Reducing the impact of the impending myopia epidemic in New Zealand
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ABSTRACT
Myopia is an eye condition that is increasing around the world, reaching epidemic levels in many countries. It is associated with a higher risk of other ocular diseases including myopic maculopathy and retinal detachment. Historically in New Zealand myopia has existed at a low level, however the environmental changes that have increased myopia internationally will affect New Zealanders too. Higher levels of myopia will have a profound social, economic and health burden on our country. Fortunately, proven interventions to limit the onset and degree of myopia already exist. To limit the level of myopia in New Zealand we propose the creation of a multidisciplinary myopia action group (NZMAG). The NZMAG will serve to support local research, raise awareness of the condition and its associated pathologies, facilitate access to myopia control treatments, improve identification of at-risk children via screening programs, and serve as the guiding body for myopia-related information. With prompt action now, the myopia epidemic seen in other countries can be reduced in New Zealand.

The visual condition myopia, colloquially known as short-sightedness or near-sightedness, is the most common ocular problem in the world. Currently an estimated 1.4 billion people in the world are myopic (23% of the world) with 163 million having high myopia of over five diopters (2.7%). In many East Asian countries, where urbanisation and environmental risks for myopia are high, the condition has reached near ubiquitous levels, affecting up to 90% of young adults (Figure 1). Approximately one-third of adult Americans and Europeans are myopic. Closer to home, 30% of Sydney’s 17-year-olds are myopic, double the prevalence of myopia reported in Australia more than a decade earlier. The only available New Zealand data is a prevalence of myopia of 4.2% in Dunedin 11-year-olds in 1984. Alarming, an increasing prevalence of myopia is now established in a number of populations.

The blurred sight of a myope can be corrected with glasses, contact lens or surgical vision correction, albeit with cost and inconvenience to the individual. However, the increase in axial length of the eye which occurs in myopia and which is not treatable, is associated with a host of sight-threatening complications (Table 1). In a European population, uncorrectable visual impairment from these sequelae is seen in 4% of 75-year-olds with myopia and 39% with high myopia. In Japan, degenerative myopia is the third most common cause of vision impairment, ahead of age-related macular degeneration (which is estimated to affect 10.3% of New Zealander’s aged 45–85) and cataract. Even mild levels of myopia carry a higher lifelong risk of blinding disease. To put this in context, myopia, even in the so-called ‘physiological range’, represents a major risk factor for ocular disease that is comparable with the risks associated with hypertension for cardiovascular disease and smoking for stroke.

There is a significant economic burden associated with myopia, with global loss of gross domestic product from uncorrected refractive error being estimated at $202 billion annually. Health economic analyses in the US and Australia have consistently shown that the economic burden of refractive correction far exceeds those from other eye disease.
In New Zealand, myopia’s risks are largely underappreciated by the medical, educational and public health community. Even many health professionals are not familiar with myopia, its sequelae or its prevention. Currently the focus is on managing uncorrected refractive error, rather than addressing and limiting the more important axial length elongation. Attempting to limit myopia presents a significant opportunity to reduce an individual’s lifetime risk of eye disease and visual impairment, in a similar way to reducing eye pressure in glaucoma. So how can we do this?

**Intervention options to reduce high myopia**

Once a child has become myopic, correction of their refractive error with single vision spectacles or contact lenses will improve their vision but will do nothing to slow myopic progression. Neither will deliberate uncorrection or under-correction of myopia slow a child’s progression.\(^\text{23-26}\)

However, there are several interventions currently available to eye care professionals in New Zealand that are proven to significantly slow the progression of myopia and limit axial length growth.

Firstly there are optical treatments, of which orthokeratology and multifocal soft contact lenses are the most effective. Orthokeratology involves the wear of a specially designed rigid contact lens during sleep to remodel the surface curvature of the cornea, leading to unaided correction of refractive error during the day. Meta-analysis of the myopia control effect afforded by orthokeratology shows a 45–50% mean efficacy.\(^\text{27,28}\)

In contrast, multifocal soft contact lenses are worn to correct vision during the day. These...
include the Misight myopia control daily contact lens, which was developed at the University of Auckland. Multifocal soft lenses show similar slowing of myopia with Misight lenses reducing progression of refractive myopia by 59% and axial growth by 52% over three years compared to controls. Orthokeratology treatment is generally well accepted by families and carries a high level of patient compliance as children see clearly throughout the day and their contact lens wear is supervised in a controlled environment at home. However, orthokeratology is generally only offered by a subset of optometrists with the skill and equipment to fit these specialty lenses accurately and safely and is generally more expensive than other myopia control strategies. Soft contact lenses fitted for myopia control by optometrists do not require additional equipment or training, are well tolerated by children and are of slightly lower annual cost than orthokeratology lenses. There is currently no government funding for contact lenses for myopia control unless the child or family have a valid community services card or high user card, which will cover only a small portion of the costs via the Enable subsidy.

Orthokeratology treatment is generally well accepted by families and carries a high level of patient compliance as children see clearly throughout the day and their contact lens wear is supervised in a controlled environment at home. However, orthokeratology is generally only offered by a subset of optometrists with the skill and equipment to fit these specialty lenses accurately and safely and is generally more expensive than other myopia control strategies. Soft contact lenses fitted for myopia control by optometrists do not require additional equipment or training, are well tolerated by children and are of slightly lower annual cost than orthokeratology lenses. There is currently no government funding for contact lenses for myopia control unless the child or family have a valid community services card or high user card, which will cover only a small portion of the costs via the Enable subsidy.

Secondly there are pharmacological treatments. Atropine, an anti-muscarinic agent, has been used as an eye-drop to safely control myopia progression for some time. Recently, lower concentrations of the eye-drop (eg, 0.01%) instilled daily have been shown in randomised control trials to slow myopia progression, without the significant side-effects. The main issue with low-dose atropine in New Zealand is that it is currently not commercially available nor funded. Low-dose atropine needs to be compounded at select pharmacies, increasing the cost and difficulty of access (eg, a month supply is approximately NZD$50 per bottle). If low-dose atropine can become more readily available, it represents the most realistic method for myopia control treatment due to the fact any healthcare professional can offer it.

Lastly, three major environmental factors contribute to childhood myopia: higher levels of education, greater urbanisation, and lower levels of outdoor activity. Based on current evidence, the most easily manipulated of these factors is outdoor time. Several studies have shown that school-based interventions aimed at increasing outdoor time reduced the onset and progression of myopia. Encouraging children to increase their outdoor time to approximately two hours per day is likely to have a positive impact in limiting myopia development in a population, as well as being beneficial for reducing other health problems like childhood obesity. This can be done with appropriate sun protection or undertaken earlier or later in the day.

A recent meta-analysis evaluated the methods of slowing myopia by comparing data from all the randomised controlled trials with study duration of over one year and grouped these in a strong, moderate, weak and ineffective strength relative to single vision spectacles or placebo. In terms of axial length control only low-dose atropine, orthokeratology and multifocal soft contact lenses exhibited ‘moderate’ myopia control, with only higher doses of atropine in the ‘strong’ category. This is consistent with the clinical guidelines from international myopia control experts that contact lens options and low-dose atropine on average provide a similar ~50% myopia control effect. Mathematical modelling shows that if myopia progression can be reduced by 50% across a population then the incidence of high-risk myopia above 5 D will be reduced by 97%.

What needs to be done to control myopia in New Zealand?

We have highlighted that myopia is:

- Common and increasing in prevalence worldwide.
- Strongly associated with visual impairment.
- An underappreciated individual burden and public health problem in New Zealand.
- Able to be slowed with myopia control treatments that decrease the eventual degree of myopia and the risk of visual impairment.
- Presently under-managed in that many young myopes receive only single vision refractive correction and not myopia control treatments.
What then are the translational steps that can be taken in the New Zealand setting to minimise the impact of the impending myopic epidemic? We propose the rapid establishment of a New Zealand Myopia Action Group (NZMAG), consisting of ophthalmic, optometric, paediatric, general practice, public health and Ministry of Health and Education representatives. The NZMAG would be a broad-based collaboration because myopia impacts on individuals, schools, communities, DHBs and policy makers.

The Myopia Action Group's immediate priorities would be to:

- Support research to investigate the current prevalence of myopia, and myopia sequelae, in New Zealanders. This will enable us to evaluate our risk of the social and economic burden in context with the rest of the world.
- Increase public and health professional awareness and education of myopia and its risks (eg, promote the first world Myopia Awareness Week in 2019).
- Ensure easy and affordable (publicly funded) access to low-dose atropine drops for the ophthalmic/optometry profession.
- Investigate the validity of establishing DHB myopia clinics (especially in large urban centres) that can provide the range of interventions discussed above.
- Set a minimum standard of care for childhood myopia management.
- Promote outdoor activities at school and home (while still ensuring sensible sun protection).
- Evaluate the pros and cons of an early identification of myopia school programme. Early intervention is more likely to be effective at limiting high myopia. This could be incorporated into the age 11 (year 7) vision check already undertaken by New Zealand Vision Hearing Technicians.
- To keep abreast of worldwide developments in myopia so they can be rapidly translated to the New Zealand scene.

We have written this article as a public-facing document designed to raise awareness of myopia and encourage participation and action within the relevant sectors. Our next step is to reach out to key personnel in these sectors to initiate formation of the NZMAG, and approach public and private groups for financial support to facilitate the necessary plans. China's Ministry of Education has recently announced a significant new scheme to reduce myopia in children, consisting of profound environmental and education changes. This highlights how seriously other countries are taking the threat of myopia; an example that we too should follow to prevent future vision loss in New Zealanders.

Competing interests:
Mr Petty is the director of the private optometry practice Bay Eye Care. He is a board member of the Orthokeratology Society of Oceania, a not-for-profit group supporting optometrists providing orthokeratology and myopia control services. He receives no financial compensation for this role, but does have travel expenses covered for meetings and conferences. He personally is an advocate for myopia management, including orthokeratology and specialty contact lenses. He has been asked recently to be the New Zealand spokesperson for the 'Child Myopia Report—A Focus on Future Management', a public health awareness campaign about myopia launched by Coopervision in Australia and New Zealand. He receives no financial compensation for this role.

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