

Title: “Myopia should be undercorrected - myth or fact.”

Srimanti Sarkar ¹

¹Department of Optometry, Swami Vivekananda University,
Telinipara, Barasat - Barrackpore Rd Bara Kanthalia, West
Bengal - 700121

Abstract

Background:

The management of myopia has long been a topic of significant interest and debate within the field of optometry and ophthalmology. One controversial approach is the undercorrection of myopia, where patients are deliberately left slightly nearsighted. This narrative literature review aims to evaluate the efficacy and implications of undercorrecting myopia, particularly in light of emerging evidence suggesting that it may actually lead to increased myopia progression.

Discussion:

Initial hypotheses proposed that undercorrecting myopia could slow its progression by maintaining a mild degree of myopic defocus, potentially signaling the eye to reduce axial elongation. However, a growing body of clinical evidence contradicts this hypothesis, indicating that undercorrection may, in fact, accelerate myopia progression. While analyzing the role of ciliary muscle tone in myopia progression different literature shows several factors like, According to Kaphle D et al. ciliary muscle tone causes myopia progression by thinning choroid, and also according to Bailey et al. Ciliary muscle thickening causes accommodative dysfunction which results in hyperopic defocus and leads to myopia progression. And accommodation can be in action because of under correction. Studies consistently show that patients who are undercorrected experience a greater rate of axial elongation and worsening of myopia compared to those who receive full correction. Additionally, undercorrection compromises

visual acuity and can negatively impact daily activities and overall quality of life.

Conclusion:

The literature overwhelmingly suggests that undercorrection of myopia is not a beneficial strategy and may contribute to the progression of the condition. These findings challenge the initial theoretical basis for undercorrection and highlight the importance of fully correcting myopic refractive errors to manage myopia effectively. Hence, from this review it can be concluded that the baseline treatment for any refractive error cases is to give proper Refractive correction when accommodation is relaxed.

Introduction

Myopia, or nearsightedness, is a prevalent refractive error where distant objects appear blurred while close objects can be seen clearly. According to the Myopia Institute (IMI), myopia is a chronic condition that affects nearly 30% of the world's population. This number is expected to increase to 50% by 2050, affecting 5 billion people.^[1] The prevalence of myopia varies across countries and regions, but it's rising in children and young and older adults. The rise in myopia cases has made its management a crucial area of focus within the fields of optometry and ophthalmology. Effective management strategies are essential not only to improve visual acuity but also to mitigate the risk of associated complications, such as retinal detachment, glaucoma, and macular degeneration, which can arise from high myopia.^[1]

Traditional approaches to myopia management primarily involve the use of corrective lenses, such as glasses or contact lenses, to provide clear vision by compensating for the refractive error. However, controlling the progression of myopia, characterized by the elongation of the eyeball, remains a significant challenge. This has led to the exploration of various strategies aimed at slowing down the progression of myopia, including pharmacological treatments, orthokeratology, and lifestyle modifications.^[2]

One controversial approach that has garnered attention is the undercorrection of myopia. This strategy involves prescribing lenses that partially correct the myopic refractive error, leaving patients slightly nearsighted. The theoretical basis for this approach stems from the belief that maintaining a mild degree of myopic defocus might signal the eye to reduce its rate of axial elongation. The hypothesis posits that myopic defocus could act as a feedback mechanism to control eye growth, thereby potentially slowing down myopia progression.^[3]

Despite its theoretical appeal, the practice of undercorrecting myopia has been met with considerable debate. Initial studies and hypotheses suggested potential benefits, but emerging evidence has increasingly called into question the efficacy and safety of this approach. Recent research indicates that undercorrection may not only fail to slow myopia progression but may actually exacerbate it. This raises significant concerns regarding the clinical implications of undercorrecting myopia, particularly in terms of visual acuity, quality of life, and the overall progression of the condition.^[4,5]

This narrative literature review aims to critically evaluate the efficacy and implications of undercorrecting myopia. This review seeks to synthesize current evidence and provide a thorough understanding of the impact of undercorrection on myopia progression.

Through this review, we aim to offer insights into whether undercorrection is a viable strategy for managing myopia or if it inadvertently contributes to the worsening of the condition. By examining the latest research and clinical findings, this review will inform clinical practice and guide future research in the quest to effectively manage and mitigate myopia progression.

Methodology

A comprehensive search for material published between 2000 and 2024 was conducted using the terms 'myopia progression,' 'axial myopia,' 'choroidal thickness,' 'accommodation,' and

‘ciliary muscle tone’ on PubMed, Scopus, and Google Scholar. Relevant articles were identified, reviewed, and analyzed to provide a thorough understanding of the current state of knowledge on this topic.

Discussion

Initial Hypotheses and Theoretical Basis for Undercorrection

The concept of undercorrecting myopia has its roots in the theory that maintaining a slight degree of myopic defocus might inhibit axial elongation of the eye, thereby slowing the progression of myopia. This hypothesis is based on animal studies, where imposed myopic defocus has been shown to slow eye growth. ^[6] The idea was that by leaving a myopic refractive error uncorrected, the eye would experience a similar effect, possibly leading to a reduction in the progression of myopia in humans.

The theoretical underpinning of this strategy relates to the role of visual feedback in eye growth regulation. It was thought that the eye might interpret the slight blur of distant objects as a signal to slow down its growth, thus reducing the rate of axial elongation—a key driver of myopia progression. ^[7] Additionally, proponents of undercorrection suggested that it might reduce the accommodative demand on the eye, thereby potentially alleviating stress on the ciliary muscle and reducing the stimulus for further myopic progression. ^[3]

Emerging Clinical Evidence against Undercorrection

Despite these theoretical justifications, clinical evidence accumulated over the past two decades increasingly contradicts the hypothesis that undercorrection of myopia is beneficial. Numerous studies have consistently shown that undercorrection may actually accelerate myopia progression rather than slow it down.

For example, a landmark study by Chung et al. ^[4] found that children who were undercorrected experienced a significantly greater rate of myopia progression compared to those who received full correction. In this study, 94 children were randomly assigned to receive either full

correction or undercorrection, with the results indicating a faster progression of myopia in the undercorrected group. This finding has been corroborated by subsequent research, including a study by Adams and McBrien, which followed a cohort of children over several years and found similar results—those who were undercorrected showed greater axial elongation compared to fully corrected peers.^[10]

Mechanisms of Myopia Progression in Undercorrected Patients

Several mechanisms have been proposed to explain why undercorrection may lead to faster myopia progression. One key factor is the role of the ciliary muscle in accommodation. According to Kaphle et al., sustained accommodative effort due to undercorrection can lead to ciliary muscle thickening, which is associated with accommodative dysfunction. This dysfunction may result in hyperopic defocus on the retina during near work, which paradoxically stimulates further axial elongation and myopia progression.^[11]

Moreover, the prolonged accommodative effort required in undercorrected individuals might also contribute to increased ciliary muscle tone. Elevated ciliary muscle tone can lead to choroidal thinning, which has been linked to increased susceptibility to myopia progression.^[12] The thinning of the choroid may compromise its role in providing structural support to the eye, facilitating further elongation and worsening myopia.

Another significant factor is the impact of undercorrection on visual experience and behaviour. Individuals with undercorrected myopia may experience blurred vision at a distance, leading to increase near work and less outdoor activity, both of which are associated with a higher risk of myopia progression. This behavioural adaptation could further exacerbate the condition, creating a cycle of worsening myopia.^[13]

Impact on Axial Elongation and Visual Acuity

The most compelling evidence against undercorrection comes

from studies on axial elongation, the primary structural change associated with myopia progression. Axial elongation is closely correlated with increasing levels of myopia, and studies consistently show that undercorrection is associated with a higher rate of axial elongation. For instance, a study by Li et al. (2017) involving over 200 children found that those who were undercorrected had a significantly greater increase in axial length over a two-year period compared to those who received full correction.^[14,17]

Furthermore, the compromised visual acuity associated with undercorrection can have a significant impact on daily activities and overall quality of life. Individuals with undercorrected myopia often report difficulties with tasks requiring clear distance vision, such as driving or participating in sports. This not only affects their functional abilities but also may lead to increased visual strain and discomfort.^[15]

Broader Clinical Implications

The findings from the literature suggest that undercorrection of myopia is not only ineffective in slowing myopia progression but may actually contribute to its acceleration. This challenges the initial theoretical basis for undercorrection and highlights the importance of re-evaluating clinical practices related to myopia management. Full correction, rather than undercorrection, should be the standard approach in managing myopia to prevent unnecessary progression and to maintain optimal visual acuity.

Additionally, the potential harms associated with undercorrection underscore the need for ongoing patient education and monitoring. Optometrists and ophthalmologists must ensure that patients and their families are informed about the risks of undercorrection and the importance of appropriate corrective measures to manage myopia effectively.

Conclusion

In conclusion, the literature overwhelmingly suggests that undercorrection of myopia is not a beneficial strategy and may contribute to the progression of the condition. The theoretical

benefits of myopic defocus have not been supported by clinical evidence, and the risks associated with undercorrection—such as accelerated axial elongation and compromised visual acuity—far outweigh any potential advantages. Full correction of myopia should remain the baseline treatment approach, with a focus on minimizing myopia progression and ensuring the best possible visual outcomes for patients.

Acknowledgement

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