

## A PRACTICAL GUIDE TO MANAGING CHILDREN WITH MYOPIA

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The World Council of Optometry (WCO) and CooperVision earlier this year developed and adopted a standard of care resolution for myopia management. The goal is to raise awareness of myopia as an international epidemic and the need for optometrists to embrace evidence-based approaches focused on mitigation, measurement, and management.

The WCO sought out the opinions of four optometrists renowned as experts in the field of myopia management to share their professional insight on what a standard of care for myopia management entails and how they incorporate that standard into their practice. We are pleased to share their thoughts in this article. Their insights are based on a diverse population of eye care professionals who have different management options at their disposal and serve very different patient communities.

### *Dr. Carmen Abesamis-Dichoso, Philippines*

Dr. Carmen Abesamis-Dichoso received her Doctor of Optometry from the Central Colleges of the Philippines in 1989, was on the Dean's List, and a Board Topnotcher. She earned her Master of Arts in Teaching from the Central Colleges of the Philippines and was a recipient of the IACLE Educator Fellowship Program at the School of Optometry at University of Waterloo in Canada. Dr. Abesamis-Dichoso has given local and international lectures in Myopia Management. She has run her own private practice since 1998.

### *Dr. Rufina Chan, Hong Kong*

Dr. Rufina Chan received her Bachelor and Master of Optometry from the University of New South Wales, Australia. She obtained her Doctor of Health Science from the Hong Kong Polytechnic University (HKPU). She is currently in private practice and is also a visiting lecturer at the school of Optometry, HKPU. Her major interests in clinical practice include orthokeratology, children's vision, binocular vision, and learning-related vision problems.

### *Dr. Kate Gifford, Australia*

Dr. Kate Gifford graduated from Queensland University of Technology (QUT) in 2003 with First Class Honours and a University Medal and was awarded her PhD in contact lens optics in myopia from QUT in 2018. Dr. Gifford is a clinician-scientist and peer educator based in Brisbane, Australia, and a co-founder of [Myopiaprofile.com](https://myopiaprofile.com). She works in clinical practice and holds a visiting research fellow position at QUT and is the Committee Chair and lead author on the International Myopia Institute's Clinical Management Guidelines.

### *Dr. Fuensanta Vera-Diaz, United States*

Dr. Fuensanta Vera-Diaz is an expert in myopia control, from a scientific and clinical perspective. She received a PhD from the University of Bradford, UK, for her work investigating myopia, then undertook a postdoctoral position at the [New England College of Optometry \(NECO\)](https://www.necopt.com) and a research fellowship at Harvard. Dr. Vera-Diaz has developed a successful research program at NECO funded by the NIH. She investigates mechanisms contributing to the development of myopia and myopia interventions. Dr. Vera-Diaz has a strong publication record and serves as a reviewer for multiple journals and NIH study panel sections. She also leads [NECO's Myopia Control Clinic](https://www.necopt.com).

## What does early mitigation as an aspect of the standard of care for myopia management mean to you? How do you bring it to life in your practice?

**Dr. Abesamis-Dichoso:** Coming from a family of three generations of eye care professionals (ECPs), I have “traditionally” practiced myopia correction, so switching to myopia management as a standard of care was not easy. As they say, anything novel takes time before it is accepted. I have experienced a lot of “wait and see” attitudes in my efforts to make this change.

Fast forward to 2013, my practice went into a full-time myopia management focus, and today, I see my main myopia management challenge being to ensure that children come in for eye examinations. I try to make this happen in a number of different ways, firstly, I encourage all adult patients to bring their children in for an eye exam. [We have also updated our website](#) with information about the importance of regular examinations for children. As a practice, [we are active on social media](#), contribute articles to daily newspapers and online magazines in our efforts to promote eye care for children.

### ***My recommendations:***

- Be patient: Transitioning from traditional myopia correction to management takes effort.
- Be proactive: As ECPs you need to reach out, not the other way around.
- Social media is a powerful tool in getting the word out.

## In your clinic, how do you identify children who are potentially at risk of developing myopia? Do you have particular considerations with regard to pre-school aged children?

**Dr. Gifford:** Children at risk of myopia can be identified by their family history (one or two myopic parents), visual environmental risk factors such as less than 90 minutes a day spent outdoors and more than two to three hours a day spent on near work (outside of school time) and particular binocular vision conditions which are linked to myopia development such as esophoria, accommodative lag, high AC/A ratios, and intermittent exotropia.

The biggest risk factor for future myopia, though, independent of these other factors, is a child not being as hyperopic as they should be at a particular age. A child who is +0.75D or less at six years of age is at risk of becoming myopic by their teens and should be considered a pre-myope. This is my key consideration for preschool and early-school aged children - achieving an accurate refraction to evaluate for pre-myopia.

### ***My recommendations:***

- Strongest risk factor: +0.75D or less at age six.
- Other risk factors: Family history of myopia, visual environment, and binocular vision.

## When do you think it is appropriate to introduce the idea of myopia management?

**Dr. Chan:** When a child is at risk of developing myopia, the education of patients and parents is particularly important. I believe it is essential to explain causes of myopia and give recommendations on healthy lifestyle habits such as time spent outdoors and the need to restrict near work as well as taking breaks during such time<sup>1</sup>. I would explain the risks of myopia to patients and parents so that they are cautioned about the possible onset of myopia. Finally, I would briefly introduce the family to the different options of myopia

<sup>1</sup>Ramamurthy D, Lin Chua SY, Saw SM. A review of environmental risk factors for myopia during early life, childhood and adolescence. *Clin Exp Optom*. 2015; 98:497-506.

management so they are prepared for actions we may need to take in the near future. My clinical management of children depends on whether children are hitting normal ocular developmental milestones. If their refractive status suggests a myopic future, I may suggest a follow-up in six months.

### **My recommendations:**

- Education of patients and parents:
  - Causes and risks of myopia development and progression
  - Time spent outdoors and how to manage near work time.
  - Introduce different options of myopia management.
- Follow-ups: every six months or more frequently.

### **What factors influence your expectations of the success of a myopia management intervention?**

### **What factors might influence you to change course with your myopia management intervention choice?**

**Dr. Vera-Diaz:** It is difficult to predict how successful an intervention will be for one individual child as we do not yet have enough evidence to make such specific predictions. Generally, the expected progression depends on the age of the child, with older children progressing more slowly than younger children, we should therefore anticipate different intervention goals depending on the age of the child. Although not complete (axial length growth rate varies with age, sex, and ethnicity), expected eye growth curves are available and should be used to estimate the expected progression for each specific child.<sup>2,3,4,5</sup>

Another important factor to consider is motivation. Children who are highly motivated, particularly with contact lens interventions, are more likely to be compliant, and therefore more likely to be successful. Of course, the family's support is important too, but the child's motivation is the number one factor for compliance and success.

Lastly, we must consider lifestyle. Some families struggle to follow recommendations in relation to near work and outdoors time. I advise to reduce time spent doing near work (with any material), increase the viewing distance and have frequent breaks.<sup>6,7</sup> With regard to outdoor time, I recommend that the child spends two hours a day or more during the daytime outside.<sup>8,9</sup>

To evaluate if an intervention is effective or not, I use both the amount of myopia in diopters and axial length, an important test that is more accurate than refraction in determining myopia progression. It is important to also note that the concern with myopia is the excessive elongation of the eye, not the amount of diopters. If progression is not lower than expected based on age expected norms after at least a 12-month period, I recommend changing or adding an additional intervention.

<sup>2</sup> Tideman JWL, Polling JR, Vingerling JR, et al. Axial length growth and the risk of developing myopia in European children. *Acta Ophthalmol.* 2018;96:301-309.

<sup>3</sup> Sanz-Diez P, Yang L-H, Lu M-X, Wahl S, Ohlendorf A. Growth curves of myopia-related parameters to clinically monitor the refractive development in Chinese schoolchildren. *Graefes Arch Clin Exp Ophthalmol.* 2019;257(5):1045-1053.

<sup>4</sup> He X, Sankaridurg P, Naduvilath T, et al. Normative data and percentile curves for axial length and axial length/corneal curvature in Chinese children and adolescents aged 4-18 years. *Br J Ophthalmol.* 2021;319431.

<sup>5</sup> Truckenbrod C, Meigen C, Brandt M, et al. Longitudinal analysis of axial length growth in a German cohort of healthy children and adolescents. *Ophthalmic Physiol Opt.* 2021 May;41(3):532-540.

<sup>6</sup> Wen L, Cao Y, Cheng Q, et al. Objectively measured near work, outdoor exposure and myopia in children. *Br J Ophthalmol.* 2020 Nov;104(11):1542-1547.

<sup>7</sup> Huang P-C, Hsiao Y-C, Tsai C-Y, et al. Protective behaviours of near work and time outdoors in myopia prevalence and progression in myopic children: a 2-year prospective population study. *Br J Ophthalmol.* 2020 Jul;104(7):956-961.

<sup>8</sup> Rose KA, Morgan IG, Ip J, et al. Outdoor activity reduces the prevalence of myopia in children. *Ophthalmology.* 2008 Aug;115(8):1279-85.

<sup>9</sup> Lanca C, Yam JC, Jiang W-J, et al. Near work, screen time, outdoor time and myopia in schoolchildren in the Sunflower Myopia AEEC Consortium. *Acta Ophthalmol.* 2021 Jun 17.

### **My recommendations:**

- Motivation of children and their parents: Key factor of myopia management success.
- Lifestyle: Near work management (frequent breaks!) and minimum of two hours a day outdoors.
- Impact after 12 months: compare progression with age expected norms (diopters and axial length).

**Myopia management relies greatly on how patients follow the recommended plan**

### **During follow-up examinations of a child undergoing myopia management, to what areas do you pay particular attention?**

**Dr. Chan:** My focus in these follow-up exams varies depending upon the type of myopia management. In general, my number one concern is patient compliance to the prescribed intervention - whether that is the most appropriate wearing time for contact lenses and spectacles, or the frequency of drop administration and so forth. Whether the intervention is spectacles, contact lenses, or pharmaceuticals; the effectiveness on myopia management relies greatly on how patients follow the recommended plan. Furthermore, non-compliance to handling and hygiene of contact lenses in some cases may even lead to sight threatening complications.<sup>10,11</sup> Therefore, a detailed history of the patient's tolerance of potential effects<sup>12</sup> and compliance is vital.

In relation to clinical findings, I use subjective and cycloplegic refraction to assess the progression of myopia management and axial length measurement<sup>13,14</sup> as supplementary data points on myopia progression. A thorough ocular health examination is essential to reveal potential side-effects or complications. Finally, communication with patients and parents in explaining results and reinforcement of intervention compliance are also key to successful myopia management.

### **My recommendations:**

- Case history: Compliance and adaptation to recommended myopia management option.
- Progression evaluation: Subjective, cycloplegic refractions and axial length measurement.
- Side-effects and complications: Internal and external ocular health examination.
- Family communication focus: Myopia management results and compliance.

### **Do you consider both spherical equivalent and axial elongation as part of measuring myopia management success?**

**Dr. Gifford:** Providing an accurate refraction to our young myopic patients is arguably the most important and most visible component of the eye examination. Myopia management is all about correcting, maintaining, and preserving vision. Both parents and patients readily understand refraction. Refraction, though, is seven to 10 times less accurate to gauge small changes in myopia than axial length measurement by optical biometry. Axial length is also an important clinical

<sup>10</sup> Liu YM, Xie P. The safety of orthokeratology--A systematic review. *Eye Contact Lens*. 2016; 42:35-42.

<sup>11</sup> Yam JC, Li FF, Zhang X, et al. Two-year clinical trial of the Low-Concentration Atropine for Myopia Progression (LAMP) Study: Phase 2 report. *Ophthalmology*. 2020; 127:910-9.

<sup>12</sup> Chia A, Chua WH, Cheung YB, et al. Atropine for the intervention of childhood myopia: Safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Intervention of Myopia 2). *Ophthalmology*. 2012; 119:347-54.

<sup>13</sup> Song JS, Yoon DY, Hyon JY, Jeon HS. Comparison of ocular biometry and refractive outcomes using IOL Master 500, IOL Master 700, and Lenstar LS900. *Korean J Ophthalmol*. 2020; 34:126-32.

<sup>14</sup> Wolffsohn JS, Kollbaum PS, Berntsen DA, et al. IMI - Clinical myopia control trials and instrumentation report. *Invest Ophthalmol Vis Sci*. 2019; 60:M132-M60.

indicator of increased eye disease risk. I feel both are important and will continue to be so, although both require context and explanation. For example, I can find parents are disappointed when their 8-year-old child progresses  $-0.50$  in a year, or axial length increases  $0.15\text{mm}$ , despite these both indicating a great outcome at that age.

**My recommendations:**

- Spherical equivalent: Most important measurement to correct, maintain and preserve vision.
- Axial length (valuable but not essential): indicates disease risk and more accurate progression measurement.
- How to evaluate: Learn about the typical annual myopia progression of a single-vision corrected child, based on their age and ethnicity to have a point of comparison.

**What does management as an aspect of standard of care for myopia management mean to you? How do you bring it to life in your practice?**

**Dr. Gifford:** Management of myopia means doing more than just correcting the refractive error. This starts with a conversation about myopia – explaining its typical childhood progression, its impact on function in the short-term and the increased risk of eye disease and vision impairment in the long-term. If parents of myopic children have no or low myopia themselves, this can take some effort to understand.

The next step is providing advice on visual environment; more specifically, to increase time spent outdoors to 90 minutes per day and try to decrease leisure near-work or screen time to less than two hours per day (outside of school time). This is good practice for all children, and parents are often desperate for actionable advice on managing screen time. Finally, to my mind, management means considering the best optical intervention I have available, suiting the child in question, which will both correct their myopia and control its progression.

**My recommendations:**

Three steps to managing myopia are:

- Conversations about myopia progression, functional impact and eye health risk.
- Advice on managing the visual environment.
- Most suitable optical intervention which both corrects and helps to control myopia.

**Myopia progresses faster in younger children**

**At what stage do you recommend initiating an intervention for myopia management with a child? What guides your decision-making process?**

**Dr. Vera-Diaz:** I generally recommend starting myopia management as soon as possible. Myopia progresses more rapidly around the time of onset, so as soon as a child develops myopia, regardless of the age, I recommend starting myopia management. In addition, we know that myopia progresses faster in younger children, and that a younger child will progress for longer, therefore, we expect higher levels of myopia in adulthood the earlier in life they develop myopia.<sup>15,16</sup> The most effective intervention is the one that best suits the individual child's situation at all life-stages and lifestyles so it's important to have a range of clinically useful interventions supported by the evidence base at our disposal. For these reasons, I more strongly recommend myopia

<sup>15</sup> Mutti DO, Hayes JR, Mitchel GL, et al. Refractive error, axial length, and relative peripheral refractive error before and after the onset of myopia. *Invest Ophthalmol Vis Sci.* 2007 Jun;48(6):2510-2519.

<sup>16</sup> Jones-Jordan LA, Sinnott LT, Chu RH, et al. Myopia Progression as a Function of Sex, Age, and Ethnicity. 2021 Aug 2;62(10):36.

management to younger children with myopia, and more so if they have higher levels of myopia. I would never recommend 'old' myopia correction methods such as single vision spectacles or contact lenses to children whose myopia may progress. This basically means most children younger than 15 years of age.

### **My recommendations:**

- Start myopia management as early as possible.
- Myopia control is most important in:
  - Younger children
  - Children with higher degrees of myopia.

### **How do you choose which myopia management intervention is best for each patient?**

**Dr. Abesamis-Dichoso:** Interviewing parents to get a sense of their children's lifestyle, their hobbies or sports activities if any, and sleeping pattern (how many hours and what time) is a must. This gives me a sense of whether the child will be compliant to the myopia management that I am considering.<sup>17,18</sup>

***There's no one-size-fits-all for myopia management.***

A 10-year-old girl who is myopic and does ballet, for example, dancing 8 hour per day via an online class, five days a week, will most likely comply with orthokeratology. A 10-year-old boy who is myopic by the same amount but spends more time on online gaming and sleeps very late at night may comply better with a soft myopia controlling contact lenses worn for a maximum of 10-11 hours a day.

Certain spectacles aiming to reduce myopia progression or simply bifocal executive lenses are our myopia management options of choice when single-vision contact lenses are unsuccessful and if parents are not yet ready for their children to wear contact lenses.

If there is no evidence of slowing down axial length and myopia continues to increase, I usually do not switch to another strategy but co-manage it with an ophthalmologist who prescribes 0.05% atropine instilled on the eye every night. This should have a 30 to 70 percent impact on myopia progression.<sup>19,20</sup> However, in the Philippines, this kind of myopia management is a premium service and usually afforded only by wealthy families. I do offer more affordable interventions such as bifocal executive lenses.

### **My recommendations:**

- There's no one-size-fits-all for myopia management.
- Interview parents and children to understand hobbies and sleeping patterns.
- Consider different intervention options to cater for families' varying financial capacities.

<sup>17</sup> Jones LA, Walline JJ, Gaume A, Rah MJ, Manny RE, Berntsen DA, Chitkara M, Kim A, Quinn N; CLIP Study Group. Purchase of contact lenses and contact-lenses-related symptoms following the Contact Lenses in Pediatrics (CLIP) Study. *Cont Lens Anterior Eye*. 2009 Aug;32(4):157-63.

<sup>18</sup> Sankaridurg P, Bakaraju RC, Naduvilath T, Chen X, Weng R, Tilia D, Xu P, Li W, Conrad F, Smith EL 3rd, Ehrmann K. Myopia control with novel central and peripheral plus contact lenses and extended depth of focus contact lenses: 2 year results from a randomised clinical trial. *Ophthalmic Physiol Opt*. 2019 Jul;39(4):294-307.

<sup>19</sup> Yam JC, Jiang Y, Tang SM, Law AKP, Chan JJ, Wong E, Ko ST, Young AL, Tham CC, Chen LJ, Pang CP. Low-Concentration Atropine for Myopia Progression (LAMP) Study: A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.05%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control. *Ophthalmology*. 2019 Jan;126(1):113-124.

<sup>20</sup> Chua WH, Balakrishnan V, Chan YH, et al. Atropine for the treatment of childhood myopia. *Ophthalmology*. 2006 Dec;113(12):2285-91.

## What factors might influence you to change course with your myopia management intervention choice?

**Dr. Chan:** If my patient's myopia progression is not well-controlled, I consider either changing from the initial intervention choice to another type of myopia management, or combining the initial management option with a second intervention method. Recent research has revealed beneficial results in combining intervention modalities such as atropine and orthokeratology<sup>21</sup> or multifocal contact lenses.<sup>22</sup>

If a patient is noncompliant then I would also consider either changing the initial choice of myopia management to something more acceptable to the patient, or even terminate intervention.

### ***My recommendations:***

- Poor response to myopia management:
  - Change initial intervention of choice.
  - Combine with another intervention method.
- Noncompliant or experiences some side effects:
  - Change initial intervention of choice.
  - Terminate intervention.

***We can only work on overall observations to apply the best myopia management strategy***

## When do you typically consider ending your myopia management intervention and what is your approach in monitoring patients after intervention has ended?

**Dr. Gifford:** This is an important question that parents can often ask at the first consultation. The answer is that half of myopes appear to stabilize by age 16, but this means half are still progressing. Around three-quarters of myopes stabilize by age 18,<sup>23</sup> but then 20 percent of myopes can progress by at least one diopter in their 20s.<sup>24,25</sup>

My advice, then, is that myopia management should continue until at least age 18, and likely into early adulthood if an individual proceeds into a near-work centred visual environment such as tertiary study. This is what research tells us, but research can't tell us whether, for the individual child in our chair, their myopia will stabilize at age 14, age 24 or even beyond. We can only work on overall observations to apply the best myopia management strategy for the strongest potential impact, while also considering the impact of stopping. For example, if we have a successful 18-year-old orthokeratology or dual-focus or multifocal contact lens wearer, do they need to stop? They still need vision correction. Stopping earlier than this would typically be due to emerging unsuitability of the intervention, for example due to side-effects or time or cost requirements.

After cessation, I would confirm vision and comfort suitability of the post-myopia management single vision correction – a significant rebound effect is unlikely in older teens and young adults – and educate the patient that their eye health still requires ongoing clinical monitoring.

### ***My recommendations:***

- From the start: Explain that myopia management should likely continue until age 18 and perhaps beyond.
- Why cease intervention before age 18? Intervention becoming unsuitable due to time, cost, or side-effects.

<sup>21</sup> Tan Q, Ng AL, Cheng GP, et al. Combined atropine with orthokeratology for myopia control: Study design and preliminary results. *Curr Eye Res.* 2019; 44:671-8.

<sup>22</sup> Huang J, Mutti DO, Jones-Jordan LA, Walline JJ. Bifocal & atropine in myopia study: Baseline data and methods. *Optom Vis Sci.* 2019; 96:335-44.

<sup>23</sup> COMET Group. Myopia stabilization and associated factors among participants in the Correction of Myopia Evaluation Trial (COMET). *Invest Ophthalmol Vis Sci.* 2013 Dec 3;54(13):7871-84.

<sup>24</sup> Bullimore MA, Reuter KS, Jones LA, Mitchell GL, Zoz J, Rah MJ. The Study of Progression of Adult Nearsightedness (SPAN): design and baseline characteristics. *Optom Vis Sci.* 2006 Aug;83(8):594-604.

<sup>25</sup> Pärssinen O, Kauppinen M, Viljanen A. The progression of myopia from its onset at age 8-12 to adulthood and the influence of heredity and external factors on myopic progression. A 23-year follow-up study. *Acta Ophthalmol.* 2014 Dec;92(8):730-9.

To learn more about and adopt the World Council of Optometry's recommended myopia standard of care based upon mitigation, measurement, and management, visit the online resource at [myopia.worldcouncilofoptometry.info](https://myopia.worldcouncilofoptometry.info).

Join the online myopia management forum to share ideas and ask questions at [myopia.worldcouncilofoptometry.info/community-forum](https://myopia.worldcouncilofoptometry.info/community-forum).

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