Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

The Role of Biometry in Myopia Management

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Background

As a graduate in the late 1980s, the equipment I needed to manage young myopic patients was very simple: a retinoscope, trial frame or phoropter and a set of trial lenses. In the 21st century, myopia management is more involved and requires a bigger investment of time and money. Can you manage myopes with the equipment of the 1980s? Yes, you could, and some practitioners still do, but the question is: ***should you***?

Myopia has, for some time, been recognized as a significant public health concern.[1, 2] It has been well documented that there is an increasing prevalence of myopia worldwide, and that there are now safe and effective strategies to slow down its progression.[3, 4] In 2021, the World Council of Optometry passed a resolution publicly declaring support for myopia management being the standard of care for myopic patients worldwide.[5] One component of the evidence-based standard of care resolution relates to "measurement" of myopia, with a suggestion that axial length should be evaluated whenever possible. So, what is axial length and how is it measured?

What is Axial Length?

Axial length, the combination of anterior chamber depth, lens thickness and vitreous chamber depth, is the most significant contributor to refractive error and the main risk factor for myopia-associated ocular pathology.[6-8] Typically, axial length increases from around 15.1mm in infancy to 23.6mm in adulthood and that increase is offset by changes in the refractive state of other ocular components such as the crystalline lens and the cornea.[9] Myopia results from an increase in axial length outside of the normal rate expected for the age of the patient.

Why Measure Axial Length?

It has been suggested that monitoring axial length may be a more reliable measure of myopia progression than cycloplegic refractive error.[10] This is particularly relevant, as axial length change may be the first indication of myopia progression, even before there is evidence of change in refractive error.[6] Axial length has the biggest impact on ocular complications associated with myopia. For example, the odds ratio of having visual impairment is >90 for a patient over the age of 60 with an axial length ≥ 30mm compared to a similar individual with an axial length <24mm.[11] With respect to management of myopia progression, if orthokeratology (Ortho-K) is the chosen modality, axial length change is the only indication of progression that can be monitored to determine whether the therapy is working.

How is Axial Length Measured?

Biometry is the term used for the measurement of axial length. There are two main options to determine axial length: ultrasound biometry and optical biometry, and ultrasound has been largely superseded by optical methods. A-scan ultrasound is a contact-based technique that can be particularly challenging for young children and does not have comparable accuracy or repeatability with the available optical methods.[12, 13]

Optical biometers can be sub-divided into stand-alone biometers and multifunction instruments. Stand-alone instruments, such as the IOL Master 500 or 700 (Zeiss Meditec, Jena, Germany) or the Lenstar LS 900 (Haag-Streit, Koeniz, Switzerland), offer the option for accurate, repeatable measures of axial length.[14-16] These biometers have been traditionally used by cataract surgeons to aid in their surgical calculations and have also been used widely in myopia research studies, where axial length measurement is considered to be an essential outcome measure.[17-20]

Multifunction instruments offer eyecare professionals the opportunity to have a single instrument, occupying a small footprint, that provides multiple clinical measures. These instruments also offer opportunities for patient/parent education and progression monitoring by means of pre-programmed, normative data. Several multi-function instruments that include the option to determine axial length exist. These include:

Myah (Topcon, Tokyo, Japan) – The Myah (Figure 1) uses optical low-coherence reflectometry (OLCR) to measure axial length. The instrument also measures corneal topography with visit-to-visit comparisons, includes dry eye assessment tools to determine tear meniscus height, non-invasive tear break-up time, analysis of blink patterns and meibomian gland analysis. The software has pre-loaded normative growth curves utilizing a European database,[21] providing the opportunity to compare the patient in the chair with a standardized data set (Figure 2). This can help with assessing risk of progression and support discussion with parents about the need for myopia management and the likelihood of progression for the patient while in the consulting room. It has been reported that axial length growth curves can be used to determine treatment success, and if a child trends towards a lower percentile curve, this indicates a slowing of progression and success of the adopted myopia control treatment.[22] The Myah also has a database of commonly fit RGP and Ortho-K contact lenses, as well as fluorescein simulation to aid in the selection of the most appropriate contact lens for a patient. Reports can be printed for parents to take away for their own records, showing the progression of axial length over time. The dynamic pupillometry feature can be useful in monitoring compliance with atropine and can also be used for Ortho-K fitting.

Figure 1: Topcon Myah (image courtesy of Topcon)

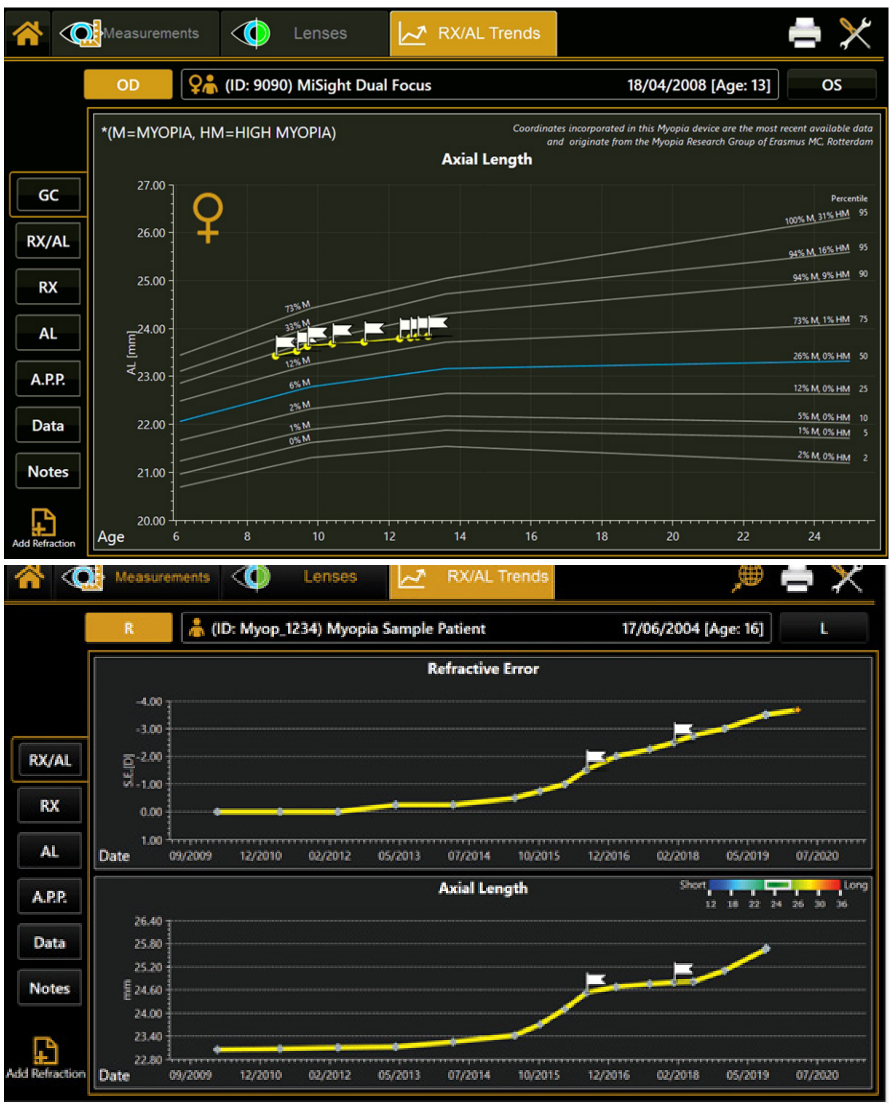

Figure 2: Normative Axial Length curves and patient progression plots (image courtesy of Topcon)

Myopia Master (Oculus, Wetzlar, Germany) –The Myopia Master (Figure 3) uses partial coherence interferometry (PCI) to measure axial length. This instrument also has a variety of capabilities that are valuable in the assessment of patients being selected for myopia management, including auto-refraction and keratometry. The software has a database of standardized biometry measures for Asian and European eyes,[21, 23] offering ethnicity and gender-dependent growth curves.

Figure 3: Oculus Myopia Master

A software algorithm assesses myopia risk factors by means of a default questionnaire and can recommend treatment options based on the data and answers to the questionnaire. Progression plots of refraction and axial length can be created and customized reports generated for parents to take home or have emailed directly from the instrument (Figure 4).

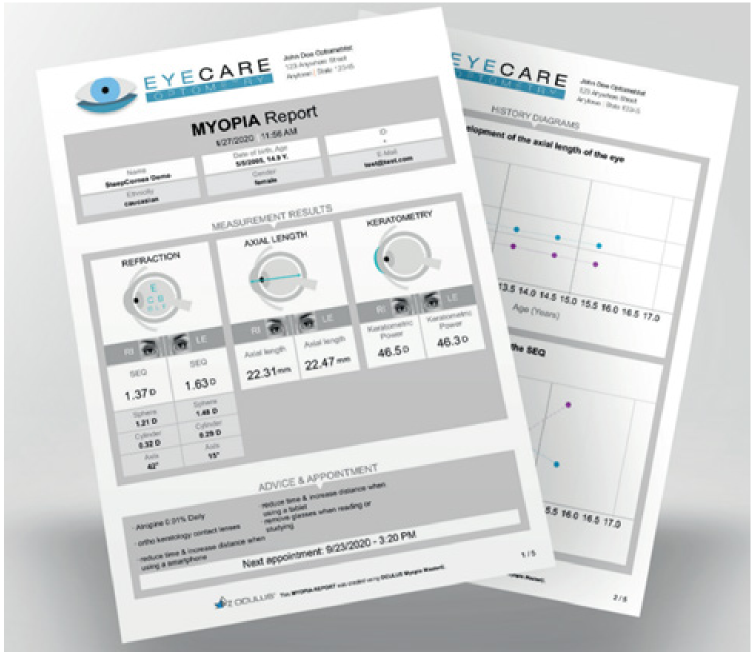

Figure 4: Patient reports (image courtesy of Oculus)

Myopia Expert 700 (Essilor, Paris, France) – The Myopia Expert 700 (Figure 5) also utilizes OLCR for biometry. Its multifunction capabilities include keratometry, pupillometry and corneal topography. It also boasts a database of Asian and European axial length standardized percentile curves to aid in monitoring progression over time and assessing risk. There is support for contact lens fitting, with fluorescein pattern simulation. Reports can be printed for parents that help them understand the necessity for myopia control and they can also see change over time for their child.

Figure 5: Essilor Myopia Expert 700
(image courtesy of Essilor)

For those practitioners in the market for a fundus camera, the **REVO FC** (Optopol Technology, Zawiercie, Poland) offers fundus photography with additional capabilities of axial length measurement, topography and OCT imaging (Figure 6).

Figure 6: REVO FC (image courtesy of Optopol)

In addition to dedicated instruments, there are options for software add-ons to existing instruments such as the **Eye Suite** software for the Lenstar 900 (Figure 7). This provides a comparison with age norms (Asian and European data) and the option to import refractive error data to provide a comprehensive comparison of measurements across time. Patient reports can also be generated.

Figure 7: Lenstar 900 with EyeSuite (image courtesy of Haag Streit)

Summary

This brief overview of some of the available multifunction instruments hopefully demonstrates that one instrument can truly provide a wealth of information to support your management of young myopic patients. The option to have a single instrument providing multiple clinical measures provides an opportunity for a streamlined approach to patient care. Documentation of changes across time and comparison to normative data provides practitioners the ability to manage their patients with increased confidence. Parents can also monitor their child's progress with timely, instrument-generated reports.

As we look forward to the ever-increasing evidence of the importance of myopia management, the trusty retinoscope will still have its place in the management of refractive error. However, multifunction instruments with advanced software provide an opportunity to elevate the clinical management and care of myopic patients. There are already excellent options available, and likely more will come to market with increased capabilities and advanced software to support the efforts of eye care professionals in changing the future of myopia. The prediction that 50% of the world's population will be myopic by 2050 [3] does not have to become a reality. The future is in our hands.

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