

Contact Lens Update

CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

The Myopia Epidemic Today

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After a long history of study, as well as a significant recent increase in research attention, the cause or causes of myopia, particularly in relation to its progressive development in children, is still not clear. Other factors, such as the high prevalence of myopia and its harmful effect on visual acuity, even at low levels, have contributed to this interest (only 1.00 D of myopia will result in an average visual acuity of 6/19.5 and a range of 6/9 to 6/45¹).

The early history of the study of myopia can be characterized by controversy as to whether it is caused by genetic factors or whether it is related to the visual environment—particularly the role that accommodation may or may not have in its etiology. The eminent 19th century scholars von Helmholtz² and Donders³ considered myopia an acquired anomaly caused by excessive near work, as did Tscherning⁴. The possibility that myopia is acquired led to many suggested and tried interventions, a number of which were based on questionable science. As a result, myopia research was not seriously investigated during the middle decades of the 20th century.

Serendipitous results published in the late 1970s showed that myopia could be induced in animals during early development by manipulating the visual environment, helping legitimize myopia research and sparking the beginning of a period of extensive and ongoing study of myopia. This effort has included study of animal models as well as clinical/human investigation.

The results of the past three decades of intensive research may be highlighted by the finding that myopia development involves both genetics and the visual experience⁵, although how these two interact is far from clear. Moreover, the separation line between these factors is not as sharply delineated as once thought, as shown for example in recent work by Dirani, Sheker and Baird⁶, which notes that educational attainment is related to genetics and is therefore not purely an indication of environmental risk.

The other important conclusion is that the prevalence of myopia is increasing significantly, and not only in East Asian populations. In 2002, Grosvenor⁷ published a book on myopia directed to the lay public, which he called “The Myopia Epidemic: Nearsightedness; Vision Impairment and Other Vision Problems.” Recent epidemiological reports indicate that his use of the term “epidemic” is very appropriate and not at all alarmist.

In this context, it is important to keep in mind that as the prevalence of myopia increases, there is a corresponding increase in extreme levels of myopia and associated ocular pathologies. For example a study of 11,000 Taiwanese children aged six to 18 years highlights the extreme incidence of myopia among Asian populations⁸. The study indicated that by the time they are 18 years old, over 84 per cent of these children are myopic, with extreme myopia (over 6.00 D) amounting to 18 per cent in girls and 12 per cent in boys. A report on the prevalence and progression of myopia in Singaporean children also found high levels for both, particularly in Chinese children⁹.

Another study, published in 2009 by Vitale, Sperduto and Ferris¹⁰ is important because it compares recent data on the incidence of myopia in the United States with data collected using the same methods in the early 1970s. This study used a variety of criteria and methods, such as lensometry, pinhole visual acuity and retinoscopy, depending on the subjects' visual acuity, to survey the prevalence of myopia in people 12 to 54 years of age. The important point is the consistency of the methods used in the earlier and later studies. The results indicate a significant increase in overall prevalence of myopia from 25.0 per cent in the earlier study to 41.6 per cent in the more recent study. The change for African Americans is even more dramatic, with a reported increase from 13.0 to 33.5 per cent. A more recent Canadian report, based on a review of over 6000 patient visits to a university eye clinic over one year (2007 to 2008), arrives at a remarkably similar overall myopia prevalence finding of 41%, with a maximum prevalence of 72% in patients 20 to 25 years of age¹¹.

The prevalence of myopia and its association with body stature and educational level in over 23 thousand 19-year-old male conscripts in Seoul, South Korea was reported by Jung et al., in 2012¹². Myopia was defined as a spherical equivalent <-0.5 diopters (D) and high myopia >-6.0 D. The results indicate an astounding prevalence of myopia of 96.5%, while the prevalence of high myopia was 21.61%. An equally high prevalence of myopia and high myopia was found in over five thousand Chinese university students in Shanghai in a study published the same year¹³. The mean spherical equivalent refraction of the students was -4.1 D and 95.5% of subjects were myopic while 19.5% were highly myopic and only 3.3% were emmetropic ≤ 0.5 D). The postgraduates were more myopic than the undergraduates (96.9% and 94.9% respectively). Most recently, a retrospective cross-sectional study presented at the 2014 ARVO meeting shows that the prevalence of myopia in Europeans is significantly higher (33%) in younger (20 to 30 years) individuals than in older cohorts (22.6 % in those born between 1930 and 1939)¹⁴.

There is a long history of efforts to prevent or mitigate myopia development in children. These include the use of bifocals, progressive addition lenses or pharmaceuticals to reduce accommodation, and contact lenses designed to flatten the cornea. Promising new avenues include methods that have investigated the effect of peripheral refraction on the development of central ocular refractive state as well as study of the role of outdoor activity on refractive development in children. Nevertheless, all that appears to be certain at this point is that the myopia epidemic is accelerating. In East Asian countries the prevalence of myopia is approaching 100% in young adults, and the rate of change in North American and European populations remains significant and may be increasing. Perhaps it is timely to consider a world in which at least 50% of the population will be myopes?

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