur apparition sous la paupière[24]. En 2011, 6,5 % de tous les CBC et 1,3 % de tous les CSC diagnostiqués au Canada touchaient la paupière[21]. En outre, plus de 50 % des NMM ont fait leur apparition sur le cou en montant. Il est clair qu'il faut porter un chapeau et des lunettes de protection appropriés contre les UV dès le jeune âge.

ATTEINTE DE LA SURFACE OCULAIRE

Ptérygion

Les dommages causés à la surface oculaire par l'exposition chronique aux UV se manifestent le plus souvent sous forme de ptérygions, tandis que l'éblouissement du soudeur et la cécité des neiges causée par l'exposition aux UVB constituent les traumatismes aigus les plus fréquents. Il faut attribuer à Coroneo la majeure partie du mérite pour avoir expliqué l'effet de la convergence de la lumière périphérique (CLP), aussi appelé effet Coroneo (Figure 2)[25]. Les UV incidents qui frappent la cornée temporale seront concentrés, en passant par la chambre antérieure, sur les cellules souches basales internes du limbe nasal, leur intensité augmentant d'un facteur de 20 environ. La lumière directe du soleil ne devrait pas autrement pouvoir atteindre ces cellules souches plus profondes parce qu'elle serait bloquée par les cellules limbiques supérieures[2527]. Coroneo a posé en hypothèse que les cellules souches basales endommagées par les UV pourraient produire plusieurs types de cellules nouvelles qui pourraient franchir la barrière limbique et envahir la cornée. D'autres chercheurs et lui-même ont produit par la suite un volume important de recherches visant à déterminer le mécanisme pathogène qui fait que les cellules épithéliales jouent ensuite un rôle dans la fibrose, l'angiogénèse et l'hyperplasie caractéristiques du ptérygion[25]. À cause des caractéristiques quasi tumorales du ptérygion, on a procédé à une étude histopathologique qui a porté sur 100 ptérygions excisés. L'analyse a produit des données indiquant que le ptérygion est une maladie des cellules souches et a aussi montré que des maladies prénéoplasiques comme la mélanose acquise primitive et la néoplasie spinocellulaire de la surface oculaire peuvent coexister avec le ptérygion. Les auteurs ont conclu que tous les ptérygions excisés devraient faire l'objet d'une évaluation histologique[28].

Figure 2: *Tiré de Coroneo, 2011 Ultraviolet radiation and the anterior eye E&CL Coïncidence de l'emplacement habituel du ptérygion avec convergence de lumière nasale intense après convergence de lumière périphérique au niveau du limbe nasal.*



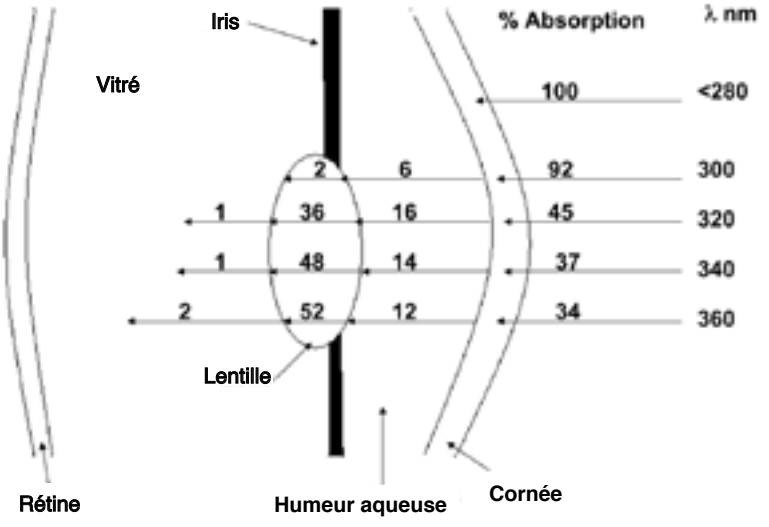
Pinguecula

Même si l'on croit que les pingueculas sont associés à l'exposition aux RUV, on n'a pas établi de relation de cause à effet[2]. Une étude importante portant sur des personnes qui ont travaillé sur l'eau de la baie de Chesapeake au Maryland a révélé un lien clair entre l'exposition aux RUV et un risque accru de ptérygion et de kératopathie bulleuse climatique, mais un lien faible seulement avec le pinguecula[29]. On a toutefois constaté aussi la présence, dans le pinguecula, de caractéristiques connues de l'élastoplasie et de l'élastrodystrophie que l'on trouve dans le ptérygion[30].

Cornée

La cornée humaine transmet toutes les longueurs d'onde visibles du spectre EMR, mais elle absorbe la majeure partie des UVB de longueurs d'onde plus courtes et essentiellement 100 % des UVC[3]. Cette absorption peut entraîner deux types de réactions cornéennes aux RUV (Figure 3)[31]. La photokératite est une kératopathie ponctuée superficielle causée par une exposition aiguë aux UVB. Aussi appelée cécité des neiges, elle se produit habituellement après une exposition excessive aux UVB survenue pendant qu'on skie en altitude, ou à la plage. On associe plus souvent la kératite bulleuse climatique à une exposition chronique aux UVA et aux UVB. Même si elle est plus courante sous les tropiques, elle se manifeste aussi dans l'Arctique canadien où les gens sont exposés à de fortes concentrations de rayons UV réfléchis[3 32].

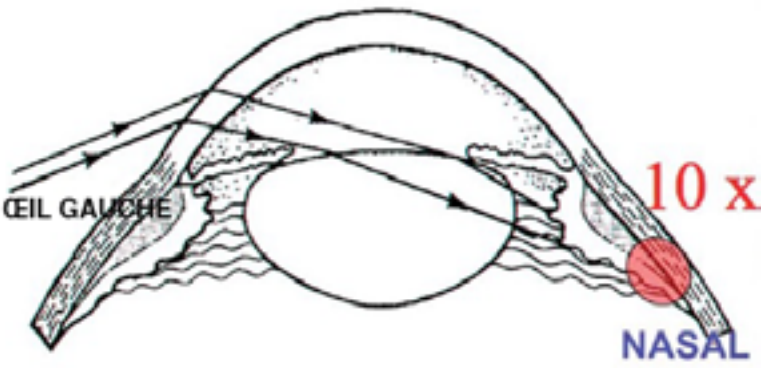
Figure 3: *Tiré de Lucas E&CL Epidemiological perspective of UV exposure 2011*



Cataracte

La cataracte la plus courante que voient les optométristes est la cataracte sclérotique nucléaire liée à l'âge (NLA). Elle se manifeste par un jaunissement du cristallin, qui finit par avoir une apparence fumeuse plus sombre qui oblige à subir une intervention chirurgicale. Même si l'on reconnaît généralement que les cataractes NLA sont causées par l'oxydation du cristallin, le rôle des RUV dans la facilitation de l'évolution soulève plus d'hypothèses. À l'âge mûr, un pigment lenticulaire naturel se transforme lentement en acide xanthurénique qui commence alors à absorber les RUV et forme des particules oxydantes nuisibles. La production de groupes d'antioxydants diminue par ailleurs en fonction de l'âge, les protéines du cristallin subissent plus de dommages, ce qui aggrave l'opacification du cristallin[33-35]. Il est bien connu que la cataracte corticale est causée par l'exposition aux RUV. Établi pour illustrer la formation du ptérygion, l'effet Coroneo aide aussi à expliquer l'emplacement courant des cataractes corticales du côté nasal inférieur (Figure 4)[25]. L'exposition temporale aux UV d'un angle différent de celui qui cause le ptérygion permet à la cornée de concentrer les RUV qui traversent la pupille et les cellules équatoriales du côté nasal inférieur du cristallin humain. La région équatoriale constitue la zone germinative du cristallin, probablement à l'origine de la cataracte en rayons[25 36].

Figure 4: *Tiré de Coroneo 2011 E&CL Ultraviolet and Anterior Eye*



Dégénérescence maculaire liée à l'âge (DMA)

On associe l'apparition et l'évolution de la DMA à des facteurs de risque génétiques et environnementaux, y compris l'âge, la cigarette, la race blanche, le sexe féminin, l'iris bleu, l'obésité, les facteurs nutritifs et une alimentation pauvre en antioxydants[37]. Une étude portant sur 465 articles réalisée par Sui et coll. en 2012 au sujet du lien entre la DMA et l'exposition au soleil a indiqué que certaines personnes plus exposées au soleil présentent un risque beaucoup plus important de DMA[38]. Le vieillissement des cellules épithéliales des pigments rétiniens (EPR) et de la membrane de Bruch, la circulation déficiente dans les choriocapillaires et l'exposition de la rétine aux rayons UV et à la lumière bleue sont tous des facteurs que l'on a incriminés dans la dégénérescence[39-41]. La perte de cellules EPR semble jouer un rôle pivot dans l'évolution de la DMA. Les cellules EPR jouent un rôle vital dans le contrôle de l'inflammation causée par le stress oxydatif provenant de diverses sources, y compris l'exposition constante aux stimuli lumineux[2 42]. Il est démontré que la lumière bleue constitue la partie du spectre visible qui cause le plus de dommages photochimiques dans les cellules ERP animales[2]. Il existe différents types de particules oxydatives appelées collectivement espèces réactives à l'oxygène (ERO)[37 39]. Le fonctionnement aérobie de toutes les cellules humaines comporte la production d'ERO, mais la rétine a particulièrement tendance à produire des ERO à cause de la tension partielle élevée d'oxygène et de l'exposition aux UV et à la lumière bleue[37]. Normalement, la rétine réagit au stress oxydatif en partie en augmentant la production d'antioxydants et en partie en dissociant des protéines endommagées (protéolyse). Si ce système est débordé, des produits nuisibles comme la lipofuscine et les drusens extracellulaires commencent à s'accumuler et à causer des signes visibles de DMA[43].

On reconnaît généralement dans les publications que les UV et la lumière bleue visible à haute énergie sont phototoxiques pour la rétine et contribuent au phénomène nuisible que constitue le DMA. On ne défend toutefois pas fermement l'exposition aux UV comme principale cause de la DMA puisque le jaunissement du cristallin vieillissant bloque presque totalement la transmission des UV et les optométristes voient habituellement des patients qui ont une DMA après qu'ils ont franchi le stade de l'âge mûr. On reconnaît généralement dans les publications que le cristallin humain transmet 75 % de la lumière proche des UV (300 à 400 nm) jusqu'à 10 ans, mais qu'à 25 ans, le jaunissement du cristallin humain réduira la transmittance à 10 %[44]. Même si le cristallin humain transmet toujours la majeure partie de la lumière bleue visible (400 à 500 nm) à ces âges, le cristallin âgé présente une absorbance beaucoup plus importante[33 44]. Il ne faut pas oublier qu'habituellement, la DMA évolue lentement et qu'il lui faut en général des années pour devenir invalidante sur le plan visuel. Il est clair que l'avantage maximal de protection contre la DMA qu'offre le port de lentilles absorbant les RUV et bloquant la lumière bleue visible commence au cours de la jeunesse et diminue avec l'âge.

On reconnaît généralement dans les publications que le cristallin humain transmet 75 % de la lumière proche des UV (300 à 400 nm) jusqu'à 10 ans, mais qu'à 25 ans, le jaunissement du cristallin humain réduira la transmittance à 10 %[44].

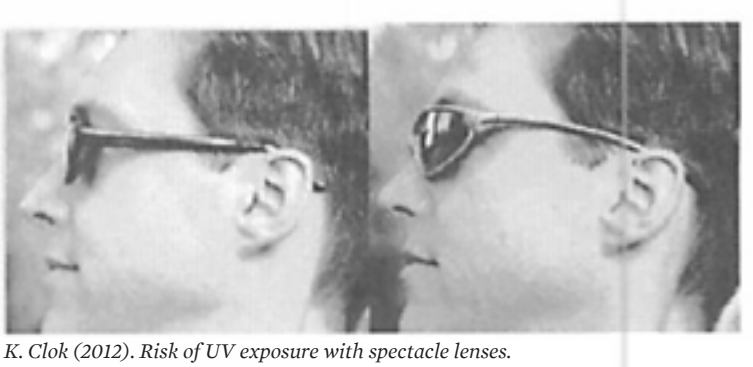
Mélanome de l'uvée

Les publications épidémiologiques indiquent que l'exposition aux UV peut jouer un rôle dans l'apparition de tumeurs intraoculaires malignes primitives chez l'adulte, même si l'on a essayé d'établir un lien entre le travail à l'extérieur et l'exposition chronique aux UV, d'une part, et l'apparition du mélanome de l'uvée, de l'autre, sans arriver à des données concluantes[45-50]. Il a toutefois été démontré que l'effet cancérogène de la lumière UV sur les enfants, qui peut causer le mélanome cutané, peut être plus important à l'âge adulte[51]. Le lien pertinent porte sur le fait que la pathogénèse du mélanome de l'uvée peut être la même que celle du mélanome cutané.

Considérations relatives à la protection oculaire

Tous les optométristes du Canada reconnaissent qu'il faut protéger l'œil contre les RUV et nous devons aborder de façon routinière cette question avec nos patients. Même si les matériaux dont sont faits beaucoup de lentilles et leurs revêtements bloquent adéquatement les UV, il importe aussi de tenir compte de la monture des lunettes. Le travail effectué par Coroneo pour démontrer les dommages causés par la lumière périphérique conjugué à la tendance humaine à se détourner des rayons directs du soleil indique que nous devrions nous efforcer de fournir à nos patients des montures enveloppantes bien ajustées (Figure 5)[52].

Figure 5: *Tiré des notes de Ralph Chou*



K. Clok (2012). Risk of UV exposure with spectacle lenses.

Sans compter les UV qui frappent directement l'œil en provenance de la périphérie, la réflectance des UV provenant de la surface arrière des lentilles qui n'enveloppent pas le visage ou qui se trouvent trop loin de l'œil constitue aussi une source de préoccupations. Des lentilles claires sans revêtement antireflets réfléchiront de 4 à 6 % des UVA et UVB provenant de la surface arrière de la lentille, mais des lentilles dotées d'une couche antireflets réfléchiront en moyenne 25 % des longueurs d'onde de la plupart des UV[53]. Ces connaissances ont aidé Essilor SA (France) à mettre au point le facteur E-SPF[MC] et à le protéger par une marque de commerce. E-SPF mesure les UV entre 280 et 380 nm qui sont transmis directement par une lentille, ainsi que la quantité de rayons UV réfléchis de la surface arrière de la lentille à un angle de 145 degrés :

$$E - SPF = \frac{1}{\text{T}UVO^{\circ} + Ruv145^{\circ}}$$

Par exemple, un E-SPF de 7 représente une faible protection et un E-SPF de 50, une protection importante[14]. Le facteur E-SPF désigne seulement les caractéristiques de la lentille et du revêtement et n'élimine pas l'obligation de bien ajuster la monture.

Le même facteur qui a trait à l'ajustement de la monture s'applique aussi aux lunettes de soleil fabriquées à l'usine. Les grandes montures enveloppantes bien ajustées offrent la meilleure protection. Le Canada n'a pas de norme de sécurité propre sur la transmittance des lunettes de soleil et c'est pourquoi on voit le plus souvent l'étiquette Z80.3 de l'American National Standard Institute (ANSI) : les lentilles de classe I absorbent au moins 90 % des UVA et 99 % des UVB, tandis que celles de la classe II bloquent au moins 70 % des UVA et 95 % des UVB[54]. Il faut vérifier l'emballage ou l'étiquetage avant de distribuer le produit aux patients tout en n'oubliant pas que beaucoup de rayons UVB peuvent atteindre l'œil sans traverser directement les lentilles[55,56].

Les lentilles cornéennes qui bloquent les UV protègent bien l'œil et il faut toujours les envisager, particulièrement chez les jeunes patients plus vulnérables aux dommages oculaires causés par les UV, et chez les personnes qui se livrent à des activités de plein air. Bien entendu, il faudrait quand même des lunettes de soleil pour protéger la peau autour de l'œil, mais au moins, la lentille cornéenne protège l'œil même toute la journée.

MESSAGE PUBLIC SUR LA PROTECTION DE L'ŒIL CONTRE LES UV

On a déjà signalé dans cet article que le Comité de protection solaire a envoyé un document final à la Revue canadienne de santé publique. La principale mesure de protection recommandée comportait des commentaires au sujet de l'indice UV qui est à son maximum entre 11 h et 15 h, période au cours de laquelle il faut protéger la peau au maximum. En dépit de l'exhortation du Sous-comité des soins oculaires représentant l'optométrie, l'ophtalmologie, l'INCA et d'autres disciplines, on n'a pas insisté de la même façon sur le message selon lequel les tissus oculaires et périoculaires sont les plus à risque en dehors de cette période.

L'American Cancer Society a diffusé l'énoncé suivant :
« Idéalement, tous les types de produits de lunetterie, y compris les lunettes d'ordonnance et les lentilles cornéennes, doivent protéger contre les rayons UV. Certaines lentilles cornéennes sont maintenant fabriquées de façon à bloquer la majeure partie des rayons UV, mais comme elles ne couvrent pas l'œil au complet et les régions voisines, elles n'assurent pas une protection oculaire suffisante lorsqu'elles sont utilisées seules »[57].

Le Cancer Council Australia a diffusé l'énoncé suivant :
« L'exposition des yeux aux rayons UV dépend de nombreux facteurs et l'on n'établit pas de lien serré entre l'exposition et les concentrations de rayons UV ambiants et l'indice UV. Cancer Council Australia recommande de toujours se protéger les yeux contre les UV à l'extérieur le jour »[58].

Comme fournisseurs de soins oculaires de premier recours, les optométristes doivent constamment recommander à leurs patients de mieux se protéger les yeux contre les RUV. Nous sommes témoins des effets nocifs de l'exposition aux UV et il nous incombe de faire passer le message selon lequel l'œil est plus exposé tout au long de la journée que le public pourrait le croire à entendre les messages sur l'indice UV seulement.

Le sous-comité des soins oculaires a proposé la recommandation générale suivante : « Dans des conditions normales le jour, il faut porter des lunettes fumées ou des lunettes d'ordonnance dotées de lentilles protégeant contre les UV à l'extérieur, toute l'année durant. » Même si cette recommandation n'a pas été incluse dans le document final soumis à la Revue canadienne de santé publique, les associations nationale et provinciales d'optométrie, y compris l'Association canadienne des optométristes (ACO), devraient approuver le message à cet effet que tous leurs membres devraient adopter.

Il y a une observation finale révélatrice dont il faut tenir compte, soit que parmi tous les enfants qui se rendent à l'école et en reviennent à pied tous les jours, il est rare d'en voir un qui porte des lunettes de soleil. Si les membres de ce groupe sont les plus vulnérables à cause de leur âge et de la période de la journée pendant laquelle ils se déplacent à l'extérieur, il reste alors beaucoup plus de travail à faire pour les protéger. ●

Une des raisons pour lesquelles nous ne voyons pas plus souvent les enfants et les adolescents porter des lunettes de soleil au Canada, c'est que l'on considère que les effets nocifs de l'exposition aux UV constituent un trouble chez l'adulte, alors que nous savons qu'il s'agit d'un problème cumulatif qui découle de l'exposition au cours de l'enfance.

Cela peut être aussi parce que l'on considère les lunettes de soleil simplement comme un coûteux symbole de statut social et que les parents ne veulent pas encourager le consumérisme chez leurs enfants.

Pour promouvoir l'utilisation plus généralisée des lunettes de soleil, en particulier chez les jeunes, il serait utile que les optométristes soient les fournisseurs de lunettes de soleil et offrent des lunettes abordables mais à la mode.

Si cet article contient des énoncés qui pourraient selon vous toucher vos patients, n'hésitez pas à les citer comme extrait de la RCO et à les afficher dans votre bureau à l'intention du public.

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2017 CAO Congress Poster Session Abstracts

Lifitegrast 5.0% in Patients with Dry Eye Disease: A Pooled Analysis

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PURPOSE

Lifitegrast is an integrin (transmembrane receptor) antagonist that specifically blocks the interaction of cell surface proteins (LFA-1 and ICAM-1), thus inhibiting release of inflammatory cytokines involved in the inflammatory pathway of dry eye disease (DED). Data from 2 phase 3, multicenter, randomized-controlled trials (OPUS-2 and OPUS-3) of similar design, were pooled to characterize the effect of lifitegrast ophthalmic solution 5.0% (LIF) on DED symptoms and signs.

METHODS

Adults with DED (Schirmer 1-10 mm, eye dryness score [EDS, visual analogue scale 0–100; 0=no discomfort, 100=maximal discomfort] ≥40, corneal staining score ≥2.0), and a history of recent artificial tear use were randomized 1:1 to receive LIF or placebo (PBO) *bid* for 84 days. The change from baseline in symptoms (EDS) and signs (Schirmer, ocular surface staining and conjunctival redness score) was evaluated at day 14, 42 and 84.

RESULTS

1429 subjects were included (713 LIF; 716 PBO) with an overall mean age of 58.7 yrs (1087F:342M). Subjects using LIF experienced significantly greater improvement from baseline in EDS vs PBO at days 14 (treatment effect [TE], 7.23; 95% CI, 4.71–9.76; P<0.0001), 42 (TE, 9.75; 95% CI, 6.99–12.50; P<0.0001) and 84 (TE, 9.92; 95% CI, 7.01–12.83; P<0.0001). In OPUS-2, sign measures improved from baseline in both groups over time but were not statistically different between groups. In OPUS-3, inferior corneal staining score demonstrated a nominally significant improvement in favor of LIF (TE 0.17, nominal *P*=0.0144). The most common adverse events (≥5% in either group) were instillation site irritation (LIF 13.0%, PBO 2.2%), instillation site reaction (LIF 9.8%, PBO 3.2%) and dysgeusia (LIF 14.5%, PBO 0.3%).

CONCLUSION

In this pooled analysis of 2 trials, LIF significantly improved symptoms of eye dryness, as measured by EDS, vs PBO in subjects with DED as early as day 14. Signs were improved vs PBO in 1 of the 2 trials. LIF appeared well tolerated.

CONFLICT OF INTEREST DISCLOSURE

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- Aparna Raychaudhuri was an employee of Shire PLC at the time of this work and owns stock in Shire PLC.

- Monica Roy and Amir Shojaei are employees of Shire PLC and own stock/stock options in Shire.

Targeted Outcomes of a Clinical Externship Program from 2010–2015

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PURPOSE

The student externship experience relies extensively on the clinical setting of the particular site (ie. solo vs multi-disciplinary practice (OD/MD), hospital, and US public health service-USPHS), each with their unique characteristics. The primary objective of the Externship Program in our curriculum was to increase patient encounters over a 3-month rotation and enhance exposure to ocular disease diagnosis and management. The use of diagnostic (DPA) and therapeutic (TPA) pharmaceutical agents was a way to target the outcome of OD exposure. This presentation describes a five-year retrospective of the student's clinical experience in the externship program.

METHODS

A retrospective evaluation was performed between 2010-2015 to calculate patient demographics (age, gender, race), patient encounters and the use of DPA and TPA per type of externship setting. DPA was used as a measure of ocular disease diagnosis and subdivided into anesthetic, mydriatic and cycloplegic use, while TPA use was used as a measure of ocular disease management and subdivided into topical and oral categories.

RESULTS

Demographics, patient encounters and DPA/TPA use were site dependent. Hospital settings have older patients with a preponderance of caucasian males. Patient encounters revealed an average of 342 ± 27 at all sites combined with the most seen in OD/MD settings (avg 351 ± 33). DPA use was highest for anesthetics (avg 12724 ± 1280) representing a growth over the past 5 years of 16%. Cycloplegics had the lowest use (avg 255 ± 161) due to an older population in externship sites. TPA use was strongest in an OD/MD setting for all topical/oral medications, with those for dryness, steroids and glaucoma being prescribed the most.

CONCLUSIONS

Targeted outcomes such as patient encounters, DPA/TPA use provide an indirect measure of the student's experience with diagnosis and management of ocular disease. These can be used as markers of the progress of a clinical externship program.

CONFLICT OF INTEREST DISCLOSURE

- Etty Bitton has no direct conflict with the information presented here. She is the Director of the Clinical Externship program since 1994. She has been a consultant and/or received honoraria from Akorn, ALCON, Allergan, CooperVision, Labtician, JOBSON publishing, OPTICIAN journal, Orimed, Shire, TBWA World Health. Dr. Bitton has received research funding from ALCON Canada, Allergan Canada, Canadian Optometric Educational Trust Fund (COETF), FDERC, I-med Pharma Inc.

- Ariana Verni is an optometry student with no conflicts of interest to disclose.

Prevalence of visual impairment and eye disease in Miragoâne, Haïti

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CONTEXT

In Haiti, few data on blindness and visual impairment are available. The National Blindness Prevention Committee (CNPC) has estimated blindness to affect 1% Haitians and that 7% of children attending school have undiagnosed refractive errors. *IRIS Mundial (IM)* is a non-governmental organisation collaborating with the CNPC to develop local eye care infrastructure.

PURPOSE

To estimate the prevalence and causes of visual impairment and blindness in the region of Miragoâne.

METHODS

From April 27th to May 1st 2016, an *IM* team performed ophthalmic examinations in Miragoâne. Data collected from all examinations were compiled.

RESULTS

In total, 1709 patients were examined (61% female; 18% aged 18 or less). In the better eye, 83% of patients had normal vision (presenting VA $\geq$ 6/18); 15% had moderate visual impairment (< 6/18 $\geq$ 6/60), 0.2% had severe visual impairment (< 6/60 $\geq$ 3/60) and 2% were blind (<3/60). Seventeen percent of patients had low myopia (0D to -3D) in both eyes (OU) and 1.2% had myopia > -3D OU. Fifty-three percent had low hyperopia ($\leq$ 2D) OU while 5% showed high hyperopia (> 2D OU); 65% were presbyopic. Forty-two percent of patients had high astigmatism ($\geq$2D) OU. Five percent of patients showed binocular cataracts of grade 3 or worse. One percent of patients were diagnosed with probable glaucoma (C/D > 0.8 and IOP > 24 mmHg) OU and 5% had binocular pterygium (> 1-2 mm on cornea).

CONCLUSIONS

Our data give an indication of the prevalence of visual impairment and ocular disease in Miragoâne, Haïti. Prevalence estimates for uncorrected distance refractive errors were significant, especially for presbyopia and high astigmatism. Cataracts, glaucoma and pterygium are confirmed as prevalent conditions in this population, which prompts the need to plan appropriate interventions to tackle this burden of disease.

Drop comfort assessment in OPUS-3, a phase 3 randomized controlled trial of lifitegrast ophthalmic solution 5.0% for dry eye disease

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PURPOSE
Lifitegrast is a small molecule integrin antagonist that targets inflammation in dry eye disease (DED) by blocking interaction of lymphocyte function-associated antigen 1 (LFA-1) and intercellular adhesion molecule-1 (ICAM-1). We report drop comfort score of lifitegrast ophthalmic solution 5.0% (LIF) in OPUS-3, an efficacy/safety trial of LIF versus placebo (PBO) in patients with DED.

METHODS
OPUS-3 was a 12-week, prospective, randomized, multicenter, double-masked, PBO-controlled study conducted in the US (NCT02284516). After a 2-week PBO run-in, adults with DED (Schirmer Tear Test ≥1 and ≤10 mm in ≥1 eye, eye dryness score [visual analogue scale 0–100, single score for both eyes] ≥40, corneal staining score ≥2.0 (0-4 scale) in ≥1 region in ≥1 eye, and recent artificial tear use were randomized to LIF or PBO in a 1:1 ratio twice-daily for 84 days. On days 0 (baseline), 14, 42, and 84 (visits 2–5), drop comfort score (DC, 0–10 scale; 0=very comfortable, 10=very uncomfortable) of both eyes was evaluated at 0, 1, 2, and 3 min post instillation. If DC was >3 at 3 min, assessment was repeated at 5, 10 and 15 min until DC ≤3.

RESULTS
Overall, 711 subjects (LIF, n=357; PBO, n=354) were included. Numeric improvements in mean DC of the study eye at instillation were observed across visits in LIF-treated subjects (baseline, LIF group 4.4, PBO group 1.2; day 14, LIF 4.0, PBO 1.4; day 42, LIF 3.5, PBO 1.1; day 84, LIF 3.4, PBO 1.0). On days 14, 42 and 84, respectively, 66%, 64% and 64% of LIF-treated subjects reported DC <3 at 3 min post instillation. In subjects reassessed for DC at 5, 10 or 15 min, the mean score in LIF-treated subjects was similar to or better than that in the PBO group at the same time points.

CONCLUSIONS
Initial DC in LIF-treated subjects showed improvements within 3 min of instillation and consistent reductions across visits.

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Aparna Raychaudhuri was an employee of Shire PLC at the time of this work and owns stock in Shire PLC.

Monica Roy and Amir Shojaei are employees of Shire PLC and own stock/stock options in Shire.

The addition of Orientation and Mobility (O&M) training improves movement detection in the blind hemi-field when using Peli prisms for hemianopia: A Case Study

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INTRODUCTION

Previous research has indicated that Peli prisms improve mobility, primarily as evaluated by questionnaires. We designed an interdisciplinary protocol to quantify this gain in mobility objectively in order to allow comparison with and without training by an O&M specialist.

METHODS

We developed a protocol similar to the in-office training originally suggested by Peli and colleagues. However, our clinical impression indicated better adaptation to the prisms by the patients once the O&M intervention was introduced. We designed an interdisciplinary protocol to maximise the adaptation to the device, which includes the patient selection, prism adjustment by the optometrist and short in-office training. Then, two quantitative reference tests are performed (Time 0) to evaluate the detection (static) and mobility (dynamic) abilities of the patient. The patient is asked to wear the prism as much as possible and to return two weeks later and the static and dynamic tests are repeated with the Peli prisms (Time 1). Thereafter, the O&M specialist takes charge of the training with specific exercises developed to help the patient overcome the confusion caused by sudden and moving images, and to use the peripheral image efficiently. After two weeks of O&M training, the patient repeats the static and dynamic tests (Time 2).

RESULTS

By fitting a regression line from a birds-eye perspective to the detection points in the blind hemi-field of Patient MF, we observed a flattening in the slope of this line when measuring detection with a parallel moving target (from -2.37 to -1.33) as well as with a perpendicularly moving target (from -3.18 to -2.19), indicating an increase in the size of the perceived visual field from T1 to T2.

CONCLUSION

The data indicate that adding O&M training improved movement detection in the blind hemi-field using the Peli prisms. Next steps will focus on a patient-centered evaluation of the subjectively perceived benefits.

A Unique Presentation of Rapid Onset Normal Tension Glaucoma and Possible Association with Breast Cancer

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A 70-year-old Caucasian woman presented for a routine assessment with no complaints after not having had an eye examination in 6 years. Medical history was remarkable for hypertension, atrial fibrillation and breast cancer, the latter of which was treated with localized radiation therapy (2008), recurred, and was subsequently treated with a right mastectomy (2015). Record review between 1985 and 2010 revealed cupping between 0.1-0.2 in the right eye and 0.1-0.3 in the left and IOPs between 14-23mmHg. Best-corrected visual acuity was 20/25 OD and 20/20 OS. A trace relative afferent pupillary defect was noted on the right. Dilated examination revealed late to end-stage cupping of the optic nerves at 0.95 OD and 0.85 OS. No pallor was observed. Complete superior and inferior visual field loss with central sparing was documented in the right eye, and partial superior arcuate loss in the left eye. Advanced, asymmetrical, rapid onset and fast progressing normal tension glaucoma (NTG) was diagnosed, with non-glaucomatous optic neuropathy to be investigated along with other systemic conditions such as breast cancer itself, ocular or orbital metastasis, autoimmune and vascular causes, and the contribution of radiotherapy. MRI imaging of the brain and orbits with contrast was unremarkable for compressive or metastatic lesions; results from other systemic tests are pending. NTG is often a slow progressing condition; therefore, this case report will highlight some critical as well as uncommon systemic disease associations with NTG that clinicians should consider investigating when rapid progression is noted. In addition, the case report will also describe the possible associations of rapidly progressing normal tension glaucoma with history of breast cancer and systemic adverse effects of treatment.

Characteristics of posterior corneal astigmatism in the different stages of keratoconus

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PURPOSE
To evaluate the magnitudes, axis orientation, ratio and correlation of anterior corneal astigmatism (ACA) and posterior corneal astigmatism (PCA) in the different stages of keratoconus (KC).

METHODS
This retrospective case series study comprises 161 eyes of 161 KC patients (104 men and 57 women; mean age ± standard deviation,22.35± 6.10 years) that were divided into 4 subgroups according to the Amsler-Krumeich classification. Scheimpflug imaging system (OCULUS Optikgerate GmbH, Wetzlar, Germany)was used to measure the magnitude and the axis orientation of ACA and PCA. The posterior–anterior corneal astigmatism ratio was also calculated.

RESULTS
The average amounts of anterior, posterior, and total central corneal astigmatism were 4.08 ± 2.21 Diopters (D), 0.86 ± 0.46 D, and 3.50 ± 1.94 D, respectively. With-the-rule (WTR), against-the-rule (ATR), and oblique astigmatism of the posterior surface of corneal were found in 61 eyes (37.9%), 67 eyes (41.6%), and 33 eyes (20.5%). Respectively, whereas the corresponding astigmatism of the anterior corneal surface was found in 55 eyes (32.4%), 56 eyes (34.8%), and 50 eyes (31.1%), respectively. A strong correlation ($P \leq 0.001$, $r=0.839$) was found between ACA and PCA in the different stages of KC; the correlation was weaker in grades 3($P \leq 0.001$, $r=0.711$) and 4($P \leq 0.001$, $r=0.717$) KC cases. The maximum amount of posterior–anterior corneal astigmatism ratio was in stage 1 of KC patients (0.246).

CONCLUSION
Cornea astigmatism in anterior surface was more affected than posterior surface by increasing in the KC severity, although PCA was more affected than ACA in an early stage of KC.

Refractive outcomes after intracorneal ring implantation

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PURPOSE
The investigation of refractive error and visual acuity before and 6 months after myoring implantation in patients with keratoconus at Farabi hospital in Tehran, Iran.

METHODS
In this retrospective study, thirty-four eyes of twenty-eight keratoconic patients files with mean age of 29 ± 7.41 underwent myoring operation and they were reevaluated after 6 months. In these patients best corrected visual acuity (BCVA), refractive outcomes and Pentacam [Oculus GmbH] findings were assessed. All patients had clear central corneas, contact lens intolerance, and a central corneal thickness of more than 360 mm.

RESULTS
Six months postoperately, the mean BCVA (in LogMAR value) improved significantly from 0.30 ±0.22 to 0.20 ± 0.20 ($p=0.006$) and the mean spherical refractive error improved from -4.66 diopters(D) ± 3.76 to -1.48D ± 3.72 ($p<0.001$). The mean cylindrical refractive error decreased significantly from -4.27D ±3.15 to -2.18D ±1.63 ($P<0.001$).

In cylindrical refraction, the frequency percent of with the rule, oblique and against the rule axes of astigmatism before operation were 21% ,44% and 35% ,respectively and after operation have been 18% ,24% and 58% ,respectively.

CONCLUSION
Myoring operation provided significant improvement in BCVA, spherical and cylindrical refractive error .

Subjective Outcomes in Symptomatic Patients wearing Dailies Total1 Multifocal Lens

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PURPOSE
To report the subjective outcomes of DAILIES TOTAL1 Multifocal (DT1MF, delefilcon A, Alcon) contact lenses (CLs) in a population of symptomatic multifocal (MF) contact lens wearers.

METHODS
A total of 166 subjects were exposed to DT1MF CLs or their habitual MF CLs in this prospective, multi-site, randomized, bilateral cross-over clinical trial. In order to qualify, subjects had to report eye dryness toward the end of the day and rate their habitual MF CLs as uncomfortable during the day. Subjects completed the Contact Lens Dry Eye Questionnaire-8 (CLDEQ-8) at baseline based on their habitual MF CL and after 14±3 days of wearing DT1MF CLs, where lower scores indicate less symptoms. Subjects rated comfort and dryness on a 10 point scale (1 =poor, 10 =excellent) and also reported frequency of dryness symptoms.

RESULTS
The study population consisted of 77.1% female, with a mean age of 52.0±5.14 years. The mean CLDEQ-8 score at baseline was 21.3±5.2 that significantly improved to 9.9±5.4 after two weeks of wearing DT1 MF CLs ($p<0.0001$). Subject-reported end of day comfort was 8.5±1.8, end of day dryness was 8.4±2.0, and dryness during digital device use was 8.4±2.2 with DT1MF CLs wear after two weeks. These mean scores after DT1MF CL wear were significantly better than habitual MF CLs ($p<0.0001$). Over 72% of subjects reported never or rarely having dryness symptoms after two weeks of DT1 MF lens wear.

CONCLUSIONS
Presbyopic patients who may have a compromised tear film may also experience difficulty wearing contact lenses. DT1MF CLs are a good option for patients who report discomfort and dryness with their current CLs.

CONFLICT OF INTEREST DISCLOSURE
The authors are employees of Alcon Research, Ltd.

Alcon Multifocal Contact Lenses for Presbyopia Correction

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PURPOSE
To describe visual outcomes in patients fitted with three Alcon multifocal (MF) contact lenses (lotrafilcon B, nelfilcon A, delefilcon A) that contain the same Precision Profile optical design.

METHODS
In the first study, 27 subjects were fit with lotrafilcon B and nelfilcon A MF lenses in a prospective, single-site, bilateral cross-over trial. In the second study, 166 subjects were fit with delefilcon A MF lenses in a prospective, multi-site, bilateral trial. LogMAR visual acuity (VA) at 40 cm (near), 80 cm (intermediate), and 4 m (distance) was collected after the 1-2 week follow-up period. At dispense, subjects were asked to rate their vision quality at near, intermediate and distance on a 10-point scale (1=poor and 10=excellent) and at follow up they were asked to rate their overall vision.

RESULTS

The mean logMAR at near, intermediate, and distance after wearing lotrafilcon B MF lenses for 1 week was 0.11±0.10, -0.08±0.12, and -0.05±0.05, respectively. The mean logMAR at near, intermediate, and distance after 1 week of wearing nelfilcon A was 0.12±0.11, -0.07±0.10, and -0.05±0.04, respectively. The mean logMAR VA at near, intermediate, and distance after 2 weeks of wearing delefilcon A MF lenses was 0.15±0.15, -0.07±0.10, and -0.10±0.07, respectively. The mean subjective rating for vision quality at near was 9.1±1.1, intermediate was 9.4±0.8, and distance was 9.1±0.8 for lotrafilcon B at dispense. The mean subjective rating for vision quality at near was 8.3±1.8, intermediate was 8.6±1.4, and distance was 8.7±1.0 for nelfilcon A at dispense. At dispense of DT1MF, the mean subjective rating for vision quality at near was 7.2±2.0, intermediate was 8.6±1.2, and distance was 8.8±1.1. After one to two weeks of use, subjects rated all three lenses a 7.5 or better for overall vision quality.

CONCLUSIONS

Alcon manufactures a variety of MF contact lenses to give eye care professionals options for fitting their presbyopic patients based on their needs. The Precision Profile design provides excellent vision outcomes across different modalities and materials.

North American Patient and ECP Satisfaction with a Novel Water Gradient Daily Disposable Multifocal Contact Lens

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PURPOSE

A novel water gradient daily disposable (DD) multifocal (MF) contact lens (delefilcon A, DDMF) was evaluated based on patient and eye care professional (ECP) satisfaction in Canada and the United States.

METHODS

Presbyopes who were fit into the DDMF lens were offered the opportunity to participate in a voluntary survey. After being fitted with DDMF lenses, patients were scheduled for follow up after 1-2 weeks where each patient completed a survey assessing satisfaction with the new CL. ECPs also completed a survey before and after fitting patients in DDMF lenses.

RESULTS

Presbyopes (n=165) and ECPs (n=17) from the US and Canada completed pre and post-fitting surveys. Mean age was 52.9yrs; 71% were female. Habitual CL use was 53% MF, 24% monovision, and 23% single vision. After 1-2 weeks of wearing DDMF, mean comfortable wear time was 11.88h/day vs. 9.35h/day (habitual). Patients reported the following satisfaction (Agreed/Strongly Agreed) with the DDMF: Feel comfortable at the end of the day (91%); Feel less dry at the end of the day compared to previous lenses (79%); Vision is clear when using digital devices (79%) and when driving (83%). DDMF lenses were preferred by 87% of presbyopes over their habitual lenses. After fitting the new CL, 100% of ECPs surveyed reported DDMF lenses are easy and efficient to fit. Additionally, 100% would recommend DDMF lenses to colleagues, and 93% reported they prefer fitting MF lenses with a consistent design across modalities.

CONCLUSIONS

Presbyopic patients and ECPs in North America reported a high level of satisfaction with the novel water gradient DDMF, reporting excellent comfort, vision and ease of fit.

CONFLICT OF INTEREST DISCLOSURE

The authors are employees of Alcon Research, Ltd.

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The prevalence of strabismus types in strabismic patients.

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PURPOSE
To determine the frequency of different types of strabismus and amblyopia in patients of strabismus clinic from 2008 to 2014.

METHOD
This retrospective cross-sectional study was conducted using data from the archives of Farabi hospital in Tehran, Iran from 2008 to 2014. In this study, from the records of strabismic patients, strabismus types and associated abnormalities, kind of amblyopia and other ocular pathological findings were recorded.

RESULTS
In this study, 1,174 strabismic patients were studied. The "Accommodative Esotropia(ET)" is the most prevalent type of strabismus reaching 25.04% of all strabismic patients and "Intermittent Exotropia(XT)", " Non accommodative ET" and "partially accommodative ET" respectively with 12.09, 11.24% and 10.39% were relatively common, while 63.03% of all strabismic patients has esodeviation and exotropia comes second reaching 24.53 percent. 236 patients (20.1%) had other ocular pathologic findings in addition to strabismus. The most common association with those types of strabismus was inferior oblique overaction reaching 11.07% of all cases and 88 patients had nystagmus in addition to strabismus. 45% of patients had no amblyopia and 37% of patients had combine type of amblyopia that is most common types of amblyopia in strabismic patients.

CONCLUSION
As almost half of strabismic patients suffer from amblyopia this study suggests that strabismus screening of children could be useful in early detection of strabismus, appropriate management of it and prevention of strabismic amblyopia.

The Prevalence of Refractive Errors and Binocular Anomalies in Students of Deaf Boys Schools in Tehran.

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PURPOSE
The association between deafness and ocular abnormalities is well established; however the nature and prevalence of these problems are diverse across the globe.

METHODS
A team of optometrists and social worker visited one hundred fifty eight deaf boy students at their schools and those who needed more detailed evaluation were referred to the Farabi Eye Hospital's strabismus clinic. These students in selected schools underwent detailed visual acuity testing, refraction, binocular examination, color vision and fundoscopy.

RESULTS
The percentage of ocular abnormalities in the deaf boys included in this study was 52.8%. The frequency of refractive errors in the present study was 39.9%. Astigmatism was the leading refractive anomaly (31%). Hypermetropia was found in 13.2% of the children and myopia was found in 12.6%. Anisometropia was detected in thirty children (19%) and amblyo-

pia was found in 22 children (13.9%). A disturbance of ocular motility was present in 18 cases (11.3%). In 44 (28%) cases stereopsis was reduced, and in six (3.8%) cases it was absent. Majority of the students (89.9%) had congenital hearing loss. 6.3% children had color vision deficiency. Seventy four deaf boys (46.8%) had a normal eye examination, while 84 (53.2%) cases had ocular problems, and 20 (12.65%) of them had more than one problem. The prevalence of refractive error, amblyopia, and strabismus was found to be significantly increased compared to the general population. In addition, the prevalence of ocular abnormalities generally increased with the severity of the hearing loss.

CONCLUSION

We recommended that screening for ocular abnormalities should be made mandatory in hearing-impaired children and parents must be aware of high prevalence of ocular abnormalities in deaf children, as they need appropriate visual sense to compensate their poor auditory sense.

Incidence and prevalence of dry eye disease: estimates from claims database analysis in a large United States health care system

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PURPOSE

Dry eye disease (DED) is typically a chronic, multifactorial, ocular surface disease. Previous studies have produced a wide range of DED prevalence estimates, but incidence data are limited. This study estimated DED annual incidence, overall prevalence, and annual prevalence in the United States (US), using data from the US Department of Defense healthcare database (9.7 million beneficiaries).

METHODS

Beneficiaries with DED were identified through an algorithm of selected diagnostic and procedural codes for indicators of DED or prescriptions for cyclosporine ophthalmic emulsion. Incidence rates, based on available calendar years (2008–2012), were estimated for >6.5 million patients with 5 years' continuous enrollment before and including each study year. Overall prevalence was estimated for the entire cohort (2003–2015). Annual prevalence, in available calendar years (2005–2012), was assessed for over 7.0 million patients with continuous enrollment for 2 years before, after, and including study year.

RESULTS

DED incidence increased across age groups from 2008 to 2012: 0.2% to 0.3% among beneficiaries aged 18–39 years, 0.4% to 0.7% among those aged 40–49 years, and 1.0% to 1.6% in those aged ≥50 years. Incidence was generally higher among women than men. Among women, incidence increased from 0.8% (2008) to 1.2% (2012), and among men, from 0.3% to 0.6%. Overall prevalence of DED was 5.3% (2003–2015); 7.8% in women vs 3.0% in men; 0.2%, 2.0%, 5.7%, and 11.7% in beneficiaries aged 2–17 years, 18–39 years, 40–49 years, and ≥50 years, respectively. Annual prevalence increased from 0.1% (2005) to 0.6% (2012) in beneficiaries aged 18–39 years, from 0.5% to 1.9% in those aged 40–49 years, and from 1.8% to 6.0% in those aged ≥50 years.

CONCLUSIONS

Analysis of data from this large demographically diverse survey demonstrates increasing incidence and prevalence of DED over time across age groups among Americans. Our results reinforce the public health significance of this prevalent condition.

CONFLICT OF INTEREST DISCLOSURE

J. L. Bradley, no conflicts. R. Dana, consultant: Cambium, Capricor, Dompé, Shire PLC, Sun Pharma Advanced Research Company, and Vision Medicines; grant support: Allergan, National Eye Institute; equity owner: Vision Medi-

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Ergonomics Survey in Canadian Optometry (ESCO-Optom)

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PURPOSE

To identify the prevalence, type, significance and risk factors of musculoskeletal (MSK) pain and injury in Canadian optometrists.

METHODS

University of Western Ontario Research Ethics Board submission was obtained prior to commencement of the study.

Canadian optometrists and practicing ophthalmology physicians were surveyed via Survey Monkey online surveys. Optometrists are believed to share similar clinical practices with general ophthalmologists and thus ophthalmologists served as s good comparator group. The survey was sent out via Canadian Association of Optometrists email lists to all practicing members. Similar email lists were used for ophthalmologists via the Canadian Ophthalmology Society.

Completion of the survey was completely voluntary and served as implicit consent. There was no compensation. Questioned surveyed were adapted from the literature to identify the prevalence and significance of MSK issues in the responders.

Statistical analysis was completed with SPSS and GraphPAD and Microsoft Excel to analyze difference between groups. Linear Regression analysis was used to identify risk factors and aggravating factors of MSK pain and injuries.

RESULTS

There were 121 (76 female and 45 male) respondents from the optometry group and 169 (52 female, 115 male) respondents from the ophthalmology group. 61% of respondents reported musculoskeletal pain and injury in the last 12 months which they attributed to work in the clinic. Most prevalent sites of pain were shoulder (41%), lower back (37%), neck (34%) and hand/wrist pain (32%). Aggravating factors identified included: "performing the same tasks over and over again", "working in the same position for long periods of time", "working in cramped conditions" and "reaching over your head and body".

CONCLUSIONS

- There is a significant prevalence of MSK injuries and pain in Canadian Optometrists
- Most common sites of pain were shoulder (41%), lower back (37%), neck (34%) and hand/wrist pain (32%).
- Identification of risk factors for development of MSK pain and injury is an important next step

The Prevalence of Sub-Clinical Microaneurysms Observed with Multi-Spectral Imaging in Sample Populations from Canada, the USA and China – A Retrospective, Preliminary Study

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PURPOSE
The prevalence of pre-diabetes is increasing at an alarming rate, particularly in China where it is 50.1%.[1] The prevalence of pre-diabetes is 23%[2] and 38%[3] in Canada and the USA, respectively. Retinal sub-clinical microaneurysms (MA), imaged with 580 nm multi-spectral imaging (MSI) have been shown to correlate strongly with insulin sensitivity, the inverse of insulin resistance in people without diabetes.[4] The purpose of this preliminary study was to determine if a difference exists in the quantity of MAs seen in MSI-580 images captured with the RHA™ (Annidis Corp., Ottawa, Canada) in population samples from Canada, the USA and China.

METHOD
MSI-580 images of 42 healthy patients (16 males, average age 47 ± 16 years) from an optometry clinic in London, ON, Canada, 46 patients (21 males, average age 42 ± 16 years) from Woodbridge, NJ, USA and 51 patients (33 males, average age 46 ± 9 years) from Beijing Xicheng District, China were retrospectively analyzed for sub-clinical MAs. Image evaluation was completed by an experienced, masked observer, based on a newly implemented grading scale from zero (healthy) to three (pre-diabetes likely), allowing for inter-observer variability and image noise.

RESULTS
The patients from the USA showed the greatest number of grade 2 and 3 MAs at 11% and 13%, respectively. 48% were given a grade zero, with no significant microaneurysms. In Canada, the results were 57% grade zero, 40% grade 1 and 2% grade 3. In China 78% were grade zero, 16% were grade 1 and 6% were grade 2.

CONCLUSION
The results of this study did not follow the published pre-diabetes prevalence statistics by region, likely due to the small sample size. A large-scale, multi-center clinical study would likely reveal similar statistics to the norms. Regardless, the numbers herein indicate that there is a significant pre-diabetes epidemic lurking world-wide that needs to be addressed. MSI screening is highly sensitive for imaging sub-clinical microaneurysms.

CONFLICT OF INTEREST DISCLOSURE
Dr. Zimmer is the Clinical Affairs and Research Manager at Annidis Corporation.

Dr. Dong is a Director with NIMO, the Chinese Distributor for Annidis Corporation.

The Diagnostic Sensitivity and Specificity of Multi-Spectral Imaging as compared to Dark Adaptation in Diagnosing Age-Related Macular Degeneration – A Retrospective Preliminary Study

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PURPOSE
Reduced dark adaptation (DA) is a means of definitively diagnosing age-related macular degeneration (AMD).1 Normal eyes on fundus photography with an abnormal DA at baseline were approximately twice as likely to have AMD at the three year follow up visit.2 Multi-spectral imaging (MSI) has demonstrated very early signs of RPE disruption in patients as young as 26.3 The purpose of this study was to determine the sensitivity and specificity of the RHATM (Annidis, Ottawa, Canada) using MSI to definitively diagnose AMD, as compared to DA with the AdaptDx® (Maculogix, Hummelstown, USA).

METHOD
The MSI images of 32 patients from one optometry clinic were retrospectively analyzed for AMD by an experienced, masked observer, based on a simplification of the AREDS Classification. The MSI images were given a grade

of 1 or 0 depending on the presence or absence, respectively, of RPE disruption (melanin migration or aggregation), drusen and/or geographic atrophy in one or both eyes.

The results were compared to the DA rod intercept in minutes for the short duration (6.5 minutes) screening on the same day for each eye. 65.6% of the patients were female and the mean age was 58.5 ± 9.2 years. The sensitivity and specificity of the MSI images relative to DA results were calculated for the highest rod intercept of each patient.

RESULTS

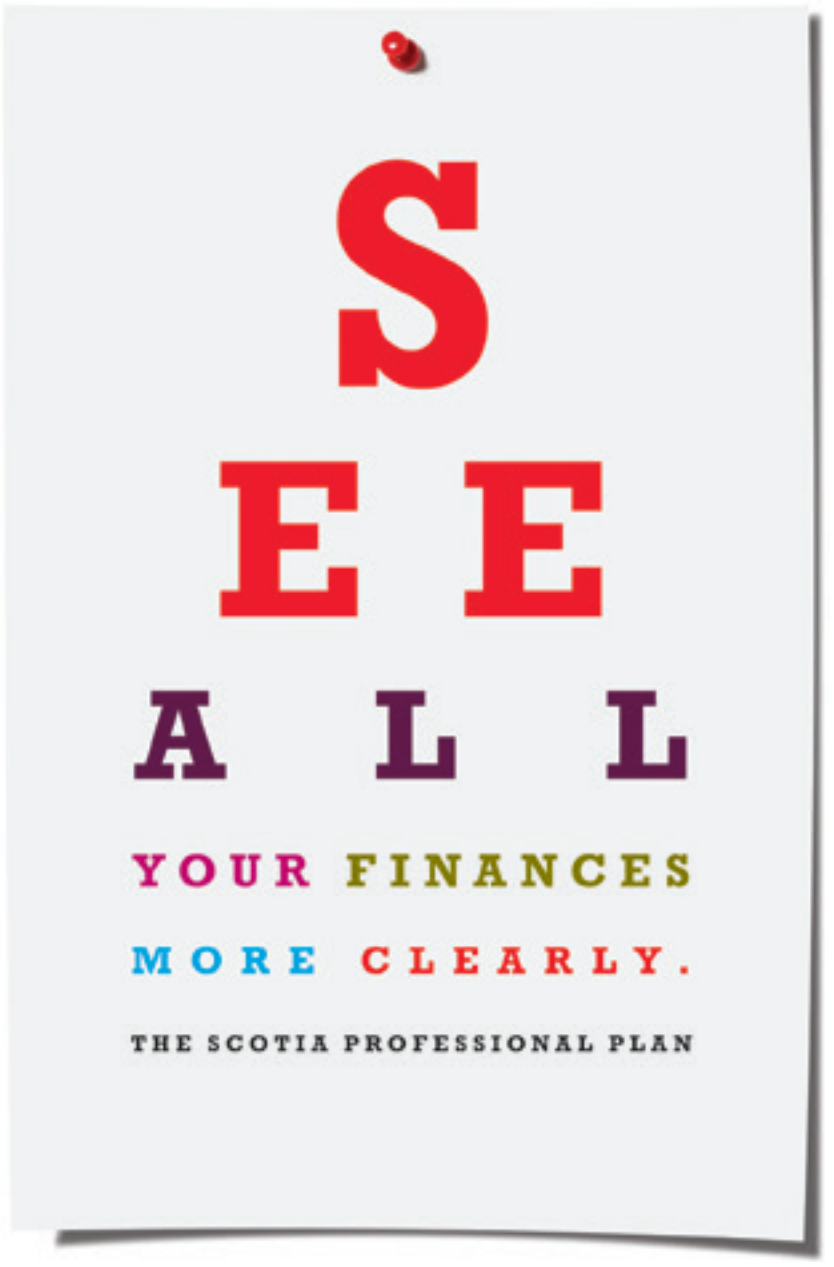
DA was the standard to which MSI was compared. 13 patients were true positives and 1 was a false negative for AMD. There were 9 true negatives, considered healthy normal by both tests and 9 false positives found with MSI. The sensitivity of MSI for diagnosing AMD was 92.9% however it was only 50.0% specific.

CONCLUSION

MSI is highly sensitive for diagnosing AMD as compared to DA, although it is not specific for AMD, identifying normal drusen of aging and RPE disruption of other origins. This suggests that MSI is an excellent screening tool for ocular pathology and can drive more patients toward DA for a definitive diagnosis of AMD.

CONFLICT OF INTEREST DISCLOSURE

Dr. Zimmer is the Clinical Affairs and Research Manager at Annidis Corporation.



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An Optometrist's Guide to Protection from Burglary

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You work hard to build and maintain your business. That's why it's important to ensure you're protected from all potential losses – including burglary.

Since introducing optional business insurance to the Canadian Association of Optometrists (CAO) insurance program in 2015, over 75% of all property claims have involved burglary or theft. According to Derrick Roberts, Senior Casualty Specialist with Aviva Canada, optometrist businesses are at risk, particularly for burglary of portable equipment and stock. "We see a lot of incidents where the burglar will go after high-end frames and sunglasses", says Roberts. "Generally, they are looking for designer products that are easy to carry and easy to sell."

Losses associated with burglary claims can be fairly significant, ranging from a few thousand dollars to tens of thousands of dollars worth of property being stolen. With this in mind, a robust risk management plan is a major consideration for optometry business owners.

RISK MANAGEMENT

There are many options to consider when designing a burglary prevention plan because every business has unique requirements based on its location, size, and internal layout. Use this information as a guideline as you review the security requirements of your premises to determine the right burglary protection plan for you.

1) EXTERNAL PROTECTION MEASURES

Think of the outside of your premises as your first line of defence against forced entry as you consider the necessary measures required to protect your property from intruders.

Doors

- Install exterior doors constructed from external grade materials based on local building code and manufacturer guidelines;
- Ensure exterior doors and frames are in good condition, fitted, reinforced and well secured to the building structure;
- Consider improving security by fixing a secondary panel, steel bars, grilles, 3M security film, or mesh across external doors, particularly over glass sections or thinner panels;
- Review your door locks and padlocks and consult a locksmith to determine the security levels required by door type, for example, a single cylinder deadbolt should be fitted on timber doors;

- Include a closed shackle padlock and heavy duty pad-bar for double doors;
- Seek outside advice regarding additional security from the fire department or your insurance company as fire exit doors are usually secured only by panic bars.

Windows

- Ensure windows and frames are in good condition, fitted and well secured to the building structure;
- Reduce forced entry through windows by installing steel bars, grilles or shutters;
- Fit ground, basement and accessible upper floor windows with key operated window locks.

2) ELECTRONIC PROTECTION MEASURES

The installation of an alarm or closed-circuit video surveillance system should be determined based on the specific needs of your business and equipment should only be installed by a reputable company.

Alarm system

- Select your alarm system based on its ability to deter intruders, attract attention and initiate a response from police, a contract security company or authorized employees;
- A simple alarm with at least one high level external sounder can act as a significant deterrent to forced entry, and limit the time an intruder is prepared to risk staying within the premises;
- More sophisticated alarms can be connected to an alarm-receiving centre, security service or police if activated;
- Ensure the alarm system has ULC certification.*

Closed Circuit Video (CCV)

- Install CCV systems if you have high risk premises, to capture any evidence of criminal activity on the premises, including burglary;
- Select a system based on your needs. A basic internal system will view and record activity in strategic areas, while a complex system requires a resource to monitor activity continually;
- Ensure equipment and recording media are checked regularly for correct operation and picture quality;
- Re-use recording media in strict date order.

Key or badge access control

The use of electronic access control locks on doors and careful attention to working arrangements and staff training can help reduce the risk of unauthorized entry.

3) INTERNAL PROTECTION MEASURES

The inside of your premises will require measures based on a number of factors including layout, equipment and stock. Consider the necessary measures required to protect your property from burglary during business and after hours.

Staff procedures

- Conduct thorough reference checks when hiring employees;
- Ensure all staff is trained, understand and comply with all security measures in place.

Cash

- Ensure cash tills are located in areas covered by staff at all times;

- Install a cash drawer till-guard to reduce the chances of cash being snatched when the till is open;
- Cash-out after the premises are locked or in a separate locked room;
- Minimize the risk of damage to cash tills by leaving them empty and open outside business hours;
- Install a burglar resistant ULC certified safe* to use for cash and cheque storage;
- Bolt the safe to the floor, not against an exterior wall, and out of sight of the general public;
- Store cash (including change floats and excess cash from daily sales) in a safe or remove it from the premises after business hours;
- Make frequent deposits and limit the maximum amount of cash based on your business requirements;
- Provide a minimum number of people with access to the safe.

Equipment and inventory

- Ensure your inventory logs are updated regularly, to account for merchandise and stock on hand in case of theft;
- Where possible, bolt equipment to the walls or floor of the premises and lock up any portable equipment after hours.

Computers

- Add an identification mark or a serial number to computers to make them easily identifiable and unattractive to thieves;
- Locate the processor unit in a locked cupboard or room away from the monitor and secure it to a desk or wall using lockable steel cables;
- Ensure any confidential customer or personal files are encrypted within your computer and keep a back-up copy of the information off-site in a secure place.

Additional considerations

- Neighbourhood watch: teaming up with neighbouring businesses or even the tenant of an apartment above your business may serve as a deterrent to burglary or result in prompt notification of a break-in;
- Lighting: leaving a few night lights on inside the premises and installing movement sensor lights can aid surveillance by neighbours, members of the public, and the police.

4) INSURANCE

A comprehensive business risk management plan should always include an assessment of your insurance needs with consideration given to your specific exposures.

This article addresses burglary and theft, coverage for which is generally included in a Commercial Property insurance policy. However, business owners must also be aware of their other property and contents-related exposures (such as fire or water damage) and should secure adequate insurance protection against these events. There are also general liability exposures to consider; if your patients or other visiting parties hurt themselves on your premises (for instance, in a slip and fall on a wet floor), they can sue you.

CAO members have access to an exclusive Clinic/Business Package insurance to protect your premises and the contents within from these exposures. The Clinic/Business Package insurance policy bundles together three key insurance coverages to ensure comprehensive protection of your optometry business. These include: Commercial General Liability coverage, Commercial Property Insurance, and Crime protection. Business interruption coverage is also embedded in the policy to recover loss of income caused by an interruption of business activities arising from an insured loss, such as a burglary.

The information and risk strategies included above are intended to serve as a guide for optometry business owners. Every business situation is unique, so we encourage readers to seek specific advice from a knowledgeable insurance and risk management professional when dealing with particular situations. For further information on this topic, or to learn more about the coverage available through the CAO program, please contact BMS Group at 1-844-517-1371 or cao.insurance@bmsgroup.com, or visit www.cao.bmsgroup.com. ●

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