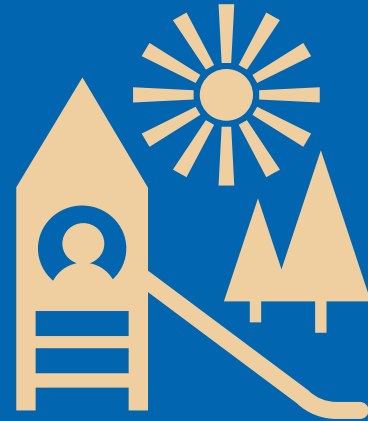


Consensus: Daylight & Myopia



Introduction

This HOYA advisory meeting is designed to share experts' opinions on myopia management based on scientific evidence and their clinical experience and provide a consensus on daylight and myopia management in children.

Advisory Meeting set-up

Four well-known independent experts in myopia research from Asia and Europe with specific knowledge related to light and myopia were suggested by the International Myopia Institute with the goal to reach a consensus on the topic of daylight and myopia management in children. For this specific advisory meeting daylight referred to outdoor sunlight specifically.

Children should spend more time outdoors in daylight to delay the onset of myopia and slow down myopia progression.¹

From different studies as summarized in the White Papers from the International Myopia Institute (IMI) it has been confirmed that outdoor time in daylight has a preventive effect on the onset of myopia and potentially reducing the progression of myopia in children.¹ The role of outdoor time in children with myopia is still unclear but the recommendation is to stay outdoors in daylight for at least 80 minutes a day.² The experts mentioned that each 45 min additionally spent outdoors can prevent 20% of the onset of myopia.

The difference in light between indoors and outdoors has to do with light intensity, spectral composition, temporal frequency, and time and place itself. The balance between indoor and outdoor tasks and activities in relation to myopia onset and its progression is still under consideration, but generally speaking when children are

outdoors, they tend to be involved in activities that are at a distance instead of close-by.³ Current evidence suggests the beneficial effect of daylight and being outdoor for myopia management are dose dependent.⁴ The dose dependent effect with dosage, add power or wearing time has been seen with optical and pharmaceutical treatment options.^{5,6,7}

Based on animal studies summarized in the IMI white papers, it is still not clear which wavelengths are relevant in myopia development.⁸ In animal studies a dose dependent effect of light and wavelengths has been observed but also varying results between different species exist.⁸

Children should be protected from intense sunlight.

Sun protection from UV rays is important because of the risk of early cataracts, damage to the conjunctiva and potentially the retina.⁹ The experts mentioned that sun intensity depends on the time of day - midday is the most dangerous time. There is also a relationship between seasons and regions in the intensity of sun light.

The awareness of sun protection varies from region to region. The same attention should be given for eye protection like we protect our skin from the sun. In some countries such as Australia, sun protection, e.g. a hat with a brim, is recommended, but a sun hat does not protect from reflected light.

Intense sunlight also reduces contrast sensitivity, visual comfort and performance.¹⁰

Some children under atropine treatment are more light sensitive and demonstrate more glare related symptoms due to the increase of pupillary size.¹¹ For this reason, sun protection is particularly recommended by the experts for children who are sensitive to light and for those who suffer from these side effects.

Understanding the role of light transmission on myopia management lenses

UV rays should be cut below 380nm as it is a standard in sun protection.¹² From animal studies in the white paper from IMI it is unclear which visible wavelengths play a role in regulating eye growth.⁸ It may be the full visible light spectrum, light intensity and child behavior influence on the axial eye length rather than a particular wavelength itself.¹³ The light intensity outdoors even under a cloudy sky or in the shade is more intensive than in an indoor situation.^{14,15}

The experts mentioned that even with sunglasses, children will still be exposed to more intense light outdoors than indoors and still have the positive effect of daylight for myopia management.¹⁴

The retina is able to differentiate different contrast levels and decreased contrast can also be a factor in myopia development during childhood.¹⁶

Combining sun protection with optical treatment options

As there is no evidence yet, it requires further investigations to find out if the treatment effect is influenced by the combination of myopia management spectacles alongside sun protection filters compared to the current studies on clear spectacle lenses.

A potentially beneficial effect of using myopia management spectacles lenses in combination with protection from intense sunlight may occur if this leads children to spend more time outdoors or increases the overall wearing time of the optical myopia management treatment. Photochromic lens would make it easier for the child to have one pair of spectacles for both indoors and outdoors.

Reduced transmission dilates the pupil and a larger pupil size may be more beneficial to the myopia management effect than adverse.¹⁷

Photochromic or sun protection spectacle lenses are widely used with higher dosage of atropine $\geq 0.1\%$ ¹⁸ but children also suffer from visual symptoms under the more commonly used low dose atropine.¹¹ Research suggests that photochromic spectacle lenses improve visual symptoms in children receiving low concentration atropine.¹⁹

Conclusion

It is scientifically accepted that spending more than 80 minutes a day outdoors in daylight has a preventive effect on the onset of myopia and possibly reducing the progression. The longer the optical treatment options are worn, the greater the expected effectiveness of the treatment will be.

UV rays can cause potential damage to the eye structures, and intense daylight can cause glare and reduce visual performance. These symptoms may be increased while using atropine in myopia management.

At present, there is no evidence on how a reduction of transmission of outdoor daylight in general and specific wavelengths from the visible light spectrum influence the effectiveness of optical myopia management options.

The possible slowing of myopia progression by increasing the wearing time of defocus optics could be positively influenced by prolonged exposure to daylight when symptoms from intense sunlight would be less disturbing due to inbuilt sun protection.

* The opinions expressed in this consensus and by the experts advisory meetings are the current opinions of the individual experts and cited reference sources and do not reflect the opinions of HOYA. The opinions are presented for informational purposes only and are not intended as medical advice, diagnosis, or choice of treatment. Patients should always consult their Eye Care Professionals for diagnosis and treatment decisions.

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