Myopia: a growing problem

Expert Statement: Royal Irish Academy Life and Medical Sciences Committee

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Myopia

Myopia (sometimes called short- or near-sight) is an error of focus of the eye. For clear vision, light rays entering the eye should be focused accurately on the photosensitive cells of the retina at the back of the eye. The non-myopic 'typical' eye can focus images at a range of distances to provide clear images of objects close by and in the distance. A myopic eye only achieves accurate focus naturally when an object is close to the eye; objects further away become increasingly blurred. Myopia is routinely corrected using optical methods such as spectacles or contact lenses. More recently, surgical correction has also become an accessible option.

The myopia epidemic

Researchers and clinicians have noted a startling increase in prevalence of myopia over recent decades; this has been described as a 'myopia epidemic'. This 'epidemic' has been most strikingly documented in East and Southeast Asia. In Taiwan, for example, the prevalence of myopia has increased rapidly such that over 60% of 12-year-old Taiwanese children were myopic in 2000, compared with approximately 20% in 1983. Over 80–90% of young adults currently completing high school in urban Taiwan are myopic. Whilst a lower prevalence of myopia is reported amongst white populations, there are considerable geographical variations. Myopia affects approximately 15% of Northern Irish children aged 12–13 years; a level three times greater than that reported in a comparable white population of European descent in Australia at the start of the twenty-first century. However, as in East and Southeast Asian ethnic groups, prevalence appears to be increasing amongst white populations. In the UK, contemporary teenagers demonstrate myopia prevalence double that described in the UK in the 1960s, and recent Australian data describes a significant increase in prevalence of myopia in school children over a much shorter, 5–6-year, time frame.

In most individuals the onset and development of myopia cannot be explained by simple genetic factors; rather, genetic susceptibility to myopia is encouraged or depressed by environment. Environmental factors proposed to increase risk for myopia include increased time spent in formal schooling and higher levels of educational attainment. Myopia is almost universal amongst children in the intense, high-achieving urban schooling systems of East Asian countries such as Singapore and Hong Kong. In Northern Ireland, myopia prevalence and progression are also strongly associated with grammar-schooling. The mechanisms underpinning the strong association between education and myopia are not fully understood, although the physical demands and optical consequences of extensive periods of near work have been implicated.

The cost of myopia

Whilst correction of myopia is relatively straightforward, and myopia may not be regarded as a major health issue, the startling rise in the prevalence of myopia is not entirely benign. One analysis has estimated the cost of providing optical or surgical correction for myopic individuals in Australia to total hundreds of millions of dollars per annum. In addition to these significant costs to individuals and health providers in countries where eye-care services are readily available, there are, conversely, the costs to society, the economy and to individuals

when optical correction is not available or within the resources of myopic individuals. It is estimated that 153 million people in developing countries, where access to eye-care is severely restricted, are visually impaired, and therefore economically and socially less active simply because they are unable to obtain spectacles to correct simple errors of focus such as myopia.

Higher levels of myopia bring with them risk for additional, sight-threatening pathologies that optical correction cannot prevent. Myopia usually occurs as a result of excessive eye growth; the amount of myopia increasing proportionally with eye size. The abnormal elongation of the myopic eye deforms and weakens the structures of the posterior eye, and these structural deformations become more evident with increasing age and with larger, more myopic eyes. Eye health and vision should be monitored more closely in these individuals.

Can the epidemic be contained?

Myopia is not a static condition. Most myopia begins during school years, increasing in magnitude through the teenage period. Research clearly highlights heredity as one risk factor for a child becoming myopic; children in Northern Ireland are four times more likely to be myopic at 12–13 years if they have a myopic parent (compared to a child with non-myopic parents), and six times more likely if both parents are myopic. It is, however, currently unclear why some myopic children show rapid rates of myopic eye growth and higher resultant levels of myopic error than their peers whose myopia remains small or moderate. Research has identified some potential methods to slow the progression of myopia, including the use of corneal moulding contact lenses and specially designed spectacle lenses that alter visual experience to 'trick' the eye into slowing its growth. Pharmaceutical interventions that act on the chemical receptors within the eye have had some success in limiting eye growth and reducing myopic progression. To date, however, none of these approaches has achieved wide-scale acceptance, due to limitations in the size and sustainability of the effect and concerns over side-effects of pharmaceutical agents.

Environmental strategies to limit both the onset and progression of myopia have also been proffered. This is in response to research suggesting that exposure to outdoor lighting levels can have a protective effect against myopia onset and development. Animal work reassuringly demonstrates the robustness of this environmental effect under UV-free conditions, therefore ensuring that increasing exposure to outdoor light in order to modify risk for myopia is not at odds with messages about UV protection and prevention of skin cancer. Further work is required to explore fully whether children's visual development can benefit from increasing exposure to outdoor light levels, but an increase in engagement in outdoor activity and exercise clearly aligns with well-founded public health directives.

With published data demonstrating three times more myopia amongst comparable groups of children in the North of Ireland compared with Australia, and given the obvious differences in climate between these two populations, parents in Ireland may have additional reasons to encourage children to get off the sofa and into the garden.

The authors are part of the Northern Ireland Childhood Errors of Refraction (NICER) Study team, in the Biomedical Sciences Research Institute, Ulster University, Coleraine. The NICER study is funded by the UK College of Optometrists.

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