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Short Communication

Myopia Management: Why is it So Important?

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Myopia presents the biggest threat to eye health of the 21st century. A chronic, progressive disease, it is characterised by excessive eye elongation and can lead to sight-threatening complications [1]. Incidence of myopia has increased at alarming rates around the world, with higher prevalence recorded among children and young adults. This is placing not only a significant toll on patients, but considerable strain on public health services [2].

With myopia projected to affect over half the world's population by 2050, there has never been a greater need for a new approach to managing and treating this disease [2,3]. Asia, where increased myopia prevalence was first recorded in the 1980s, and several other countries have now declared public health emergencies in response. Advances in knowledge of the cause and development of myopia have given eye health professionals a better understanding of the clinical interventions required.

What causes myopia

Myopia was believed to be mostly genetic.

But more recent evidence, however, shows that myopia onset and progression, results from a complex interaction between environmental, visual conditions and the genetic mechanisms intended to modulate emmetropization [3,5].

Emmetropization is a visually guided developmental process that aims to match the eye's axial length to the power of its optical components, so that the unaccommodated eye is focused at distance. At birth, most babies have a focus point that falls behind the back of the eyes. When form deprivation or hyperopic retinal defocus is experienced:

1. Biochemical signals are transmitted by the retina, through the choroid to the sclera, where it alters the biomechanical properties of the sclera, increasing axial length [3,4].
2. The choroid also plays an active role in emmetropization, both by
    a. Decreasing choroidal thickness, which moves the retina closer to the focus point of the eye (choroidal accommodation). This is not permanent and may even function as a mechanism to sustain focus on the retina until the length of the eye 'catches up' to the power of its optical components. Choroidal thickness returns to normal at a pace similar to that of the changing size of the globe [3,4].
    b. Releasing growth factors that regulate scleral changes which lead to axial length increase [3,4].

Myopia develops when this control mechanism is no longer accurate, and the axial length increases beyond the point of focus of the eye [3,4]. Environmental and ocular factors that can affect image quality, stimulating eye growth (axial elongation) include:

- Peripheral retinal defocus [3,4]
- Under accommodation [3,4]
- Higher-order aberrations [3,4]
- Contrast [4]
- Circadian rhythms [3,4]
- Light intensity and spectral compositions [3,4].

Why is myopia increasing

There are many factors and hypothesis, but the main reasons that myopia is caused and increased, is genetic, visual and environmental factors interacting with one another [3-5].

Genetic

- Parental history of myopia correlates with the rate of axial elongation and increase in myopic refraction [3,5].

Binocular vision/accommodation

- Esophoria has been associated with a higher prevalence of myopia [3,5].
- Lag of accommodation has been associated with a higher prevalence of myopia. A high lag of accommodative is associated with faster progression of myopia [3,5].
- High AC/A ratio seems to be a reliable predictor of myopia onset and begins to increase approximately 4 years prior to the onset of myopia. It is also associated with myopia progression [3].
- Intermittent exotropia (IXT) has also been associated with a higher prevalence of myopia, with 47% of children with IXT becoming myopic by age 10 and 91% by age 20 [5]. This could be due to the increased accommodative demand in children with intermittent exotropia [6].

Environment

- Less time outdoors has been the most influential environmental factor associated with the onset of myopia to date. There are many different theories about whether it could be due to the brightness or wavelength of the light exposure, the intricate spatial properties and three-dimensional structures of the natural world, and/or other mechanisms. But one thing is certain, spending more time outdoors is effective in slowing the myopic shift in refractive error in non-myopic eyes and preventing the onset of myopia [3-5].
- More near work usually goes hand-in-hand with less time spend outdoors. But evidence further suggest that for every 1 diopter per hour spend doing near work, the odds of becoming more myopic increases by 2% [3-5].
- Increased screen time, for both academia and recreation by very young children may be further promoting myopia onset and progression [3].

How can we manage myopia

The most fundamental discovery from animal studies was that retinal defocus carries specific visual information used to regulate the growth and refractive state of the developing eye [4]. Therefore, controlling the visual conditions that affect eye growth offers both non-invasive and economic means to reduce myopia progression.

But where controlling visual conditions are not enough, personalised options for myopia control should be considered as early as possible, to stem myopia and the vision-threatening conditions associated with this disease. Treatment should be based on individual motivation, lifestyle and ocular characteristics, but evidence based myopia control studies suggest better efficacy for the following.

Binocular conditions like esophoria, high AC/A ratio and accommodative issues:

- Visual therapy [7]
- Lenses neutralising lag of accommodation and eso fixation disparity (FD) at near [8]
- Progressive addition spectacle lenses [3,5]
- Bifocal (centre distant) contact lenses [3,8]
- OrthoK lenses [3,5].

Binocular conditions like intermittent exotropia:

- Visual therapy.

With normal accommodation:

- Overcorrection minus lenses, to stimulate accommodation and reduce exo, was found to not accelerate myopic shift [9].

With reduced accommodation issues:

- Prism bifocal lenses (to reduce the near exo shift caused by the additional plus) [3,10].

Myopia with no binocular vision issues:

- Peripheral defocus myopia spectacle lenses [3]
- Peripheral defocus myopia contact lenses [3]
- Atropine [3].

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Volume 4 Issue 6 June 2021