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1. INTRODUCTION

Myopia is on the rise globally, with projections indicating **that 50% of the world's population will be affected by 2050**[1]. Children are especially vulnerable, and **early intervention is key** to preserving their long-term vision and quality of life. **Childhood myopia increases the risk** of cataract, glaucoma, retinal detachment, and myopic maculopathy[2].

Horizons Optical is committed to advancing excellence and innovation in vision care and has established an alliance with the **Brien Holden Vision Institute**, a globally recognized leader in myopia research, to co-create **KARE, an advanced solution for myopia management**. This strategic partnership has enabled the creation of a **next-generation approach to slow-down myopia progression**, grounded in the most recent **scientific findings and clinical evidence**.

Like other proven solutions on the market, **KARE is built on the principle of peripheral defocus**, but **it takes the concept further**. By integrating **advanced HEXAVISION technology** and a **proprietary zone optimization technique**, KARE enhances the **peripheral defocus effect with greater precision** across the lens surface. The result: **a smarter way to manage axial eye elongation**, while delivering **sharp central vision**, **comfort**, and a **non-invasive** and **discreet lens design** that kids enjoy wearing.

This document offers a **comprehensive deep dive into the advanced technical features of the KAR**E lens and the **scientific principles** that underpin its innovative design.

2. MYOPIA MANAGEMENT LENS MARKET OVERVIEW AND EMERGING INSIGHTS

The **current market for spectacle lenses designed for myopia management** is **rapidly evolving**, offering several effective options that demonstrate measurable benefits in **slowing myopia progression**[3]. However, a significant **gap remains between clinical effectiveness and aesthetic appeal**, as many lenses that deliver strong myopia management results often **compromise on visual comfort** or **cosmetic subtlety**.

At the same time, this field is **fueled by continuous scientific discoveries** and **breakthroughs in understanding ocular growth and peripheral defocus mechanisms**. These advances constantly **inspire the development of innovative lens designs**, creating a **dynamic environment** where **new products emerge regularly**, each aiming to **better balance efficacy, comfort, and wearer satisfaction**.

3. FOUNDATIONS OF MYOPIA PROGRESSION AND MANAGEMENT

Myopia occurs when infinite incoming light rays are focused in front of the retina in the absence of accommodative effort. Standard single vision lenses are typically divergent negative lenses, prescribed to correct myopia as they shift the image back onto the retinal plane, ensuring **clear vision at the central retina**.

PERIPHERAL HYPEROPIC DEFOCUS (PHD)

However, in the peripheral retina, these lenses cause light rays to focus **behind the retinal surface**, resulting in a **peripheral hyperopic defocus** and reduced image clarity in the outer regions of the visual field. It is well known that **PHD** stimulates **axial elongation**, leading to an increase in myopia [3].

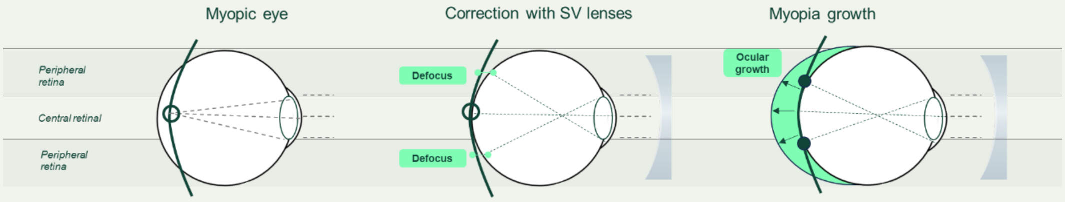

Figure 1: Myopic eye, SV correction (central correction and PHD In the periphery) and myopia growth

PERIPHERAL MYOPIC DEFOCUS (PMD)

Based on the **peripheral defocus theory**, current myopia management strategies aim to control myopia progression by addressing peripheral retinal defocus. The theory suggests that **incorporating positive power in the peripheral zones** of the lens helps **shift the peripheral focal plane onto or in front of the retina**, thereby reducing peripheral hyperopic defocus and slowing axial elongation.

These lenses provide **negative power in the central zone to shift the focal plane backward**, thereby correcting myopia and delivering clear vision at the central retina and fovea. In the peripheral zones, they incorporate **positive power to induce myopic defocus, which shifts the peripheral image plane forward**, reducing hyperopic defocus and helping to slow axial elongation.

Negative lenses shift the focal plane backward and, positive lenses shift the focal plane forward.

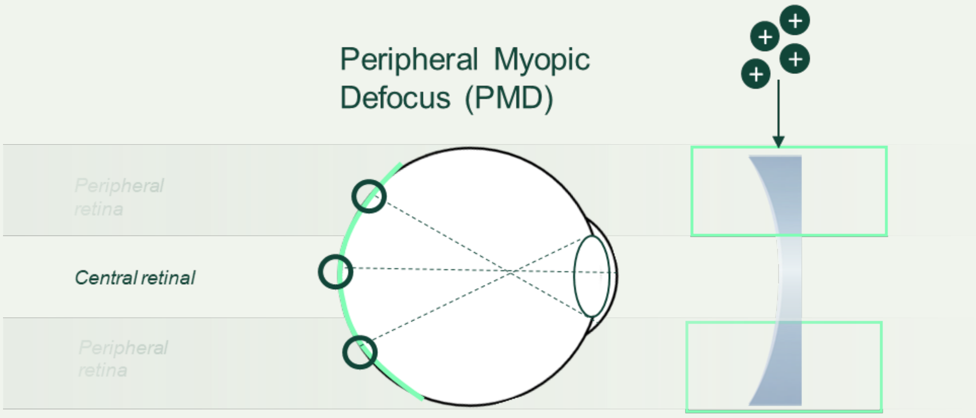

Figure 2: Peripheral myopic defocus

In human vision, each part of the visual field is detected by the opposite side of the retina: what we see on the outer (temporal) side is captured by the inner (nasal) retina, and vice versa.

4. KARE AND HEXAVISION TECHNOLOGY

KARE lenses boast a continuous surface design with **six precisely optimized zones for distance vision, near vision, and peripheral myopia management**. With **addition powers ranging from +0.50D to +2.75D**, they deliver a flawless blend of aesthetic appeal and wearer comfort, avoiding abrupt power transitions. Grounded in the **peripheral defocus theory** which identifies hyperopic defocus in the peripheral retina as a driver of axial elongation. KARE leverages **HEXAVISION technology** to strategically **induce peripheral myopic defocus (PMD) across targeted lens zones**, effectively counteracting myopia progression.

FAR VISION ZONE

The **far vision zone, also known as optical zone,** is the central optical area of the lens, specifically designed to **correct myopia** and provide sharp, stable vision at a distance. It features an ovoid shape to enhance visual comfort and expand the horizontal field of view. With an optimized **diameter of 8 mm**, this zone ensures precise distance correction while allowing adequate space for peripheral therapeutic zones essential for myopia management. Its balanced design supports both visual performance and treatment efficacy.

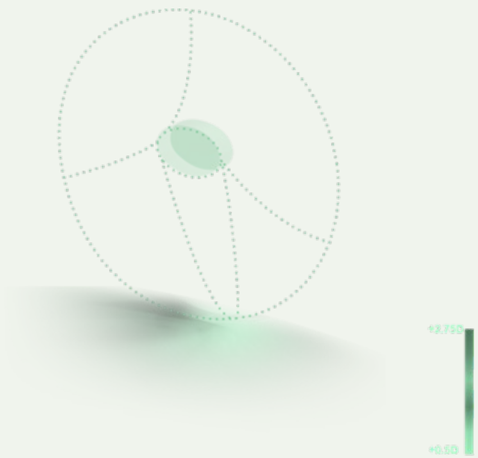

Figure 3: Central optical zone with far vision prescription

MYOPIA MANAGEMENT ZONE DURING FAR VISION

Surrounding the central far vision zone, this area is engineered to induce **controlled myopic defocus** on the **peripheral retina** when the child is looking at distant objects. It features an **asymmetric power distribution**, with **greater positive power on the nasal side** compared to the temporal side. This **intentional and unique asymmetry** is designed to align with the latest research on the relationship between **peripheral refraction** and **myopia progression**[7] that is detailed in the next section.

Together, these zones deliver a precise and scientifically guided peripheral defocus, contributing to effective myopia management in children.

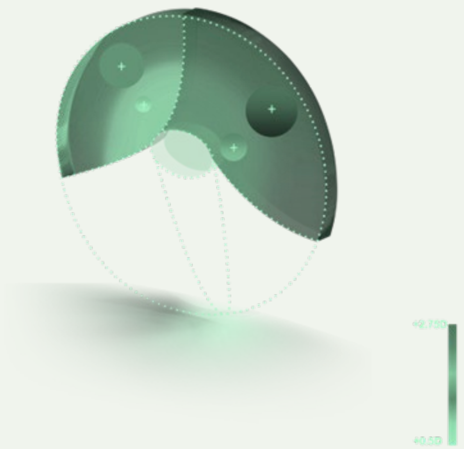

Figure 4: Far PMD zones (nasal and temporal)

MYOPIA MANAGEMENT ZONE DURING NEAR VISION

This functional zone is designed to optimize myopia increase mitigation by precisely managing **peripheral defocus** when the children are performing **near vision tasks**. It incorporates a **strategic asymmetrical distribution of positive power**, adding **less positive power in the inferior region** (typically used for near vision) than in the superior, and **more in the nasal region** than in the temporal. This gradient aligns with a recent paper[8] that studied the change in peripheral refraction when accommodation is relaxed and activated during near vision.

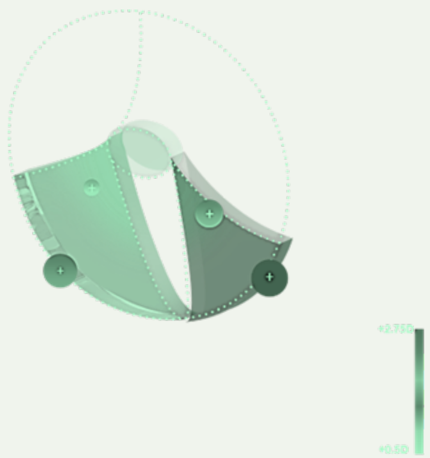

Figure 5: Near PMD zones (Nasal and temporal)

NEAR VISION ZONE

The near vision zone is designed to address the visual demands of myopic children during sustained near tasks, such as reading and digital device use. It provides an **addition of +0.50 diopters**, specifically aimed at **reducing accommodative lag**, a common characteristic in myopic children (see detailed explanation on SCIENTIFIC INSIGHTS AND RATIONALE).

By introducing this slight positive power combined with a very low astigmatism, the zone helps provide sharp vision at near and lower the accommodative effort required during prolonged near work, **enhancing comfort**.

It also **promotes the use of the near zone**, ensuring that the **peripheral areas in the lower part** of the lens continue to **deliver their intended treatment effect** even when the child is looking at near objects.

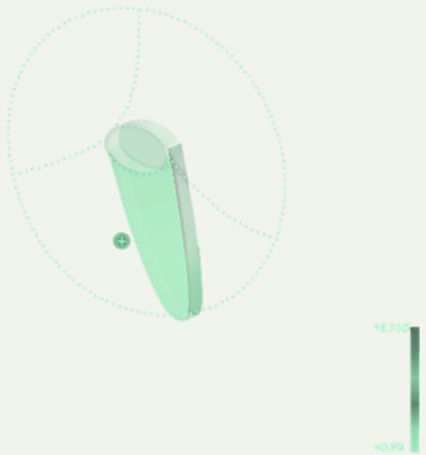

Figure 6: Near vision zone with +0.50D addition

Some other lenses apply high levels of positive addition in the near zone, which often **prevents the child from using either the central or peripheral** areas of the lens for near tasks and **causing discomfort**. In contrast, **our approach is designed to encourage natural use of the near zone**, which is expected to provide an **additional level of efficacy** beyond that achieved by the other treatments zones.

5. SCIENTIFIC INSIGHTS AND RATIONALE

KARE is built upon the foundation of existing myopia management treatments available in the market, which have demonstrated that counteracting PHD with PMD effectively slows myopia progression. **What sets KARE apart is its incorporation of the latest scientific evidence** recently made accessible through collaboration with BHVI. This new knowledge has enabled the development of an optimized lens design that refines the balance of lens zones, aiming to enhance both treatment efficacy and wearer comfort beyond current standards.

WHY DOES KARE APPLY MORE PERIPHERAL DEFOCUS NASALLY THAN TEMPORALLY?

KARE sets itself apart from existing lenses by integrating the latest advances in peripheral refraction asymmetry research.

Until now, other lenses on the market have applied similar or even greater levels of PMD in the temporal zone compared to the nasal zone (figure 7), based on anatomical structure, peripheral refraction patterns, and sensitivity differences between the nasal and temporal retina[4,5,6].

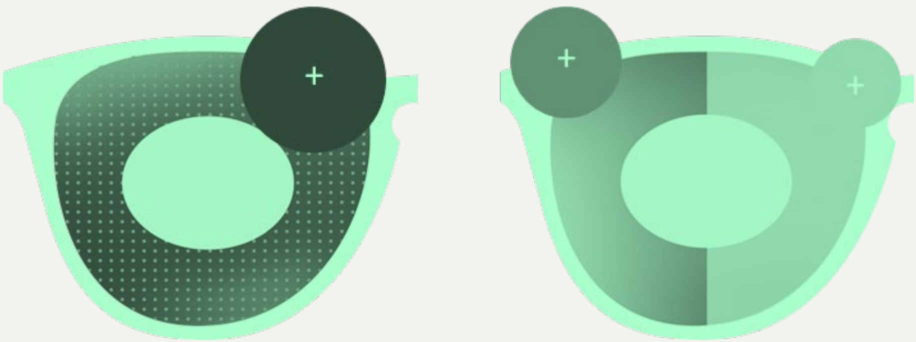

Figure 7. Other lenses available in the market (similar or more PMD at temporal)

However, recent findings concluded that children with less baseline myopic defocus in the temporal visual field progressed less compared to other groups[7].

Previous lenses induced greater myopic defocus in the nasal field. While they demonstrated some efficacy, they did not provide an optimized optical power distribution across the retina.

That's why KARE applies greater positive myopic defocus (PMD) in the nasal area of the lens, resulting in less myopic defocus in the temporal area of the lens and, consequently, in the temporal visual field of the child.

KARE aligns more closely with the peripheral refraction patterns associated with slower myopia progression, offering a more targeted approach than other lenses currently on the market.

This insight came from a large-scale metadata analysis done by the Brien Holden Vision Institute (BHVI). The study combined baseline data from seven randomized clinical trials, involving 1,186 children aged 6 to 16, with 74% having at least one myopic parent.

Peripheral refraction was measured centrally, as well as at 20° and 30° in both the nasal and temporal fields, using high-resolution instruments: the Eyemapper (Brien Holden Vision Institute) and the NVision-K 5001.

Figure 8: Eyemapper (Brien Holden Vision Institute)

Then, a linear mixed model was used to assess the relationship between peripheral refraction profiles and annual myopia progression in term of axial length and equivalent sphere (SE) change.

The results showed that children with less myopia in the temporal visual field tend to progress more slowly.

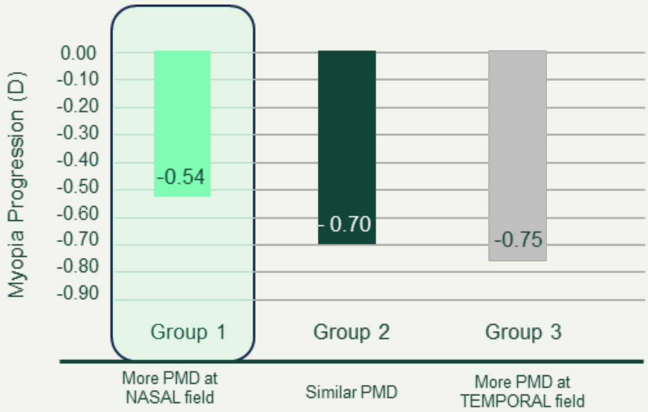

Figure 9: Result of myopia progression (SE) in the different groups evaluated.

WHY DOES KARE APPLY LESS PMD IN THE LOWER PERIPHERAL ZONE THAN IN THE UPPER?

KARE is the first lens **specifically designed to actively manage the peripheral retina** not only at far distances, but also during **near vision tasks.**

While other lenses on the market apply similar or even greater levels of PMD in the lower peripheral zone of the lens used for near vision tasks, recent studies suggest that relative PHD decreases with increasing accommodative demand. Therefore, less compensation for PHD is needed in the lower part of the lens for near tasks.

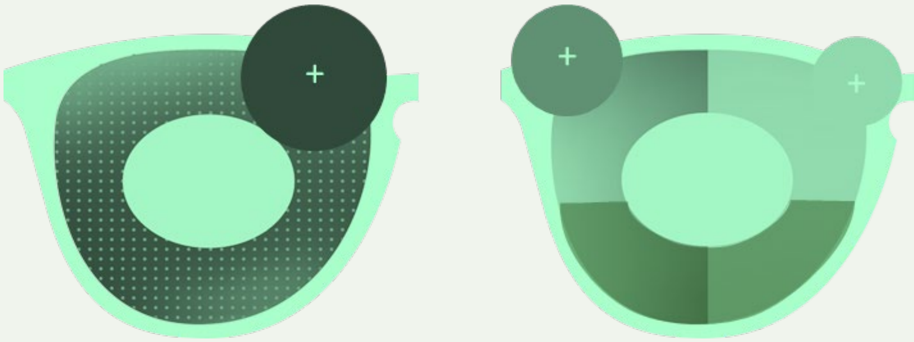

Figure 10. Other lenses available in the market (similar or more PMD at the bottom periphery)

These insights came from a recent paper that investigates how off-axis (peripheral) refraction changes during accommodation in myopic eyes, and whether the typical PHD seen in myopes is affected by near viewing[8].

Twenty young adult myopes with spherical equivalent refractive errors between –0.50 D and –4.25 D and less than 1.25 D of astigmatism participated. All participants wore soft contact lenses to correct their refractive error during testing.

Non-cycloplegic autorefraction was measured centrally and at 20°, 30°, and 40° in both nasal and temporal retina at three distances: 2 m (distance), 40 cm, and 30 cm (near).

The study concludes that, in myopic eyes, PHD is lower during near viewing (when accommodative demand is higher) compared to distance viewing.

This is why KARE applied a reduced PMD in the lower portion of the lens, as the PHD experienced by the patient during near vision is less than that observed during distance viewing.

WHY DOES KARE OFFER AN ADDITION OF +0.50D AT NEAR?

It is well established in scientific literature that **myopic children** tend to **exhibit higher accommodative lag** compared to their emmetropic peers.

This means that when focusing on near objects, such as during reading or screen use, their eyes often do not fully accommodate to the required distance. Instead of focusing exactly on the near stimulus, **the focal point falls behind the retina, creating a slight blur on the peripheral retina**. This phenomenon is referred to as accommodative lag and is considered a **contributing factor in the progression of myopia**, as it may stimulate axial elongation of the eye[9].

To address this issue, **previous optical interventions such as bifocal and progressive addition lenses (PALs) were developed with the aim of reducing accommodative lag**. Even some current myopia control lenses, although not explicitly marketed this way by manufacturers, incorporate positive power in the near zone. This design feature aims to reduce accommodative lag during near tasks, contributing to the overall goal of minimizing peripheral hyperopic defocus and slowing axial elongation.

However, all these solutions typically provide addition powers greater than +1.00, +1.50D and +2.00D[3], while recent evidence suggests that the average accommodative lag that causes real defocus at near is around +0.50 D. Providing higher addition values than necessary may lead to visual discomfort, blurriness, and ultimately rejection of the lens by the child. As a result, the intended optical signal may fail to reach the retina effectively, undermining the lens's purpose in myopia management.

This lag is routinely detected through objective measurement methods. Objective techniques measure the eye's refractive state using light reflected from the retina, without relying on patient input. They often show a **more hyperopic result**. Subjective techniques depend on the patient's visual responses, using **light absorbed by photoreceptors**. These usually give **a less hyperopic or more accurate representation of how the children see.**

The third insight that inspires KARE suggests that accommodative lags are smaller than indicated by objective measurements[10].

In this research RMS defocus, autorefractor and subjective measurements were performed in patients with an average age of 28.3 ± 5.6 years to evaluate the accommodative lag.

Objective measurements, obtained via a wavefront sensor and an autorefractor analyzing retinal reflections, showed typical accommodative lags. In contrast, subjective visual acuity measurements which also involve photoreception and neural image processing revealed much smaller errors**. In fact, the accommodative errors found were nearly zero when measured based on visual performance.**

That's why KARE applied only a 0.50D addition in the near zone.

6. POWER DISTRIBUTION MAPS

As with all ophthalmic and myopia management lenses, KARE is composed of a spherical and a cylindrical (astigmatic) component. The Mean Power and Astigmatism distribution maps are shown below (Figure 11) for a plano prescription, to better illustrate the optical behavior of the design.

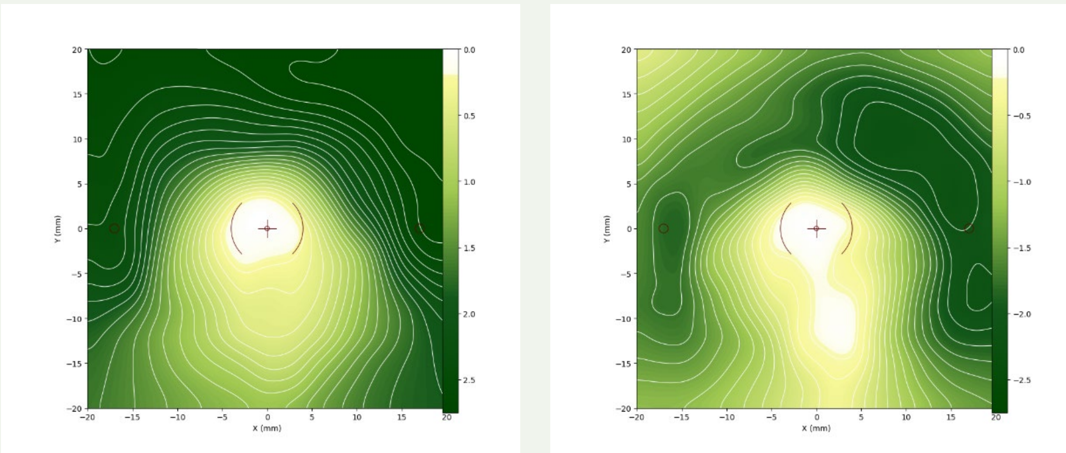

Figure 11. Mean Power map (right) and Astigmatism (left) map of KARE for a plano RX

As seen in the **Mean Power map, KARE features a central optical zone that is free of defocus**, surrounded by a **controlled increase in positive power (Mean Power Distribution, PMD)**, ranging from **+0.50 D in the Near Vision Zone** to up to **+2.75 D in the Nasal-Superior Periphery.** Overall, **peripheral defocus is more pronounced in the nasal half** of the lens compared to the temporal half, and **greater in the superior periphery than in the inferior periphery**.

Additionally, in term of astigmatism **KARE has been carefully designed to keep the critical distance and near vision zones strategically free of blur**, ensuring clear and sharp vision during visual tasks. At the same time, **unwanted astigmatism is deliberately distributed toward the peripheral areas**, where **controlled blur is introduced**. This peripheral defocus helps increase retinal defocus, supporting effective myopia management.

7. WEARABILITY AND EFFICACY CLINICAL TRIALS

KARE is proudly supported by the Brien Holden Vision Institute and leverages a robust foundation of scientific evidence demonstrating that **peripheral myopic defocus** (PMD) remains one of the most effective and clinically proven approaches in myopia management. Existing lenses employing this principle have already shown significant success in slowing myopia progression worldwide[3].

Our ongoing study is designed to quantify and showcase KARE's superior effectiveness, incorporating the latest advancements in optical design and cutting-edge clinical research.

In 2024, internal wearability assessments at Horizons Optical confirmed that children adapt quickly and report exceptional comfort and satisfaction with KARE lenses. Building on these promising results, a comprehensive multicenter clinical trial involving 146 myopic children across Spain is currently underway in 2025 to rigorously validate KARE's clinical performance and position it as a leader in myopia management solutions.

8. KEY BENEFITS OF KARE LENSES

KARE offers promising efficacy, comfort and aesthetic design, and broad compatibility. It is supported by four patents and the latest scientific evidence, making it a leading solution in myopia management.

9. TARGET AUDIENCE

Children aged 6 years and older with a myopia of -0.50D or greater.

10. CONCLUSIONS AND FUTURE OUTLOOK

KARE lenses represent a next-generation spectacle lens for myopia management, backed by credible research institutions and early clinical data. While full-term studies are ongoing, early results suggest it's a comfortable, child-friendly option, especially for those who may not tolerate contact lenses or atropine.

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