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CLINICAL SUMMARY

IMI Defining and Classifying Myopia Report

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INTRODUCTION

Myopia is widely recognized as a significant public health issue that has been shown to be a significant cause of visual loss and a risk factor for a range of other serious ocular conditions. The prevalence of this condition is increasing on a global basis, for reasons that are still not understood. Although partial reductions in progression rates have been observed from pharmacological therapies, optical treatments and behavioral modifications, we are a long way from being able to reverse the temporal trends of the last few decades. This makes myopia, and its associated complications, a high research priority.

The challenge

The extensive literature regarding the etiology of refractive errors has revealed a complex picture. It is clear that myopia is a multifactorial condition and that any classification based on simple etiological factors is likely to be an over-simplification at best, and, at worst, misleading. Time of onset is also of questionable value, since we do not yet know whether the biological processes underlying myopia at age 7 differ from those in myopia that develops in early adults.

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The accumulation of different terms and classifications is a significant hindrance and creates challenges when comparing epidemiological studies. Meta-analysis of randomized controlled trials can be weakened by variations in the inclusion criteria and definitions. Standardized, international classifications are an essential feature of the evidence-based approach.

The aim of this paper is to propose a set of definitions for myopia that are evidence based, statistically sound and clinically relevant. The authors undertook a critical review of current terminology and choice of myopia thresholds in order to ensure that the proposed standards are appropriate for clinical research purpose, relevant to the underlying biology of myopia, acceptable to researchers in the field, and useful for developing health policy

KEY FINDINGS

Refining the terminology and definitions used

The following definition has been proposed:

Myopia: "A refractive error in which rays of light entering the eye parallel to the optic axis are brought to a focus in front of the retina when ocular accommodation is relaxed. This usually results from the eyeball being too long from front to back, but can be caused by an overly curved cornea, a lens with increased optical power, or both. It is also called nearsightedness."

Sub-categorising the classification of myopia into axial vs refractive

The above definition includes all forms and degrees of myopia, which is appropriate for a general definition of myopia as a sub-category of refractive disorders. However, this definition encompasses a heterogeneous group of refractive errors. For research purposes, additional qualification is required to ensure that homogenous groups of myopes can be selected for trials or genetic studies. As indicated above, myopia can be differentiated into refractive myopia in which the optical power of the cornea and/or lens is abnormally high in eyes with a normal optical axis length, the more common, axial myopia in which the optical axis is too long in relation to the refractive power of cornea and lens, or a combination of both. Axial and refractive myopia are often defined as distinct entities:

Axial Myopia: "a myopic refractive state that can be attributed to excessive axial elongation".

Refractive Myopia: "a myopic refractive state that can be attributed to changes in the structure or location of the image forming structures of the eye, i.e. the cornea and/or lens".

Clinical trials and work with animal models of myopia have provided evidence that axial elongation is the primary factor driving myopic progression; when comparing intervention to reduce myopic progression, there is a clear relationship between the impact of an intervention on refraction and axial length.[3] The inclusion and exclusion criteria of trials investigating treatments designed to reduce myopic progression should therefore aim to primarily recruit axial myopes and exclude subjects with refractive myopia. To that end, many trials now include evidence of progression as an inclusion criterion, but additional age-specific normative data of ocular dimensions and growth patterns would enhance the ability of researchers to separate these two categories and ensure more homogenous study populations.

Sub-categorizing myopia into primary versus secondary

As noted above, for the majority of myopia we cannot define a precise etiology and hence etiological classifications are currently premature, but for certain rare forms of myopia a direct cause can be identified. The concept of primary myopia as compared to secondary myopia is lacking in refractive studies. As is the case for glaucoma, many secondary forms of myopia exist. These include syndromic forms of myopia associated with known Mendelian gene defects, myopia arising from structural abnormalities of the cornea (e.g. keratoconus) or lens (e.g. microspherophakia), and drug-induced myopia. Such secondary forms of myopia can be axial, refractive or both. The term secondary myopia certainly has value, but the utility of the term primary myopia is less obvious. Secondary myopia is best reserved for situations where a single causative factor can be identified that is not a known population risk factor for myopia development. The following definition for secondary myopia is therefore proposed:

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Secondary Myopia: "a myopic refractive state for which a single, specific cause (e.g. drug, corneal disease or systemic clinical syndrome) can be identified that is not a recognized population risk factor for myopia development."

Classifying myopia by quantification

The proposed thresholds in this paper, as is standard in myopia research, relate to spherical equivalent spectacle plane refraction on-axis. In quantitative contexts, myopia should always be treated as a negative value and that mathematical comparison symbols be used in their strict mathematical sense.

A refraction of ≤ -0.50 D merits selection as the evidence-based, consensus threshold for the diagnosis of myopia. There is no clear biological basis in terms of axial length, refraction or other ocular biometric parameter to

differentiate high from lower degrees of myopia. For consistency with the lower threshold for myopia, we propose that high myopia be defined as a refractive error ≤ -6.00 D.

The following quantitative definitions are proposed, which are independent of technique and relate to a single eye.

Myopia: "a condition in which the spherical equivalent refractive error of an eye is ≤ –0.5 D when ocular accommodation is relaxed."

High Myopia: "a condition in which the spherical equivalent refractive error of an eye is ≤ –6.00 D when ocular accommodation is relaxed."

Low Myopia: "a condition in which the spherical equivalent refractive error of an eye is ≤ -0.5 and > -6.00 D when ocular accommodation is relaxed."
Pre-myopia

Currently, reducing the rate of progression is a central goal of myopia research, but preventing the onset of myopia is an even more valuable target. Such interventions will require treatment of eyes before they become myopic. This logically requires a definition of 'pre-myopia', i.e. a non-myopic refraction in which a combination of risk factors and the observed pattern of eye growth indicate a high risk of progression to myopia.

Pre-myopia: A refractive state of an eye close to emmetropia in children where a combination of baseline refraction, age, and other quantifiable risk factors provide a sufficient likelihood of the future development of myopia to merit preventative interventions.

Pathologic myopia

Higher degrees of myopia are associated with a range of structural changes within the retina, retinal pigment epithelium (RPE), Bruch's membrane, choroid, optic nerve head, peripapillary area, optic nerve, and sclera. The following definitions are proposed.

Pathologic Myopia: "Excessive axial elongation associated with myopia that leads to structural changes in the posterior segment of the eye (including posterior staphyloma, myopic maculopathy, and high myopia-associated optic neuropathy) and that can lead to loss of best corrected visual acuity."

It is important to note that this definition refers only to the structural changes in the posterior segment and their visual consequences. Pathologic myopia is sometimes equated with high myopia, and descriptions may include a refractive (e.g. -6.00 D, -5.00 D or even -4.00 D in children) or axial length threshold (e.g. > 25.5 or 26.5mm). Many studies have demonstrated that myopic maculopathy extends to eyes of lower than -5.00 or -6.00 D, albeit at much lower prevalence. A recent study from Taiwan shows posterior staphyloma can be found in eyes less than 26.5mm axial length. Inclusion of refraction within a concept such as pathologic myopia also creates problems in relation to highly myopic eyes that have had refractive procedures (e.g. corneal, phakic intraocular lenses, clear lens or cataract extraction). In these cases, the refraction of the eye may be normal, but the risk of pathologic myopia remains. Longitudinal studies have also demonstrated that for a given refractive error, the prevalence of pathologic myopia is age dependent. Therefore, a refractive definition for pathologic myopia would mean that outcome or intervention studies could not be reliably compared unless they were accurately age-matched.

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The complications of pathologic myopia affect a range of structures and present clinically as distinct diagnostic entities. A series of definitions is therefore required for all those conditions that come under the umbrella of pathologic myopia, including myopic macular degeneration, myopic traction maculopathy and non-macular structural complications of pathologic myopia such as peripapillary atrophy, tilted optic discs, and acquired megalodiscs. The committee also proposed the introduction of the following condition:

Myopia-associated glaucoma-like optic neuropathy: “Optic neuropathy characterized by a loss of neuroretinal rim and enlargement of the optic cup, occurring in highly myopic eyes with a secondary macro disc or peripapillary delta zone at a normal intraocular pressure.”.

CONCLUSION

Standardized definitions and consistent choice of thresholds are essential elements of evidence-based medicine. It is hoped that these proposals, or derivations from them, will facilitate rigorous, evidence-based approaches to the study and management of myopia.

Reference: Flitcroft DI, He M, Jonas JB, et al. IMI - Defining and Classifying Myopia: A Proposed Set of Standards for Clinical and Epidemiologic Studies. Invest Ophthalmol Vis Sci 2019; 60(3): M20-M30. https://iovs.arvojournals.org/article.aspx?articleid=2727312

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