

# GUEST ABSTRACT

# **My name is “Optometrist”. What are my responsibilities (At least) until 2030?**

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### **Abstract:**

World Report on vision was released in 2019 by the World Health Organization, Key indicators for the eye health service delivery and a goal for each of the indicators was set. Aligning with the goals, International Agency for prevention of blindness, (IAPB) outlined the activities and guidelines for optometrists under the heading, “elevate, integrate and activate”. This session would outline the responsibilities of an optometrist that needs to be achieved by 2030.

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## **Myopia – The Silent Pandemic We Need to Talk About**

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If we’ve learned anything from global health challenges, it’s that early awareness and proactive prevention are often more effective than reactive treatment. This lesson holds particularly true for myopia, a growing but often overlooked vision condition that’s quietly affecting children across the country. If we start recognizing myopia as a pandemic, then it’s high time we approached it with the urgency and holistic strategy it deserves—starting with prevention, not just treatment.

### **Prevention Starts at Home**

Unlike other health conditions, myopia doesn’t always come with obvious symptoms—especially in children. Kids are remarkably adaptable. They rarely complain about blurry vision or strain because they don’t know what “normal” vision is supposed to look like. This natural adaptability means parents and caregivers may not even realize there's an issue.

In many households, there's a prevailing belief—often passed down from well-meaning grandparents—that children's vision will simply take care of itself. But just like any other aspect of health, children's eyes require regular check-ups and guided care. That's where behavior and habit management come in. Myopia prevention isn't about waiting for a problem to arise. It's about fostering healthy habits early on. Encouraging outdoor play, managing screen time, and ensuring proper lighting during reading or homework are simple yet powerful steps. There is *no* substitute for quality time and attentive parenting when it comes to supporting children's visual development.

### **Optometrists: The Frontline of Myopia Awareness**

For optometrists, myopia management doesn't begin in the exam room—it starts in the community. Every conversation, every school visit, every parent interaction is an opportunity to educate and create awareness. In a country where many parents don't know when to schedule their child's first eye test, optometrists can make all the difference.

The American Academy of Ophthalmology (AAO) has laid out a clear vision screening schedule that should be common knowledge among parents:

- **Newborns:** Eyes should be checked by a doctor or trained professional for any basic indicators of eye health.
- **6 to 12 months:** A second screening is recommended during the first year.
- **12 to 36 months:** Assess for healthy eye development.
- **3 to 5 years:** Test for visual acuity and eye alignment.
- **6 years and older:** Children should receive **annual eye exams**.

These milestones aren't just boxes to check—they're critical touchpoints for detecting and managing issues early.

### **Treatment Is Not Enough**

While prevention relies heavily on awareness and behavioral shifts, treatment of myopia is more technical—dispensing the right lenses, offering solutions like orthokeratology or atropine drops, and monitoring progression. But if we're only treating myopia, we're missing half the battle. Prevention and education need to be as deeply rooted in practice as prescribing glasses.

This is the moment for optometrists to lead the charge. Through proactive counseling, community outreach, and personalized care, they can help reduce the burden of myopia—one family, one child at a time.

Because when it comes to children's vision, doing nothing is not an option. Awareness is the first step. Action must follow.

We are the first line of defense in a silent pandemic that has long-term consequences if ignored. Let's raise awareness. Let's push prevention. Let's lead the change.

Because we aren't just prescribing lenses—we're protecting futures.

# Optometry Unboxed: Innovation from Clinics to Communities.

**Apurbayan Biswas (M.OPTOM, MBA)**

Founder of Eye Supervision

## **Abstract:**

Innovation in optometry begins where traditional thinking ends. When daily clinical challenges are approached with curiosity and creativity, they open the door to transformative solutions. Optometrists, often positioned closest to patients' stories, are uniquely placed to convert real-life problems into impactful ideas—whether in patient care, education, or community outreach.

Eye care is not just a health concern—it's a financial and societal one. When the only earning member of a family loses their vision, they don't just lose sight—they often lose livelihood, identity, and dignity. Blindness or visual disability can turn a provider into a dependent, creating emotional and financial strain for the entire family.

But change doesn't always require big systems. It begins with individuals—optometrists who think differently, act locally, and dare to innovate. From building community-driven models to developing low-cost solutions, even the smallest ideas can become a lifeline for someone's vision, someone's future. Unboxing optometry means redefining its limits. It means daring to care beyond the clinic and seeing each patient not as a prescription, but as a person whose life could change forever with just one right idea.

# ARTICLES

# From Refraction to Research: Empowering the Next Generation of Optometry Professionals

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### Introduction

In the dynamic and expanding field of eye care, the optometry profession is undergoing a profound transformation. From being seen primarily as refraction experts, today's optometrists are taking on diverse and critical roles-as primary care providers, vision scientists, public health contributors, and clinical researchers. This journey from refraction to research represents more than just a shift in professional responsibility; it is a reaffirmation of optometry's scientific roots and its vision for the future.

### The Expanding Horizons of Optometric Practice

Today's optometry extends well beyond the conventional clinic. It encompasses advanced diagnostic skills, ocular disease management, community outreach, and digital vision care. As technologies like optical coherence tomography (OCT), fundus photography, and AI-assisted vision screening become more accessible, optometrists are poised to play an integral part in early diagnosis and preventive eye care.

However, to fully harness these advancements, we must train future optometrists not only as

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clinicians-but as clinician-researchers who question, investigate, and contribute to the global body of vision science.

### Creating a Research-Conscious Ecosystem

To truly empower students, research must be embedded as a way of thinking-not merely an academic requirement. The following elements are vital:

- Early Exposure: Introducing research methodology from the first year builds a strong foundation.
- Clinical Curiosity: Every patient interaction is a potential research insight waiting to be explored.
- Mentorship Culture: Faculty must mentor and walk with students through hypothesis formulation, data collection, and publication.
- Infrastructure Support: Access to data, analysis tools, and writing resources helps students bridge ideas with outcomes.
- Encouragement to Publish: Be it student journals, conference souvenirs, or peer-reviewed platforms-publication validates effort and builds confidence.

## The Clinician-Researcher: A New Age Optometrist

The future belongs to those who wear both lenses-the lens of care and the lens of inquiry. Optometrists who analyze treatment outcomes, track epidemiological patterns, or innovate in low vision rehabilitation are reshaping the narrative of our profession. In a country like India, where the burden of ocular morbidity is high, indigenous research is not only necessary-it is our responsibility.

### From Refraction to Research

#### Empowering the Next Generation of Optometry Professionals

When students are trained to think beyond "what" to "why" and "what next," they evolve into critical thinkers and ethical leaders.

#### From Classroom to Conference: Empowering with Purpose

Institutes must facilitate:

- Student-led journal clubs and symposia.
- Interdisciplinary projects with ophthalmology, neurology, and public health.
- Opportunities for national and international presentations.
- Scholarships, recognitions, and internships tied to academic inquiry.

Such platforms instill self-worth, stimulate innovation, and inspire leadership. Every abstract submitted, every case presented, and every study conducted sows the seeds of lifelong learning.

### Conclusion

Our legacy as optometry educators and mentors lies not in how many students graduate, but in how many grow into compassionate, competent, and curious professionals. By nurturing a spirit of inquiry and instilling a research mindset, we do not just educate optometrists-we shape thought leaders and changemakers.

Let us encourage the next generation to not just see through lenses, but to envision a better future for eye care through research.

### Quote

"Science is not only a disciple of reason, but, also, one of romance and passion." - Stephen Hawking

# Nanotechnology in Glaucoma Medicines: Progress and Prospects

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**Abstract** A major worldwide health concern is glaucoma, a collection of eye conditions that cause progressive optic nerve damage and visual loss. Poor bioavailability and patient compliance are common problems with traditional therapeutic approaches. The development of nanotechnology presents encouraging options for efficient, long-lasting, and tailored medication administration in the treatment of glaucoma. The advantages of existing nanotechnology-based glaucoma treatment approaches over conventional ones are examined in this article, along with possible future research avenues and an assessment of the clinical translation potential of these nanomedicines.

**Keywords:** Glaucoma, Nanotechnology, Drug Delivery, Intraocular Pressure, Nanocarriers, Liposomes, Nanoparticles

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**1. Introduction** Glaucoma is one of the leading causes of irreversible blindness worldwide, affecting approximately 76 million people in 2020 and predicted to reach 111.8 million by 2040 (Tham et al., 2014). Damage to the optic nerve is the hallmark of glaucoma, which is often linked to elevated intraocular pressure (IOP). Timely intervention is required to preserve vision. The mainstay of treatment consists of medications that reduce intraocular pressure (IOP); however, traditional eye drops have limitations, including poor ocular penetration, quick precorneal clearance, and restricted bioavailability, where less than 5% of the injected dose reaches intraocular tissues (Gaudana et al., 2010).

Ocular medication delivery can be enhanced by novel nanocarrier systems that enhance drug solubility, retention time, penetration, and controlled release characteristics. New methods of circumventing these limitations are made possible by nanotechnology.

## 2. Nanocarrier Systems in Glaucoma Therapy

**2.1 Liposomes** Hydrophilic and lipophilic medications can be encapsulated in liposomes, which are spherical vesicles made of phospholipid bilayers. They are appropriate for ophthalmic applications due to their low toxicity, biocompatibility, and capacity to integrate with biological membranes. In animal models, liposomes laden with timolol have demonstrated a noticeably longer duration of IOP lowering (Lawrence & Rees, 2000).

**2.2 Polymeric Nanoparticles** Colloidal carriers known as polymeric nanoparticles are composed of biodegradable polymers such chitosan, polylactic-co-glycolic acid (PLGA), and polycaprolactone (PCL). These nanoparticles offer continuous release and shield the medication from deterioration. For example, in rabbit eyes, brimonidine tartrate encapsulated in PLGA nanoparticles showed long-lasting effects on lowering intraocular pressure for up to seven days (Huang et al., 2018).

**2.3 Dendrimers** Highly branched synthetic polymers with a regulated structure and multivalent surface functionality are called dendrimers. Site-specific delivery is made possible by their capacity to conjugate

medications to their surface or encapsulate them. PAMAM dendrimers have been studied for the delivery of latanoprost and pilocarpine with little ocular irritation and increased bioavailability (Kambhampati et al., 2015).

**2.4 Nanoemulsions and Micelles** Fine oil-in-water dispersions stabilised by surfactants, known as nanoemulsions, increase the solubility and bioavailability of medications that are not very soluble in water. Compared to traditional drops, latanoprost nanoemulsions have demonstrated better penetration and a longer duration of action (Kaur et al., 2010). Amphiphilic block copolymers can create micelles that can encapsulate hydrophobic medications and help them pass through ocular barriers.

**2.5 In Situ Gelling Systems** Liquid formulations known as in situ gels solidify into gels when they come into contact with the surface of the eye. Precorneal residence duration and sustained drug release are enhanced when in situ gelling and nanoparticles are combined. Research on nanoparticles loaded with timolol in thermosensitive gels demonstrates encouraging outcomes for once-daily dosage (Boddu et al., 2010).

### 3. Advantages of Nanotechnology in Glaucoma Treatment

- **Enhanced bioavailability:** Nanocarriers improve corneal penetration and minimize drug loss due to tear drainage.
- **Controlled and sustained release:** Reduces dosing frequency, improving adherence.
- **Targeted delivery:** Minimizes systemic exposure and associated side effects.
- **Protection from degradation:** Encapsulation shields drugs from enzymatic degradation.
- **Patient convenience:** Reduces burden of frequent administration.

**4. Clinical Translation and Challenges** Few formulations have advanced to clinical trials; one notable success is the FDA-approved nanomicellar latanoprost (NCX 470), which exhibits improved pharmacodynamics in clinical phases. Despite the noteworthy potential of nanotechnology in preclinical models, bringing these innovations to clinical use is difficult, and regulatory concerns regarding long-term safety, stability, scalability, and reproducibility need to be addressed (Nicox, 2021).

**5. Future Directions** Smart nanocarriers that react to pH, temperature, or enzymes that enable site-specific medication release are examples of emerging trends. Comprehensive glaucoma treatment may be possible by combination treatments that combine nanocarriers with gene therapy, RNA interference, or sustained-release implants. Furthermore, investigating mucoadhesive and biodegradable nanoparticles would enhance ocular retention and compatibility.

**6. Conclusion** The use of nanotechnology in glaucoma medication administration is revolutionary since it overcomes significant drawbacks of traditional treatments. Nanomedicines may establish themselves as a mainstay in the treatment of glaucoma and improve the lives of patients at risk of vision loss with sustained multidisciplinary research and strategic cooperation between scientists, physicians, and industry partners.

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## **BUTTERFLY WING BIOINSPIRED ANTI-GLARE TECHNOLOGY: A REVIEW ON NANOSTRUCTURES FOR LIGHT DIFFUSION AND VISUAL CLARITY**

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### Abstract

Glare reduction is a critical challenge in optics, display technologies, and solar energy applications. Traditional anti-reflective (AR) coatings often rely on multilayer thin films, which suffer from limitations such as narrow wavelength ranges, poor durability, and complex fabrication processes. In contrast, bio inspired nanostructures derived from butterfly wings offer a promising alternative by manipulating light diffusion through intricate micro-Nano architectures. This review explores the anti-glare properties of butterfly wing nanostructures, focusing on their ability to reduce reflectance and enhance visual clarity without additional coatings. We discuss the underlying mechanisms, structural optimization, fabrication techniques, and potential applications in solar cells, optical devices, and display technologies. Furthermore, we highlight the challenges and future prospects of implementing bio inspired anti-glare solutions in commercial applications.

### Introduction

Glare, caused by unwanted light reflection, significantly impacts visibility in optical systems,

displays, and solar panels. Conventional AR coatings reduce glare through destructive interference but are limited by material constraints and environmental degradation. Nature, however, has evolved sophisticated anti-reflective structures, such as those found on butterfly wings, which achieve superior light management through micro-nano architectures.

Figure: 01

Butterfly wings exhibit structural coloration and anti-reflective properties due to their hierarchical nanostructures, which manipulate light via diffraction, scattering, and gradient refractive index effects. Unlike synthetic AR coatings, these natural structures provide broadband and omnidirectional anti-glare performance with enhanced durability. This review examines:

- The anti-reflective mechanisms of butterfly wing nanostructures.
- Key structural parameters influencing glare reduction.
- Fabrication techniques for bioinspired anti-glare surfaces.
- Applications in optics, photovoltaics, and display technologies.
- Challenges and future research directions.

## 2. Anti-Reflective Mechanisms in Butterfly Wings

### 2.1 Structural Color and Light Interaction

Butterfly wings achieve low reflectance through micro-nano structures rather than pigments. For example:

- *Papilio epiphorbas* exhibits blue-green scales with an average reflectance of 6.24% in the infrared band.
- *Parthenos syvia* has purple scales with 7.39% reflectance.
- *Sasakia charonda* shows green scales with 14.21% reflectance.

These variations arise from differences in structural morphology, such as:

- Conical hole structures (gradient refractive index).
- Grating tower structures (diffraction-based scattering).
- Rectangular groove structures (light trapping).

### 2.2 Gradient Refractive Index Effect

The gradual transition in refractive index (GRIN) between air and the wing surface minimizes abrupt light reflection. Studies reveal that:

- Gradient structures (e.g., conical holes) outperform non-gradient ones (e.g., rectangular grooves).
- Finite-difference time-domain (FDTD) simulations confirm that optimized nanostructures reduce reflectance by 0.34–5.46% compared to flat surfaces.

### 2.3 Multi-Scale Light Manipulation

Butterfly wings employ hierarchical structures to enhance anti-glare effects through:

- Diffraction (nanoscale ridges).
- Interference (multilayer thin films).
- Scattering (microscale surface roughness).

## 3. Bioinspired Anti-Glare Nanostructures

### 3.1 Key Structural Parameters

The anti-reflective performance depends on:

- Periodicity (sub-wavelength spacing reduces diffraction).
- Aspect ratio (higher ratios improve light trapping).

- Profile geometry (conical and parabolic shapes enhance GRIN effects).

### 3.2 Fabrication Techniques

Several methods replicate butterfly wing nanostructures:

- Femtosecond laser ablation (used for THz moth-eye structures).
- Nano imprinting (cost-effective for large-scale production).
- Self-assembly (biomimetic polymer replication).

For example, Yu et al. (2023) fabricated “1D moth-eye structures “on silicon, achieving <5% reflectance in the THz band by optimizing taper profiles.

## 4. Applications of Bio inspired Anti-Glare Technology

### 4.1 Solar Energy

- Enhanced light absorption in photovoltaic cells.
- Reduced reflection losses in solar panels.

### 4.2 Optical Displays

- Glare-free screens for smartphones and monitors.
- Improved visibility in augmented reality (AR) lenses.

### 4.3 Infrared and Terahertz Devices

- Anti-reflective surfaces for THz communication (6G technology).
- Infrared stealth coatings for military applications.

### 4.4 Automotive and Aerospace

- Anti-glare windshields and camera lenses.
- Lightweight, durable coatings for aircraft windows.

## 5. Challenges and Future Perspectives

### 5.1 Current Limitations

- Scalability: Mass production of nanostructures remains costly.
- Durability: Mechanical robustness under environmental stress.
- Wavelength Range: Extending performance to UV and visible spectra.

### 5.2 Future Research Directions

- Hybrid Designs: Combining bio inspired structures with Meta materials.
- AI Optimization: Machine learning for nanostructure design.
- Sustainable Materials: Eco-friendly fabrication methods.

## Conclusion

Butterfly wing-inspired nanostructures present a revolutionary approach to anti-glare technology, offering superior light management without traditional coatings. By leveraging gradient refractive index effects and hierarchical architectures, these bio inspired designs achieve broadband, omnidirectional glare reduction. While challenges in scalability and durability persist, advancements in nanofabrication and computational modeling hold promise for commercial adoption. Future research should focus on optimizing structural parameters and expanding applications in renewable energy, telecommunications, and display technologies.

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# 'Near Vision Difficulty': An Optometrist's Perspective

**Ms. Moumita Ghosh, M. Optm., Assistant Professor, Dept of Optometry, George College of Management & Science**

Near vision tasks constitute a significant portion of modern-day visual activities. A substantial number of patients visiting eye care clinics report difficulty with near vision, often accompanied by asthenopic symptoms. A comprehensive evaluation is essential before prescribing any optical correction. This article discusses the potential causes and evidence-based management strategies for near vision difficulties and asthenopia.

## **Etiological Factors of Near Vision Difficulty**

- Hypermetropia
- Presbyopia
- Accommodative Insufficiency
- Convergence Insufficiency
- Pseudo-accommodative Insufficiency
- Computer Vision Syndrome (CVS)
- Meares-Irlen Syndrome
- Dyslexia

## **Common Patient Complaints**

- Frontal and brow headaches
- Ocular watering
- Blurred near vision
- Eye fatigue
- Ocular discomfort and itching

## **Hypermetropia**

Hypermetropia is a type of refractive error wherein parallel rays of light focus posterior to the retinal plane.

### **Accommodation in Hypermetropia:**

The ciliary muscle contracts during accommodation, increasing the lens' convexity and thus its refractive power to compensate for hypermetropia. Hypermetropia is categorized into:

- Latent Hypermetropia: Corrected by tonic ciliary tone
- Manifest Hypermetropia: Includes Facultative: Correctable by accommodation and Absolute: Not correctable by accommodation Blurring of near vision, headaches, and asthenopia are common due to excessive accommodative demand.

### **Management:**

Convex lenses are the primary corrective modality, enabling light rays to focus directly on the retina.

- Cycloplegic Refraction reveals the total hypermetropic error.
- Donder's Rule: Correction = Manifest Hypermetropia +  $\frac{1}{3}$  of Latent Hypermetropia
- Contact Lenses are an alternative correction option.

Treatment is unnecessary if visual acuity is normal and there are no symptoms. Otherwise, appropriate correction is advised.

### Presbyopia

Presbyopia is a physiological condition due to age-related decline in accommodative amplitude, not a true refractive error. Patients tend to hold reading material farther away—"short-arm syndrome"—and experience headaches or blurred near vision.

#### **Management Options:**

- Reading Glasses: Optimal comfort with minimal distortion.
- Bifocal Spectacles: Practical and effective for simultaneous distance and near correction.
- Progressive Addition Lenses (PALs): Useful for varied near vision needs, e.g., computer use; however, adaptation time is required.
- Monovision Contact Lenses: Dominant eye corrected for distance, non-dominant for near; however, stereopsis may be compromised.
- Multifocal Contact Lenses: Available in diverse designs to address presbyopic demands.
- Surgical Approaches: Techniques such as scleral expansion have been explored but lack definitive efficacy.

### Accommodative Insufficiency

This condition involves a lower-than-normal amplitude of accommodation for age (as per Hofstetter's formula: Expected minimum amplitude =  $15 - 0.25 \times \text{age}$ ). Symptoms include asthenopia, headache, diplopia, and blurred or unstable near vision.

#### **Management:**

- Evaluate Positive Relative Accommodation (PRA) and Amplitude of Accommodation (AA).
- Near addition lenses are prescribed until AA improves.
- Accommodative training exercises and treatment of systemic contributors are essential.

### Convergence Insufficiency (CI)

CI involves inadequate convergence ability, despite normal ocular alignment in primary gaze. This results in eyestrain, headaches, and diplopia during prolonged near work.

#### **Etiology:**

- Anatomical factors (e.g., large interpupillary distance)
- Co-existing accommodative disorders
- Systemic conditions

A definitive diagnosis requires demonstrating a near point of convergence  $>17$  cm or difficulty achieving  $30^\circ$  of convergence.

#### **Management:**

- Assess Positive and Negative Relative Convergence
- Prescribe Base-Out (BO) prisms to stimulate fusional convergence
- Orthoptic exercises: Pencil push-ups, stereograms
- Base-In (BI) relieving prisms or Fresnel prisms if exercises fail

**Table 1: Comparison of Methods for Treating Presbyopia**

Method	at multiple distances	near field	usable range	amblyopes	anisometropia	accommodation	refractive errors	astigmatism	aberrations	optical quality	cost	indications
Single vision glasses												
Bifocal glasses												
Trifocal glasses												
Monovision contact lenses												
Bifocal contact lenses												Indicated
Monovision contact lenses												Indicated
Monovision contact lenses												Indicated
Refractive intraocular lenses												Indicated
Refractive multifocal intraocular lenses												Indicated
Refractive laser - produced corneal lenses												Indicated
Refractive laser - produced corneal lenses												Indicated
Refractive laser incisions												Indicated
Refractive laser expansion												Indicated

**Pseudo-Accommodative Insufficiency**

Characterized by high AC/A ratio and over-convergence. To maintain single binocular vision, patients relax accommodation, resulting in blurred near vision and phorias.

**Management:**

- Evaluate Relative Accommodation, Convergence, and AC/A Ratio.
- Thorough binocular vision assessment is necessary.
- Treatment may include:
  - Surgical intervention (if indicated)
  - Base-Out prisms in reading glasses

### Computer Vision Syndrome (CVS)

CVS is a prevalent occupational health issue affecting over 60 million individuals worldwide.

**Etiology:**

Unlike print, digital displays use pixel-based images with Gaussian light distribution, making it difficult for the eyes to maintain steady focus. This leads to accommodative lag, asthenopia, and fatigue.

**Symptoms:**

- Blurred or fluctuating vision
- Dryness and irritation
- Headache
- Neck and back pain

**Management:**

- PRIO Diagnostic System: Simulates screen viewing to determine accurate computer prescription.
- Computer-specific eyewear: Often different from standard reading glasses.
- Progressive lenses: Provide optimal visual comfort at varying distances.

**Preventive Measures:**

- Anti-reflective coatings to reduce glare
- Proper illumination and ergonomic workstation setup
- Frequent breaks (20-20-20 rule): Every 20 minutes, look at something 20 feet away for 20 seconds
- Frequent blinking and use of preservative-free artificial tears
- Correct posture and screen height adjustment

### Meares-Irlen Syndrome (MIS)

MIS involves visual perceptual distortions during reading, mitigated by colored overlays or filters. First described by Olive Meares (1980) and Helen Irlen, MIS remains under-researched.

**Symptoms:**

- Print instability (e.g., movement, fading, doubling)
- Visual discomfort, headaches
- Color illusions, rivers of light
- Glare sensitivity

**Management:**

- Individualized colored overlays or tinted lenses prescribed by an orthoptist based on detailed symptom assessment.

## Conclusion

To the layperson, near vision difficulty may seem synonymous with presbyopia or hypermetropia. However, as optometrists, a deeper investigation is warranted. A comprehensive history, clinical assessment, and awareness of systemic and functional contributors are essential.

Management strategies must be customized to the patient's lifestyle, psychological readiness (e.g., reluctance toward bifocals), and ergonomic environment. In CVS, patient education on posture, exercises, and workstation setup is equally vital.

Effective counseling remains the cornerstone of managing near vision difficulties.

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