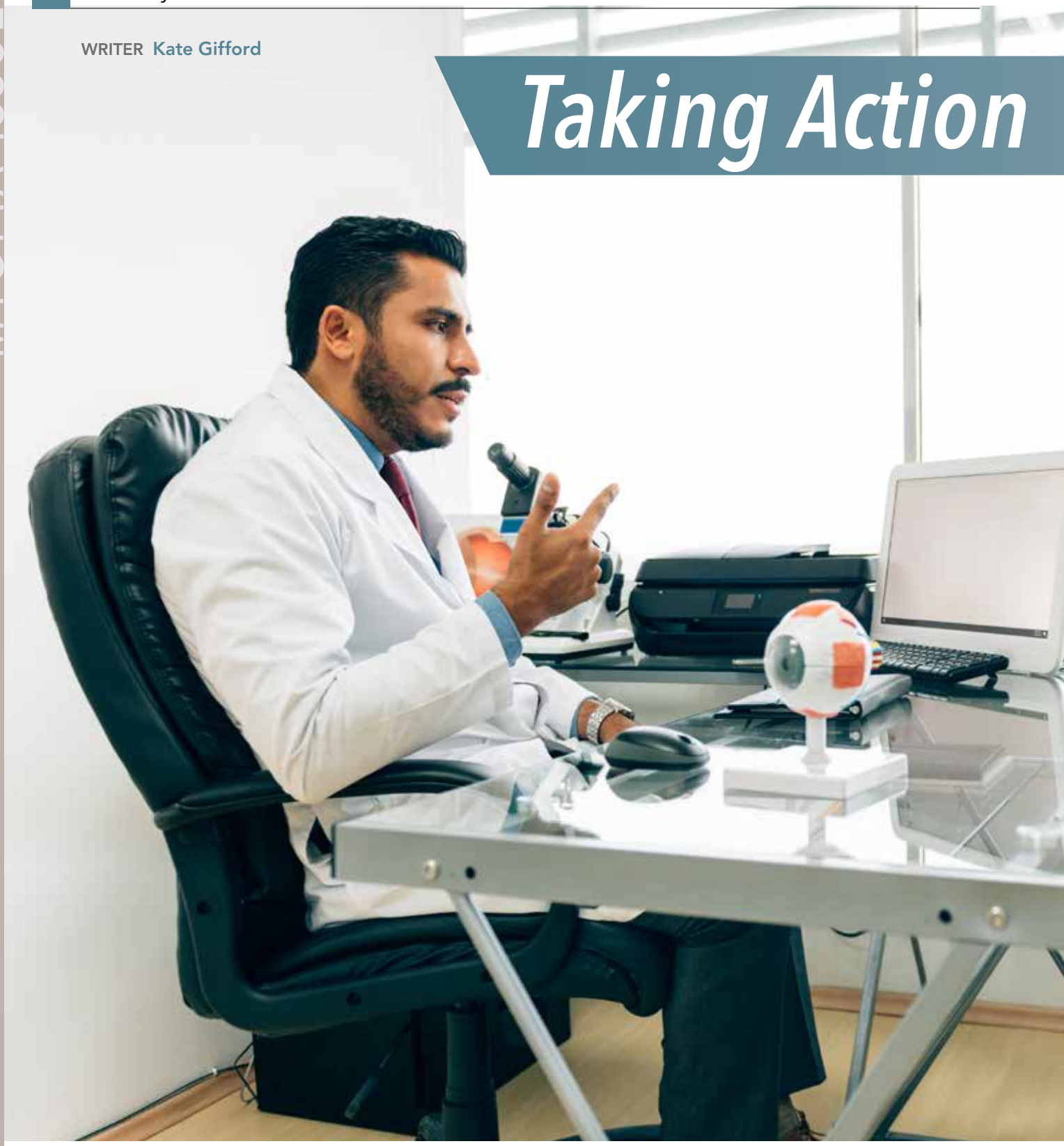
WRITER Kate Gifford

Taking Action



Over the past few years I have worked at the coal face of the myopia boom in clinical practice. During that time, I have shared my communication tools and management processes for progressive myopia with practitioners around the world. I've observed a burgeoning interest from eye care professionals, tempered by a hesitancy to put research into practice. Why? Perhaps because we don't yet have the 'perfect' product to prescribe or system to follow. What we do have, though, is increasing knowledge of and access to a variety of tools to appropriately manage our young myopic patients.

My core message is to just do something – something more than prescribing a single vision correction.

to Manage Myopia

> "three key messages on treatment are those of expectations, efficacy and safety"

A 2015 survey of more than 1,000 practitioners from a dozen countries showed that while most considered themselves active in myopia management, they prescribed single vision distance spectacle and contact lens corrections more than 50 per cent of the time to their progressing myope patients.[1] This is a management choice which, in most cases, is simply not evidence based.

A growing number of myopia management tools are available, and depending on your mode of practice, you may have access to few or all of them. The basis of myopia management starts with prescribing the best vision correction, which also provides efficacy for myopia control – necessitating a long-sighted view of the future risks of pathology, while holding in check the short-sighted concerns of treatment risk, associated with pharmacological or contact lens options.[2]

While the hard fact is there is not, and likely will never be, the ideal system to guarantee a halt to excessive axial elongation, it is remiss not to provide advice and options to each of our young progressing myopic patients. Importantly, we must communicate clear messages to patients and their parents to ensure they have a clear understanding of the condition and realistic expectations of its management.

THE PRESENT AND THE FUTURE

It is commonly understood that myopia prevalence is growing globally. By 2050, it is predicted that half of the world's population – five billion people – will be myopic, with nearly one billion at high risk of sight threatening ocular pathology.[3]

The late Brien Holden was a champion of ensuring myopia is placed on the world health agenda – high myopia is strongly linked to higher risk of cataract, retinal detachment and myopic maculopathy,[4] and increasing rates of vision impairment and blindness due to the latter are already evident in Asian countries.[5,6] Padmaja Sankaridurg and Monica Jong of the Brien Holden Vision Institute have described myopia as a public health concern in this special issue, and work at the BHVI has been key in seeing myopia put on the World Health Organization agenda.[7]

The myopia control imperative is understanding that even -1.00D of myopia carries an additional lifelong risk of posterior subcapsular cataract (PSCC), retinal detachment (RD) and myopic maculopathy (MM). According to paediatric ophthalmologist Ian Flitcroft, the delineation of physiological and pathological myopia is not valid, as the term 'physiological' implies there is a level of myopia which could be considered 'safe' in comparison to emmetropia. Using

	Glaucoma	Cataract (PSCC)	Retinal detachment	Myopic Maculopathy
-1.00 to -3.00	2.3	2.1	3.1	2.2
-3.00 to -5.00	3.3	3.1	9.0	9.7
-5.00 to -7.00	3.3	5.5	21.5	40.6
<-7.00	-	-	44.2	126.8

Table 1. Odds ratios of increased risk of ocular pathology with increasing levels of myopia, summarised from Flitcroft, 2012.[4]

odds ratios, which describe the increased risk of a condition over a reference of one (this being the risk of emmetropia), Table 1 summarises Flitcroft's data.[4] It shows that even 1D of myopia doubles the risk of MM and PSCC, and triples the risk of RD compared to the emmetrope. At 3D of myopia, the risk of PSCC triples, with the risk of RD and MM being nine times that of the emmetrope. Higher levels of myopia bring more eye-watering risks. Brisbane ophthalmologist Dr. Abhishek Sharma describes the challenge of the myopic retina in this special issue.

While dioptres of myopia are easily measurable and a good surrogate, ultimately myopia control is about axial length control. Tideman and colleagues from the Netherlands evaluated the prevalence of lifelong visual impairment (6/12 or less) with increasing axial length, using data from over 10,000 Dutch people with an average age of 61 years – an axial length of 24–26mm was used as the referent. Axial length of 26–28mm doubled the risk of visual impairment by age 60, while 28–30mm increased the risk by 11 times and an axial length of 30mm or more by 25 times. The prevalence of visual impairment by age 75 for the longest eyeballs (over 30mm) was 90 per cent. Between 26–30mm axial length, the likelihood of being visually impaired by age 75 was around 25 per cent, with the difference between shorter (26–28mm) and longer (28–30mm) eyes being the age of onset – the person with longer eyeballs is likely to suffer visual impairment for a longer duration of their life.[8] This is sobering data and provides the clear message to both patients and parents that controlling axial elongation also controls lifelong risk of visual impairment.

THE MYOPIA MANAGEMENT MESSAGE

Once the imperative to manage myopia is understood, there are three key messages on treatment that are essential for the practitioner to recognise and explain to patients and parents – expectations, efficacy and safety.

It's important for practitioners, and by turn parents and patients, to understand that some myopia progression is to be expected. The paediatric eye is expected to grow until age 12–13 through the process of emmetropization, hence some axial elongation over this period can be attributed to normal growth and not myopia progression. Don Mutti and colleagues analysed refractive and biometric data in the CLEERE (Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error) study and described that, on average, the paediatric eye will elongate by around 0.1mm per year before additional elongation contributes to myopia progression.[9] Once accelerated growth has been triggered through myopia development, progression occurs at a faster rate for younger children (around -1.00D per year for a Caucasian seven year old and -1.25D for an Asian seven year old) than for older children. The latter reduce to around -0.50 progression per year, on average, if corrected with single vision distance (SVD) spectacles.[10] The Brien Holden Vision Institute has recently released a myopia calculator whereby inputting the age and current refraction will output the predicted level of myopia by age 18. The user can then apply different treatments, which demonstrate the reduction in end-point myopia by their individual efficacy. The calculator can be freely downloaded from www.brienholdenvision.org/translational-research/myopia/myopia-calculator.html.

These predictions rely on averages, which is the best evidence based method with the current data available. There is potential for complication though in predicting a future-forward level of myopia when significant individual variation occurs. The aforementioned CLEERE study, which followed more than 2,000 children over a decade, showed that the younger a person becomes myopic, the faster they will progress and the more myopic they will become. However, their data also showed that for children who became myopic (<-0.50) at age six, some may only progress to -1.00 while others progress to -6.00.[11] This variability is also evident across older age groups – although later onset generally leads to lower final levels of myopia. Since myopia progression can be unpredictable, an alternative approach is to compare progression, after it has occurred, to expected rates in 'untreated' children, where this refers to single SVD correction.[10]

> "for the current and lifelong benefit of young myopic patients, we must ensure we are not myopic about myopia control"

If an eight year old Caucasian child has progressed -0.50 across one year of myopia management, their parents may be disappointed in the outcome, where in fact this represents a 50 per cent myopia control effect compared to their average SVD spectacle wearing counterpart. This much progression in an 11 year old, however, indicates inadequate myopia management.

Figure 1 provides a reference for the expected progression per year by age for Caucasian and Asian children (in red).[10] Figures in yellow indicate the amount of progression per year, with 33 per cent myopia control efficacy achieved by progressive/bifocal[12,13] or novel spectacle lens designs[14] in certain conditions. Green figures indicate 50 per cent efficacy, typically achieved by multifocal soft contact lenses, OrthoK and low dose atropine.[15-18]

Understanding and communicating percentage rates of myopia control can be complex because the study design and control group parameters affect the final outcome in a single study. For example, an older control group will generally show lower progression and hence a lower percentage efficacy. This means that meta-analyses provide the best indication. A recent meta-analysis of eight multifocal and novel myopia control soft

contact lenses found a mean efficacy of 30-50 per cent,[17] and similar meta-analyses undertaken on OrthoK studies showed a 45-50 per cent mean efficacy.[16,19] The key paper published on low dose atropine in 2016 compared 0.5 per cent, 0.1 per cent and 0.01 per cent concentrations. In the first two years of the study, a greater efficacy was found with the higher dosage.[20] For the next year all treatment was ceased, and the higher dosage groups showed a greater percentage of rebound, defined as progression of 0.50D or more in that year. The third phase of this study saw all participants treated with 0.01 per cent atropine for a further two years, with the final outcomes showing that those children who had been treated with 0.01 per cent atropine throughout had the lowest mean rate of progression over the total five years.[18] This group did discontinue treatment for one year in the middle of the study, and there was no control group throughout the five years (interestingly, the 0.01 per cent was employed as the control with evident plot twist result!) so a precise percentage efficacy is not calculable but is around 50 per cent, similar to the contact lens options.

Sixteen different interventions for myopia control were compared by Huang and colleagues.[15] Instead of using percentages, they grouped the interventions by ineffective, weak, moderate and strong efficacy for both refractive and axial length outcomes. Strong efficacy (mean reduction of progression by >0.50D/year) was achieved by 0.1 per cent to 1 per cent atropine (not including rebound effects) while moderate efficacy (0.25 to 0.50D/year) was used to describe OrthoK, multifocal and novel soft contact lens (SCL) designs and 0.01 per cent atropine.

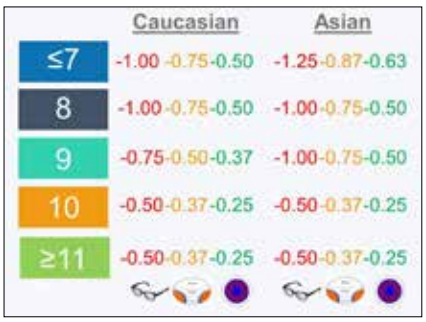


Figure 1: Typical rates of myopia progression per year, by age, in Caucasian and Asian children wearing single vision distance spectacle lenses. Data derived from meta-analysis of control groups in myopia control studies are marked in red. Yellow numbers indicate the comparative amount of progression per year when achieving 33 per cent myopia control (possible with progressive / novel spectacle lens designs) and green numbers indicate 50 per cent myopia control (average result from meta-analyses of OrthoK, multifocal soft contact lens and low dose atropine studies) – references in text. Courtesy of Paul Gifford.

These findings allow us to simplify the myopia management efficacy message to parents: generally, we can expect around 50 per cent efficacy from each of the three options. Based on this information, practitioners can consider firstly offering a contact lens correction to the progressing myope, knowing that a similar myopia management result is likely to be achieved independent of their access to, or experience with, each of the treatments.

Wide availability of distance centred multifocal SCL (Coopervision Biofinity or Proclear D lens) means we can all offer progressing myopic patients a myopia control tool that also corrects ametropia. Increasing uptake of paediatric OrthoK[21] and availability of daily disposable myopia control SCL designs such as Coopervision's MiSight (in Australia and the UK) and Visioneering Technologies' NaturalVue (in the USA) will see more tools added to our armament in the near future. Nicola Anstice and colleagues from Auckland present a detailed review of SCL options for myopia control in this issue.

For the child not yet willing or suitable for contact lens wear, atropine could be initially considered, however some parents mistakenly believe atropine will also correct ametropia. This makes it important to correct the ametropia in such a way that will also help manage myopia (OrthoK, multifocal or myopia control SCLs or even progressive spectacle lenses – see Paul Gifford's article and Alan Saks' column in this issue) and then add atropine if sufficient myopia control is not achieved, or if there is evidence or risk of faster progression. Safal Khanal's piece in this issue explains our current understanding of the mechanism of atropine, its role in refractive correction and choroidal thickness changes. If the child is suitable for contact lens wear, there is little evidence to support prescribing a single vision correction (except for very occasional wear, for example for sport). Additionally, the abovementioned options should be offered, knowing that a selection can be made on what is best for the patient and that all are likely to have a similar efficacy for myopia control.

One of the key barriers to paediatric contact lens wear is concern about safety, leading to the final key message for parents. Mark Bullimore[22] recently published a meta-analysis of paediatric SCL studies which indicated that wearing contact lenses is no more risk for children (aged eight to 12) and teens (aged 13 – 17) than it is for adults. He found no higher rates of microbial keratitis (MK) or inflammatory complications among children – in fact, evidence indicated a lower rate of infection in children than teens and adults, which he attributed to better compliance and closer parental supervision. This key paper, which is open access, should give both practitioners and parents confidence when considering childhood SCL wear – if the practitioner and parent are comfortable with fitting a teenager with SCL's, there is no safety reason to not consider the same for a younger child. When you add to this the functional and psychological benefits of childhood contact lens wear,[23] the myopia managing practitioner should discuss contact lens correction from the outset. Even if the child and parent aren't ready in the short term, at least you'll be planting the seed.

> "Intervention before age 12 will likely have the greatest impact on reducing progression"

THREE CLINICAL PILLARS FOR MYOPIA MANAGEMENT

Once the myopia management message has been communicated to the parent and patient – information on expectations, efficacy and safety – and the correction has been selected, there are three key areas of clinical focus.

Firstly, advice on visual environment is useful for both the child at risk of myopia development – those with a family history of myopia and less hyperopia than age-normal[11] – as well as the myope. Scott Read provides a detailed review of the visual environment in myopia in this issue, describing factors of urban living environment, near work and education, and outdoor time.

Secondly, contact lens options should be discussed and offered, as these show the best average efficacy for myopia management while also effectively correcting the ametropia. Where the child is not suitable for contact lens wear, spectacle lens options are available and the possible additive effect of atropine can also be employed.

Finally, binocular vision disorders such as esophoria and accommodative lag should be evaluated and managed because they could provide added benefit to myopia control treatment. These issues have been implicated in myopia progression,[24-28] and when present, provide the greatest efficacy results for progressive spectacle lens myopia management.[12,29] Binocular vision status is also relevant to visual comfort – ensuring children have functional skills for reading and schoolwork[30,31] and acceptance of their correction. In time, these individual factors may help to predict those who will respond best to particular corrections – for example, OrthoK appears to reduce both esophoria and accommodative lag,[32-35] and a Chinese study has shown children with lower accommodative amplitude achieved a 56 per cent better myopia control effect with OK wear over two years.[36]

EARLY INTERVENTION MATTERS

Attempting to keep myopia below 3D and axial length below 26mm presents a significant opportunity to reduce lifelong risk of eye disease and visual impairment, in a similar way to reducing IOP in glaucoma. Intervention before age 12 will likely have the greatest impact on reducing progression. It is important to ensure that patients and parents to have reasonable expectations of myopia progression and understand that the average efficacy achieved in scientific studies may be more or less successful for the individual for multifactorial reasons.

Until mechanisms are better understood, it is reasonable to consider that OrthoK, multifocal and myopia control design SCLs, and 0.01 per cent atropine have similar efficacy for reducing axial elongation, by around 50 per cent. Children aged eight to 12 are more likely to be safer contact lens wearers than teens, which should give optometrists the confidence to offer these options to young myopes at the time when intervention will likely have the largest benefit. Finally, the clinical pillars of myopia management include discussion of visual environment factors, contact lens correction options wherever possible, and additionally, considering the impact of binocular vision.

FURTHER RESOURCES

Practitioners and researchers alike can look forward to reading the work of the newly established International Myopia Institute, composed of seven committees and involving over 70 noted myopia researchers from around the world. The committee's aim is to produce peer consensus scientific review papers in the model of the highly successful TFOS Dry Eye Workshop (DEWS) reports. All committees met for the first time at the IMC, and the reports are likely to be published at the end of 2018 – subscription to the website for updates is open to all at www.myopiainstitute.org.

IMI Clinical Guidelines committee

References and tools available now for clinical practice include summaries of recent myopia control research at www.myopiacontrol.org and practitioner communication tools at www.myopiaprofile.com. A short survey and information resource to communicate the myopia message to parents is available at www.mykidsvision.org. Practitioners interested in peer discussion of cases and research with an international group of 2000+ colleagues can join the closed Facebook group 'Myopia Profile', which is administered by this author. A wealth of scientific support and increasing prescribing options exist for myopia management – for the current and lifelong benefit of young myopic patients, we must ensure we are not myopic about myopia control.

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