

Current Developments in Optometry and Vision Science

Edited by

Dipanwita Ghosh
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Swami Vivekananda University

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Without the assistance, commitment, and knowledge of several people and organizations, “Eye and Vision Science: Researches and Innovations” would not have been able to be produced.

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We appreciate your support and contribution, everyone.

Preface

For ages, scientists, researchers, and inventors have been enthralled with the human eye, a miracle of biological engineering. This complex organ and the complicated visual system it is connected to are essential to our ability to see and understand the world around us. As eye and vision science advances, we are at the forefront of groundbreaking discoveries and inventions that have the potential to improve millions of people's lives globally and deepen our understanding of vision.

"Eye and Vision Science: Researches and Innovations" offers a thorough examination of the most recent developments in this ever-evolving area. Leading experts' contributions are collected in this volume, providing a wide range of viewpoints and insights into the basic workings of vision as well as the innovative tools and therapies revolutionizing eye care.

This book's chapters address a wide range of subjects, such as the pathophysiology of ocular illnesses, the molecular and genetic foundations of vision, and the anatomy and physiology of the eye. We examine how the brain interprets visual information, discuss the most recent findings in visual perception research, and offer cutting-edge diagnostic methods that are improving the early identification and management of eye disorders.

The quick development of new technology and treatment strategies is one of the most fascinating features of modern vision science. This book showcases groundbreaking research in fields like artificial intelligence in ophthalmology, gene therapy, and regenerative medicine. In ways that were previously thought of as science fiction, these advancements have the potential to not only restore vision but even prevent visual loss.

Our objective in compiling this book was to produce an educational and motivational resource. We hope that the information and insights on these pages will deepen your understanding and inspire fresh concepts for further study

and innovation, regardless of your level of experience as a researcher, clinician, student, or just someone with a strong interest in eye and vision science.

We are appreciative of the readers who keep supporting and advancing the area of eye and vision science as well as the contributors who have offered their knowledge. By working together, we can envision a time when everyone's gift of sight will be preserved and improved.

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Role of Environmental Factors in Ocular Allergy: A Cross-Sectional Study in Eastern India

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Abstract

Purpose:

Allergic conjunctivitis (AC) is a frequent but often underdiagnosed ocular disorder influenced by various environmental triggers. This study evaluates the relationship between environmental factors—including dust, air pollution, pollen, and air-conditioned environments—and the prevalence, severity, and frequency of ocular allergy.

Methods:

A cross-sectional study was conducted at ASG Eye Hospital, Agarpara (January–May 2024). Data were collected via structured questionnaires from patients presenting with allergic ocular symptoms. Information on demographics, environmental exposure, and allergy severity was analyzed using PQStat software (version 1.8.6). Fisher's exact test was applied, and $p < 0.05$ was considered statistically significant.

Results:

A total of 62 patients (mean age 22.03 ± 12.4 years) were evaluated; 56.45% were female, and 56.45% resided in urban areas. The 21–30-year age group showed the highest prevalence (32.25%). Dust (32.25%) and air pollution (30.65%) were the most common allergens. Itching (100%) and redness

(85.48%) were predominant symptoms. Exposure to air-conditioned environments for >1 hour daily was reported by 67.74% of participants. Dust was significantly associated with mild ($p = 0.001$) and moderate ($p = 0.0282$) allergies, while pollen correlated strongly with severe allergy ($p < 0.00001$). Air-conditioned exposure showed significant association with mild ($p = 0.0169$) and frequent ($p = 0.0265$) allergic episodes.

Conclusion:

Environmental factors such as dust, air pollution, and prolonged exposure to air-conditioned environments significantly influence ocular allergy prevalence and severity. Regular cleaning of air-conditioner filters, minimizing exposure to outdoor pollution, and using protective eyewear can mitigate allergic symptoms. Larger, multicentric studies integrating environmental indices (AQI, humidity, particulate matter) are warranted to develop targeted preventive strategies.

Keywords:

Allergic conjunctivitis, environmental allergens, air pollution, air conditioning, ocular allergy, dust mite, pollen allergy.

1. Introduction

Allergic conjunctivitis (AC) is a prevalent ocular allergic disease encountered frequently by ophthalmologists and anterior segment specialists, affecting up to 40% of the population. Though this condition is common, many individuals do not look for treatment, leading to underdiagnosis and undertreatment¹. The prevalence of AC has risen over the past decade, making it one of the most regularly observed conditions in clinical practice. AC results from various factors, including genetic causes, underlying inflammation, air pollution, atopic diseases, exposure to pollen, and pet dander. It is usually executed by allergen-induced cross-linking of immunoglobulin E attached to receptors on prime conjunctival mast cells, resulting in mast cell degranulation and histamine release, and also for the release of cytokines, lipid mediators and chemokines. The clinical result is conjunctival hyperemia, watering, severe itching, and chemosis^{1, 2}. Severe AC can

often lead to advanced keratoconjunctivitis causing corneal ulcers and can pose a threat to functional vision². While the condition rarely becomes a vision-threatening condition, the allergic symptoms can degrade the quality of life, especially for children and adolescents³.

AC is further categorized as seasonal and perennial, SAC is found to be more common. The difference between the two conditions is mostly the recurrence or chronicity of the symptoms, which is determined by type of the allergens patients are sensitized to⁴. Seasonal symptoms are mostly triggered by allergens like tree or grass pollens. Perennial symptoms are mainly caused by indoor allergens such as house dust mites, pet dander, spores from mould and mildews, rodents or pests like cockroaches. Among the types of allergic conjunctivitis, SAC and PAC are very frequently observed. Though estimations are variable in different countries, these types of allergies are thought to affect almost 15–20% of the population⁵. These two types have almost similar clinical presentation. The difference between them is the type of allergen and also the occurrence. SAC is usually caused by some airborne pollens. Signs and symptoms usually occur/worsen in the spring and summer, and remission is observed during the winter months. PAC can occur throughout the year with exposure to perennial allergens^{5,6}. Whereas VKC is a type of AC which can potentially affect the vision by giving rise to corneal pathologies. This type of AC is comparatively rare and usually occurs in young children especially males during spring or summer⁷. AKC is found among patients with existing atopic dermatitis and is the most severe form of chronic allergic conjunctivitis. It is usually a bilateral inflammatory chronic keratoconjunctivitis and can also involve the eyelids, thus being a blepharokeratoconjunctivitis³. It can also cause scarring with potential adverse ocular sequelae.

Though the condition can be easily treated in most cases recurrence occurs, especially after discontinuation of drugs. This causes major dissatisfaction among the patients. Prolonged usage of anti-histamines and immunosuppression can have major effects and ocular health⁸.

This situation addresses a need to investigate the environmental factors that are associated with the patient's daily life. The current upsurge of AC makes understanding the associated environmental factors a matter of concern. Because the allergic manifestations are rooted in the immune system reactivity of an individual, the environmental factors are the most significant factors for the manifestation of the condition. There are indoor factors as well as outdoor factors which can cause the condition. An approach to non-pharmacological treatment should be made first and topical medications can be administered alongside⁹. Complete avoidance from potential allergens is the best strategy although it is frequently hard to carry out, and is especially important in PAC and SAC and also in VKC or AKC when there is a documented allergy³. The study aims to identify the potent environmental allergens which can contribute to the condition to enhance and extend the clinical management of AC by providing personalized treatment plans for individuals providing evidence-based insights to enlighten practitioners and patients alike.

This study aims to identify environmental allergens contributing to AC, analyze their correlation with disease frequency and severity, and assess the influence of air-conditioned environments in a clinical population in Eastern India.

2. Materials and Methods

2.1 Study Design and Setting

A prospective, cross-sectional prevalence study was conducted at ASG Eye Hospital, Agarpara, West Bengal, between January and May 2024.

2.2 Participants

Patients presenting with clinical symptoms of ocular allergy (itching, redness, tearing, swelling) were included. Exclusion criteria were: presence of skin allergies, contact lens wear, or absence of symptoms for over one month.

2.3 Data Collection

Participants completed a structured questionnaire assessing demographic profile, environmental exposures (dust, pollen,

pet dander, air pollution, air-conditioning), and frequency/severity of symptoms. Severity was graded as mild, moderate, or severe based on symptom impact. All patients underwent slit-lamp evaluation.

2.4 Sample Size

The calculated sample size ($n = 62$) was based on the formula $Z^2 p \cdot (1-p) / d^2$, with $Z = 1.96$, $p = 0.2$, and $d = 0.1$.

2.5 Statistical Analysis

Data were analyzed using PQStat (version 1.8.6). Fisher's exact test assessed associations between environmental factors and allergic severity/frequency. Odds ratios (OR) were calculated; $p < 0.05$ was statistically significant.

3. Results

The average age was 22.03 ± 12.4 (mean $\pm$ SD) in this study. Females were found to be more affected (56.45%) than males (43.55%) in this study [Table 1]. In this study most patients were from urban areas (56.45%), followed by suburban (38.70%) & rural (4.84%) [Table 2]

[Table 1]

Demographic data of the patients

Gender	No. Of patients n=62	Percentage(%)
Male	27	43.54
Female	35	56.45

[Table 2]

Locality

Locality	No. Of patients n=62	Percentage(%)
Urban	35	56.45
Suburban	24	38.70
Rural	3	4.84

In the study, ages between 21 to 30 were the age group with the maximum number of patients with ocular allergy (32.25%), [Table 3] shows the prevalence of age groups.

[Table 3]

Age group

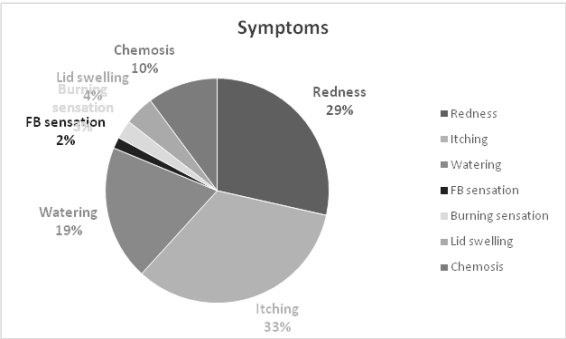
Age group	No. Of patients n=62	Percentage(%)
1-10	16	25.81
11-20	11	17.74
21-30	20	32.25
31-40	8	12.90
41-50	7	11.29

Among known allergic factors dust was the most common (32.25%), followed by air pollution (30.65%), pollen (9.68%) & pet dander (4.84%). For 22.58% of individuals, it was unknown [Table 4 & Figure 1].

[Table 4]

Symptoms reported

Symptoms	No. Of patients n=62	Percentage (%)
Redness	53	85.48
Itching	62	100
Watering	36	58.06
FB sensation	3	4.84
Burning sensation	5	8.06
Lid swelling	8	12.90
Chemosis	19	30.65



[Figure 1]

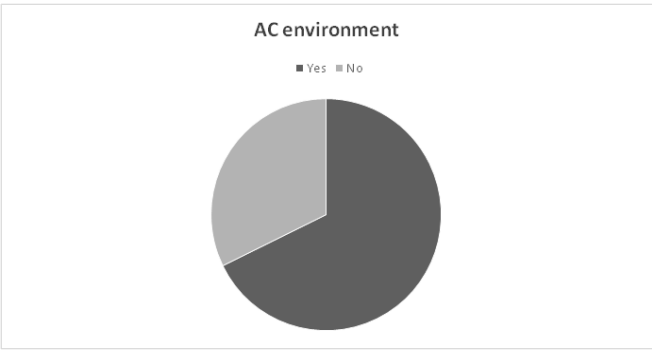
Prevalence of symptoms

Among the 62 patients, 42 were found to stay in an air-conditioned environment for more than 1 hour (67.74%) [Table 5 & Figure 2].

[Table 5]

Air-conditioned environment

Air-conditioned environment	No. Patients n=62
Yes	42
No	20



[Figure 2]

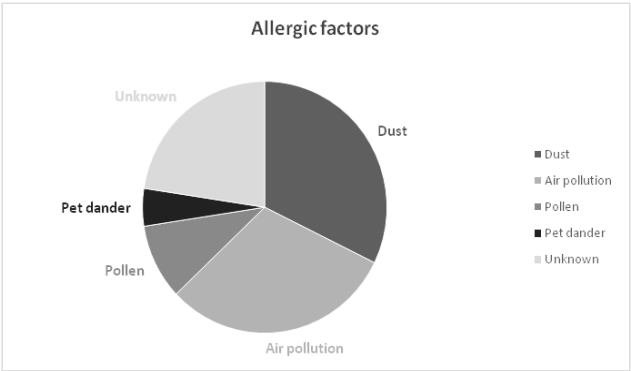
Air-conditioned environment

Itching was found among all the affected patients, redness was the 2nd most presenting symptom (85.48%) followed by watering (58.06%) [Table 6 & Figure 3].

[Table 6]

Known allergic factors

Allergic factors	No. Of patients n=62
Air pollution	19
Dust	20
Pollen	6
Pet dander	3
Unknown	14



[Figure 3]

Known allergic factors

A significant association of mild ($P=0.001$, 95% CI OR 2.15-22.5) and moderate ($P=0.0282$) AC was found with dust [Table 7]. Extremely high significance was observed between pollen and severe allergy ($P<0.00001$, 95% CI OR 6.83-459.74). air-conditioned environment was significant for mild allergy ($P=0.0169$).

[Table 7]
Co-relation between allergic factors and severity

Allergic factors		Severe	Not severe	p-value	Moderate	Not moderate	p-value	Mild	Not mild	p-value
Dust	Yes	1	19	0.6532	7	13	0.0282	12	8	0.001
	No	5	35		28	14		7	35	
Air pollution	Yes	2	17	1	11	8	1	6	13	1
	No	6	37		24	19		13	30	
Pollen	Yes	5	1	<0.00001	1	5	0.0772	0	6	0.1632
	No	3	53		34	22		19	34	
Pet dander	Yes	0	3	1	3	0	0.2473	0	3	0.5435
	No	6	52		32	28		19	34	
AC environment	Yes	7	32	0.2447	24	15	0.1682	8	31	0.0169
	No	1	19		8	12		11	9	

Dust was found to be significant for occasional ocular allergy [Table 8]. For frequent allergy also the p-value was very significant ($p=0.0008$, 95% CI OR 2.16-22). Air-conditioned environment was also proven significant for occasional($p=0.005$) and frequent ocular allergy ($P= 0.0265$, 95% CI OR 1.14-12.96). Air pollution was found to be significant for occasional ocular allergy($p=0.0494$, 95% CI OR 1.1-10.5).

[Table 8]
Co-relation between allergic factors and frequency

Allergic factors		Occasionally	Not occasionally	p-value	Frequently	Not frequently	p-value	Very frequently	Not very frequently	p-value
Dust	Yes	5	15	0.0134	14	6	0.0008	1	19	0.0788
	No	26	16		10	32		10	29	
Air pollution	Yes	13	6	0.0494	5	14	0.1606	1	18	0.4196
	No	15	25		19	21		6	34	

Pollen	Yes	1	5	0.1979	3	3	0.6793	2	4	0.1444
	No	27	26		21	32		5	48	
Pet dander	Yes	3	0	0.2377	0	3	0.2766	0	3	1
	No	28	31		24	35		7	52	
a i r conditioned environment	Yes	13	26	0.0052	20	19	0.0265	6	33	0.4045
	No	15	5		4	16		1	19	

4. Discussion

From the study, it is observed that the age group of 21-30 is the most affected group and females are more affected than males. This finding correlates with a previous study¹⁰. The relationship between female steroid sex hormones and allergies is highlighted in some previous research. Reasons for this might be that estrogen receptors are found in a large number of immunological cells¹¹. It has been suggested that estrogen can influence to modulate the immunological pathway to direct the immunological response towards the allergen directly and can favour an allergic response by promoting Th2 polarization which can lead to class switching of B cells to produce IgE. However, those findings need further study^{12, 13}. Another finding is that the younger age group (21-30) was more affected. Several factors influence in occurrence of allergic diseases like genetics, various medications, internal diseases and Immunosenescence. Immunosenescence is the change in immune function with ageing. Immunosenescence involves the modification and remodelling of tissue structure. Many functions sometimes decline with ageing, while other functions can become more active. A senescent immune system can show impaired interactions between the innate and adaptive immune responses¹⁴. Also the elderly mostly take many kinds of medications, which may also hinder any allergic response.

House dust was found to be the most prevalent allergen in this study (32.25%). Dust mite allergy is an IgE-mediated Type 1 hypersensitivity reaction to dust mite allergens,

commonly found in household dust, so it is also known as house dust allergy. It is sensitization and an allergic reaction to the droppings of the dust mites. The droppings are an indoor aeroallergen, which on inhalation triggers the allergic reaction¹⁵. Dust mite causes PAC which persists throughout the year. In this study, dust was significant for mild to moderate ocular allergies and occasional frequency. Air pollution was found to be the 2nd most prevalent factor, To date, the underlying pathophysiological mechanism of conjunctivitis caused by air pollutants is still unclear. As a human's eyes are directly exposed to air pollution, some studies have speculated that PM_{2.5}^{16, 17} PM₁₀¹⁸ particles may easily cause the inadaptability of intraocular epidermal cells, leading to cell death and the inflammation of tissue cells. Second, NO₂ and O₃ have strong oxidative stress effects¹⁹, which may stimulate conjunctival cell inflammation. Finally, NO₂ is an acidic gas. When it enters the eyes, it easily changes the acidic and alkaline environment of the inner epidermis cells of the eyes^{20, 21}, breaking the function of the eye cells and causing inflammation. Air pollution mostly accounted significant for occasional allergy, indicating the patients faced the symptoms of ocular allergy after going outside. 9.68% of patients were found with pollen allergy, which mostly manifested as seasonal VKC causing severe allergic conjunctivitis, mainly observed among children.

Among the patients, a significant number of patients (67.74%) stayed in an air-conditioned environment for more than 1 hour. Most patients with mild allergic severity were found to stay in an air-conditioned environment and the frequency was found to be significant for mild to moderate symptoms. This may indicate that the individuals get the allergy symptoms at the times when they stay in the air-conditioned environment. The cause behind the air-conditioned environment producing ocular allergy is mainly the filters and humidity. Uncleaned filters without maintenance become a shelter for mould and mildew, the spores released from which can cause allergic conjunctivitis. Dust and pollen can also get stuck in the filters and get distributed when the air conditioner is turned on. In the study, 14 patients were unknown of any possible allergen, but 12 of them were found to stay in an air-conditioned

environment for a long time, which supports the previous statements.

Limitations

Though the study gives meaningful insights into the environmental risk factors of allergic conjunctivitis, there were a few limitations to the study. The sample was relatively small compared to the context of the research. Further studies can work with a bigger sample size to provide a deeper insight. The study was a survey-based study and dependent on the data which were provided by the patients themselves. So there is a chance of error and bias which could not be avoided.

The environmental factors of the patients were not evaluated, such as air quality index, the concentration of various elements in the air, the environment of the patient's residence and working place, the type of air-conditioner used and details about its maintenance; which could provide more details to this study.

Conclusion

From this study, dust and air pollution were found to be the most reported known allergens and responsible for mild to moderate with severity seen occasionally to frequently. This is practical because low AQI can be observed in polluted areas and house dust is ubiquitous. The patients mostly seem to be aware of those allergens but they are yet to give enough significance. On the other hand, an air-conditioned environment was observed mostly among the patients with frequent and occasional symptoms and from the data it can be assumed air-conditioned environment can also be a significant factor in giving rise to ocular allergy as well as prolonging/worsening the symptoms.

Awareness needs to be spread among patients to avoid possible allergens. Tidiness should be maintained in every house to prevent allergy from dust mites, nose, mouth and eyes should be covered during cleaning the house. Individuals living in areas with low AQI should wear masks and eyeglasses/sunglasses while going out. Air conditioners need to be well

maintained by checking and cleaning/replacing the filters regularly. Humidifiers can be used alongside air conditioners to maintain good humidity.

Despite the meaningful insights, there were many limitations faced in the study, future studies with a bigger sample size and detailed analysis of environmental and behavioural factors can provide a deeper and more significant understanding of the relationship between environmental allergens and ocular allergy. By expanding the understanding of these relationships, both clinical practice and public health strategies can be well informed, ultimately reducing the burden of AC on affected individuals and strengthening non-pharmacological management.

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Clinical Profile and Visual Outcomes of Open Globe Ocular Injuries in Geriatric Patients

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Abstract

Background: Open globe ocular injuries in geriatric patients pose significant clinical challenges due to the interplay of age-related physiological changes and pre-existing health conditions. This review aims to provide a comprehensive analysis of the visual outcomes associated with such injuries in the elderly population.

Methods: A systematic review of recent literature was conducted, focusing on studies that report on the visual outcomes of open globe injuries in geriatric patients. Data was extracted regarding patient demographics, injury characteristics, management strategies, and visual outcomes.

Results: The findings indicate that while advancements in surgical techniques, such as improved repair methods and postoperative care, have led to some improvement in visual outcomes, elderly patients often face poorer prognoses compared to younger individuals. Contributing factors include higher rates of comorbidities such as diabetes and hypertension, pre-existing ocular conditions like age-related macular degeneration, and delayed presentation to care. Complications such as secondary infections and poor wound healing further exacerbate the visual outcomes in this demographic.

Discussion: The variability in visual outcomes underscores the need for tailored management strategies that consider the unique physiological and medical complexities of older adults. Early and aggressive intervention, along with a comprehensive multidisciplinary approach involving

ophthalmologists, geriatricians, and rehabilitation specialists, is crucial for optimizing recovery. Additionally, proactive measures to manage and mitigate risk factors are essential in improving overall visual prognosis.

Conclusion: Open globe ocular injuries in geriatric patients present significant challenges that impact visual outcomes. Despite advances in surgical techniques, the need for individualized treatment plans and a holistic approach to patient care remains critical in achieving the best possible visual and functional recovery. Further research is needed to refine treatment protocols and improve outcomes for this vulnerable population.

Keywords: Open globe injuries, geriatric ophthalmology, visual outcomes, ocular trauma and elderly patients.

1. Introduction

1.1 Background

Open globe injuries are severe ocular traumas characterized by a full-thickness laceration or perforation of the eye wall, including the cornea and/or sclera. These injuries are particularly concerning in elderly patients due to age-related changes in ocular anatomy and physiology, reduced healing capacity, and the prevalence of systemic comorbidities. With the global increase in the elderly population, understanding the impact of open globe injuries on this demographic is crucial for improving clinical outcomes and guiding management strategies. The study by Brophy et al. reported that ocular trauma in children accounts for 8%–14% of total injuries and is a major cause of emergency hospitalization in children.[1]

1.2 Objectives

This review seeks to:

- Examine the incidence and epidemiology of open globe injuries in elderly patients.
- Analyze the clinical presentation and diagnostic approaches for these injuries.
- Discuss current management strategies and their efficacy.

- Evaluate visual and functional outcomes post-injury.
- Identify challenges in treatment and propose future research directions.

2. Epidemiology

2.1 Incidence and Prevalence

Ocular injuries (2) are preventable in the majority of cases. Open globe injuries are less common in the elderly compared to younger individuals. However, when they do occur, they often result in more severe outcomes and a higher rate of complications. The incidence of open globe injuries in elderly patients is influenced by several factors:

Increased Fall Risk: Age-related declines in balance and mobility contribute to a higher risk of falls, which are a common cause of open globe injuries.

Decreased Visual and Cognitive Function: Reduced visual acuity and cognitive decline can impair the elderly's ability to avoid or respond to hazards.

Frailty: General frailty and weakened physical state can exacerbate the severity of injuries and complicate recovery.

2.2 Risk Factors

Several risk factors contribute to the prevalence and severity of open globe injuries in elderly patients:

Falls and Accidents: Elderly individuals are at a heightened risk of falls, which often result in traumatic eye injuries. Factors such as poor vision, reduced proprioception, and environmental hazards play significant roles.(3,4).

Visual and Cognitive Impairments: Diminished vision and cognitive decline increase the risk of accidents and injuries. Conditions such as macular degeneration, cataracts, and cognitive disorders like dementia can impair hazard perception and reaction (5).

Comorbidities: Chronic conditions such as diabetes, hypertension, and osteoporosis can exacerbate the severity of ocular injuries and complicate their management. Diabetes, for

instance, can affect wound healing and increase susceptibility to infections.

Medications: Certain medications that cause dizziness, sedation, or impaired motor function can increase the risk of falls and subsequent ocular injuries.

3. Clinical Presentation

3.1 Symptoms

The clinical presentation of open globe injuries in elderly patients may vary and is often influenced by pre-existing visual impairments. Common symptoms include:

Severe Ocular Pain: Intense pain is a common presentation of open globe injuries, reflecting the severity of the trauma.

Decreased Vision: Visual acuity loss can range from minor to profound, depending on the extent of the injury and damage to intraocular structures.

Hemorrhage: Blood may be present in the anterior chamber (hyphema), vitreous cavity (vitreous hemorrhage), or the retina (retinal hemorrhage), indicating significant trauma.

Foreign Body Sensation: Patients may report the sensation of a foreign object in the eye, which could be due to retained debris or intraocular damage.

Ocular Deformity: Visible changes in the eye's shape or bulging may indicate severe injury and require immediate attention.

Penetrating or perforating trauma can occur following an assault, domestic accidents and sports. Globe rupture is a full-thickness wound of the eye as a result of contusion or of penetrating trauma on the orbit(6).

3.2 Diagnosis

Diagnosing open globe injuries involves a combination of clinical examination and imaging studies:

Comprehensive Ocular Examination: This includes assessing the extent of the injury, visual acuity, and intraocular pressure. A slit-lamp examination helps identify the nature and location of the injury.

Imaging Studies: CT or MRI scans are crucial for evaluating the full extent of the injury. CT scans are particularly useful for detecting intraocular foreign bodies and assessing the extent of globe rupture.

Assessment of Intraocular Pressure: Elevated intraocular pressure can indicate secondary complications such as glaucoma or retained foreign bodies.

4. Management

4.1 Initial Management

Immediate management of open globe injuries focuses on stabilization and minimizing further damage:

Stabilization of the Patient: Ensure that the patient is hemodynamically stable and address any systemic issues that may impact surgical outcomes.

Protection of the Eye: Cover the injured eye with a protective shield and avoid any manipulation. The use of a rigid eye shield can prevent further injury.

Antibiotic Therapy: Broad-spectrum antibiotics are administered to prevent infection, a significant risk in open globe injuries.

Tetanus Prophylaxis: Depending on the nature of the injury and vaccination history, tetanus prophylaxis may be necessary.

Burns to the eye are most often as a result of being in contact with strong acids or alkalis which are amongst the most urgent of ophthalmic emergencies.

4.2 Surgical Techniques

Surgical management aims to repair the globe and restore ocular function:

Primary Globe Repair: This involves closing the laceration or perforation with sutures. The technique depends on the location and severity of the injury.

Vitrectomy: In cases where there is extensive vitreous damage or hemorrhage, vitrectomy may be performed to remove damaged vitreous and improve visual outcomes.

Repair of Associated Structures: Additional procedures may be required to address damage to other ocular structures, such as the cornea, lens, or retina.

4.3 Postoperative Care

Postoperative care is crucial for recovery and involves (7,8):

Infection Control: Ongoing antibiotic therapy and monitoring for signs of infection are essential to prevent complications such as endophthalmitis.

Monitoring for Complications: Regular follow-up appointments to check for complications such as retinal detachment, glaucoma, or delayed wound healing.

Pain Management: Adequate analgesia is provided to manage postoperative discomfort and improve patient compliance.

Visual Rehabilitation: Rehabilitation may include the use of low vision aids and therapy to help the patient adjust to changes in vision and optimize functional outcomes.

For blunt traumas, the prognosis is dependent on the original injury rather than the complications as a result of hyphaema formation.

5. Visual Outcomes (9)

5.1 Short-Term Outcomes

Short-term visual outcomes are influenced by several factors:

Severity of the Injury: The extent of ocular damage directly affects the immediate visual prognosis. More severe injuries typically result in poorer visual outcomes.

Timeliness of Surgical Intervention: Early and effective surgical repair can significantly improve short-term visual outcomes.

Associated Injuries: The presence of additional ocular or orbital injuries can impact visual recovery.

5.2 Long-Term Outcomes

Long-term visual outcomes are determined by:

Success of Initial Repair: Effective repair of the globe and associated structures is critical for achieving favorable long-term visual results.

Postoperative Complications:

Complications such as retinal detachment, glaucoma, or chronic inflammation can affect long-term vision.

Pre-Existing Ocular Conditions: The impact of pre-existing conditions, such as age-related macular degeneration, on long-term visual function must be considered.

5.3 Functional Outcomes

Functional outcomes assess:

Visual Acuity Improvement: The degree of improvement in visual acuity following treatment is a key indicator of success.

Restoration of Functional Vision: Ability to perform daily activities and tasks, which is essential for the patient's quality of life.

Impact on Quality of Life: Overall impact on the patient's quality of life, including psychological and social aspects, is considered in evaluating the success of treatment.

6. Challenges in Management

6.1 Age-Related Factors

Managing open globe injuries in elderly patients presents specific challenges:

Reduced Tissue Repair Capacity: Aging tissues have a reduced capacity for repair and regeneration, which can affect recovery.

Increased Risk of Systemic Complications: Elderly patients are more susceptible to systemic complications that can impact healing and recovery.

Difficulty in Postoperative Rehabilitation: Older patients may face challenges in adhering to postoperative care and rehabilitation protocols, impacting overall recovery.

6.2 Comorbidities

Comorbid conditions, such as diabetes and hypertension, can complicate the management of open globe injuries:

Diabetes: Can affect wound healing and increase the risk of infection and delayed recovery.

Hypertension: May exacerbate bleeding and increase the risk of secondary complications, such as retinal detachment.

7. Future Directions

7.1 Research Needs

Future research should focus on:

Age-Specific Management Protocols: Developing tailored management strategies that address the unique needs of elderly patients with open globe injuries.

Enhanced Surgical Techniques: Exploring innovations in surgical approaches to improve outcomes in older adults.

Long-Term Outcome Studies: Conducting studies to evaluate long-term visual and functional outcomes in elderly patients, focusing on quality of life and rehabilitation.

7.2 Technological Advancements

Advancements in technology and surgical techniques offer potential improvements in managing open globe injuries:

Imaging Technologies: Innovations in imaging techniques can provide better assessment of injury severity and guide surgical planning.

7.2 Technological Advancements

Surgical Tools: Development of advanced surgical tools and techniques can enhance precision in repair procedures. For example, the use of microsurgical instruments and techniques such as endoscopic vitrectomy may improve outcomes by allowing more precise management of intraocular injuries and minimizing further trauma.

Rehabilitation Technologies: Advances in low vision aids and rehabilitation technologies can support elderly patients in

maximizing their functional vision. Tools such as electronic magnifiers, adaptive lighting systems, and computer-assisted devices can help improve the quality of life for individuals with significant visual impairment.

8. Conclusion

The eye is a high risk organ for ocular injuries resulting in visual impairment or blindness. Open globe ocular injuries in geriatric patients present unique challenges due to the interplay of age-related physiological changes, comorbid conditions, and the increased risk of complications. Effective management requires a comprehensive approach that encompasses prompt diagnosis, individualized surgical intervention, and meticulous postoperative care.

Advancements in surgical techniques and technologies have enhanced our ability to manage these severe injuries and improve outcomes. However, there remains a need for ongoing research to develop age-specific management protocols and evaluate long-term functional outcomes. A multidisciplinary approach involving ophthalmologists, geriatricians, and rehabilitation specialists is crucial for optimizing patient care and ensuring the best possible recovery.

As the global population continues to age, understanding the specific needs and challenges of elderly patients with open globe injuries will be increasingly important. By addressing these challenges and incorporating technological innovations, we can improve both the visual and functional outcomes for this vulnerable population. Prevention of eye injuries cannot be over emphasized and this is a totally a responsibility of ophthalmologists, optometrists, pediatricians, parents,

Teachers and coaches.

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Developing new methods to improve the diagnosis and treatment of glaucoma.

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I. Introduction

Glaucoma is a group of eye conditions that damage the optic nerve, typically due to an increase in intraocular pressure. This can lead to vision loss and even blindness if left untreated. It is often called the “silent thief of sight” because symptoms may not be noticeable until the disease has progressed significantly. Early detection and treatment are crucial in managing glaucoma and preserving vision. Regular eye exams are essential in detecting glaucoma early, as it can often be asymptomatic in the early stages. The most common type of glaucoma, open-angle glaucoma, progresses slowly and can be managed effectively with medication, laser treatment, or surgery. However, if left untreated, the damage to the optic nerve can be irreversible. It is important for individuals at higher risk, such as those with a family history of glaucoma or certain medical conditions, to be proactive in monitoring their eye health and seeking regular check-ups with an eye care professional (1-4).

By catching glaucoma early, individuals can prevent further vision loss and preserve their quality of life. Regular eye exams are crucial in monitoring the progression of the disease and adjusting treatment plans as needed. With advancements in technology and treatment options, there is hope for those with glaucoma to maintain their vision and lead fulfilling lives. It is never too early to prioritize eye health and take proactive steps towards early detection and management of glaucoma. Scheduling regular appointments with an eye care professional is essential for those at risk for glaucoma, such as individuals over the age of 60, those with a family history

of the disease, or individuals with certain medical conditions like diabetes (5). These appointments can help catch any signs of glaucoma early on and allow for prompt treatment. By staying proactive and informed about the disease, individuals can take control of their eye health and potentially prevent vision loss. Remember, early detection is key in managing glaucoma and preserving vision for years to come. (6-8).

Current limitations in diagnosing and treating glaucoma include the fact that many people may not experience any symptoms in the early stages of the disease, making it difficult to detect without regular eye exams. Additionally, some treatment options for glaucoma, such as eye drops or surgery, may have side effects or risks that need to be carefully monitored by a healthcare professional (9-11). As research continues to advance in the field of ophthalmology, new technologies and therapies may become available to improve the diagnosis and management of glaucoma in the future. It is important for individuals at risk to stay informed about the latest developments in glaucoma treatment and to work closely with their healthcare provider to ensure the best possible outcomes for their eye health. By staying proactive and informed, individuals can take steps to protect their vision and overall eye health. Regular communication with a healthcare provider can help individuals stay ahead of any potential complications or changes in their condition (12-15). By staying informed about new advancements in treatment options, individuals can work with their healthcare provider to determine the best course of action for managing their glaucoma effectively. Together, patients and healthcare providers can work towards preserving vision and maintaining optimal eye health for the long term.

II. Diagnostic methods

Traditional methods (tonometry, visual field testing), as well as newer technologies such as optical coherence tomography (OCT) and retinal nerve fibre layer analysis, can provide valuable information for monitoring and managing glaucoma. These diagnostic tools help healthcare providers track progression of the disease and make informed decisions about treatment plans. By utilizing a combination

of traditional and advanced diagnostic methods, patients can receive personalized care that addresses their specific needs and helps them maintain good eye health. Regular screenings and check-ups are essential for catching any changes early and preventing further vision loss. Additionally, regular monitoring with OCT and retinal nerve fibre layer analysis can help detect subtle changes in the eye that may not be noticeable to the patient. This early detection allows for prompt intervention and adjustments to treatment plans, ultimately improving outcomes for individuals with glaucoma. By staying proactive with their eye health, patients can work closely with their healthcare providers to preserve their vision and overall quality of life (16-18). It is crucial for individuals with glaucoma to prioritize regular eye exams and follow-up appointments to ensure optimal management of their condition.

Advantages and limitations of current diagnostic tools

While current diagnostic tools have made great strides in detecting subtle changes in the eye that can indicate glaucoma progression, there are still limitations to be aware of. Some tools may not be able to detect early stage glaucoma or may produce false positives, leading to unnecessary worry and testing. Additionally, access to certain diagnostic tools may be limited in some areas, making it difficult for all individuals with glaucoma to receive the necessary monitoring and care. Despite these limitations, advancements in technology continue to improve the accuracy and accessibility of diagnostic tools for glaucoma, providing hope for better outcomes for patients in the future (19-21). Overall, while there are still challenges in detecting and monitoring glaucoma progression, the advancements in technology are promising for the future of glaucoma care. With continued research and development, it is likely that more accurate and accessible diagnostic tools will be available to patients worldwide. Through increased awareness and access to these tools, individuals with glaucoma will have a better chance at early detection and successful management of their condition. The ongoing improvements in diagnostic technology bring hope for improved outcomes and quality of life for patients with glaucoma in the years to come (22-24).

Emerging technologies (optical coherence tomography, genetic testing), as well as advancements in artificial intelligence, are revolutionizing the way glaucoma is diagnosed and treated. These technologies have the potential to not only detect the disease earlier, but also personalize treatment plans based on individual genetic factors. As a result, patients may experience better outcomes and a higher quality of life, ultimately leading to a brighter future for those living with glaucoma (25).

With these advancements, researchers and healthcare professionals are optimistic about the possibility of finding a cure for glaucoma in the near future. By utilising cutting-edge technology and personalised treatment strategies, the medical community is working towards ensuring that individuals with glaucoma can lead full and healthy lives. As more progress is made in this field, there is a growing sense of hope that one day, glaucoma may no longer be a leading cause of blindness worldwide (26-28).

III. Treatment options

Medication (eye drops, oral medications), laser therapy, and surgical procedures are currently available to help manage glaucoma and prevent further vision loss. These treatments aim to reduce intraocular pressure, which is a major risk factor for the progression of the disease. By closely monitoring patients and adjusting treatment plans as needed, healthcare providers can help individuals with glaucoma maintain their vision and quality of life (29). With ongoing research and advancements in treatment options, there is great potential for improving outcomes and ultimately finding a cure for this sight-threatening condition. Patients with glaucoma should work closely with their healthcare providers to determine the best treatment plan for their specific needs. Regular eye exams and monitoring of intraocular pressure are essential for managing the disease effectively. By staying informed about the latest treatment options and participating in clinical trials, individuals with glaucoma can be actively involved in their care and contribute to advancements in the field. With early detection and proactive management, the prognosis for individuals with glaucoma is improving, offering hope for a

future where vision loss from this condition can be prevented (30-35).

Surgical interventions (laser therapy, trabeculectomy), and medication management are also important components of treating glaucoma. These interventions can help to lower intraocular pressure and slow the progression of the disease. It is crucial for individuals with glaucoma to work closely with their eye care provider to determine the most appropriate treatment plan for their specific situation. By following their provider's recommendations and staying diligent with their eye care routine, individuals with glaucoma can help preserve their vision and maintain a good quality of life (36-38).

Regular follow-up appointments with their eye care provider are essential to monitor the effectiveness of treatment and make any necessary adjustments. In some cases, additional procedures or changes in medication may be required to manage the condition effectively. It is important for individuals with glaucoma to be proactive in their care and communicate any changes or concerns to their provider promptly. With proper management and ongoing support, individuals with glaucoma can continue to lead fulfilling and independent lives (39-41).

Potential future treatments (gene therapy, stem cell therapy) hold promise for further improving the outcomes for individuals with glaucoma. Research in these areas is ongoing, and advancements in technology and medical knowledge may provide even more effective options for managing the condition in the future (42,43). By staying informed about new developments and discussing these possibilities with their eye care provider, individuals with glaucoma can be proactive in exploring potential future treatments that may offer additional benefits for their eye health. By taking a proactive approach and staying informed, individuals with glaucoma can continue to receive the best possible care and support for their condition (44-46).

This proactive approach may also involve making lifestyle changes, such as maintaining a healthy diet, exercising regularly, and managing stress levels, which can help

to support overall eye health and potentially slow the progression of glaucoma (47, 48). Additionally, regular eye exams and monitoring of intraocular pressure are essential for early detection and treatment of any changes in the condition. By working closely with their eye care provider and following recommended treatment plans, individuals with glaucoma can better manage their condition and preserve their vision for the long term. It is important for individuals with glaucoma to be proactive and engaged in their eye care in order to achieve the best possible outcomes and maintain their quality of life (49, 50).

IV. Challenges in glaucoma management include the need for consistent medication adherence, as well as the potential for side effects from certain treatments. In some cases, surgical intervention may be necessary to control intraocular pressure and prevent further vision loss. Managing glaucoma can also be complicated by other underlying health conditions, such as diabetes or high blood pressure, which may impact the effectiveness of treatment (51, 52). Despite these challenges, with proper management and regular monitoring, individuals with glaucoma can continue to lead fulfilling and independent lives.

Compliance issues with medication can be addressed through education and support from healthcare providers. It is important for patients to understand the importance of taking their medication as prescribed to prevent progression of the disease. Regular follow-up appointments with an ophthalmologist are crucial to monitor the effectiveness of treatment and make adjustments as needed. By working closely with their healthcare team and staying proactive in their care, individuals with glaucoma can maintain their vision and overall quality of life (53).

Surgical complications and risks should also be discussed with patients considering surgical treatment for glaucoma. It is essential for patients to be fully informed about the potential risks and benefits of any surgical procedure before making a decision. Close communication with their healthcare team throughout the surgical process can help mitigate any complications and ensure a successful outcome. Patients

should feel empowered to ask questions and seek clarification on any concerns they may have about their treatment plan. With proper education and support, individuals with glaucoma can make informed decisions about their care and work towards preserving their vision for the long term (54).

Access to specialized care in underserved populations is crucial in ensuring that all individuals, regardless of their background or location, have the opportunity to receive the necessary treatment for glaucoma (55). By increasing access to specialized care in underserved populations, we can help improve outcomes and reduce the risk of vision loss in those who may not have had the resources or support to seek treatment otherwise. It is essential that healthcare systems prioritize equity and accessibility in order to effectively address the needs of all patients, especially those with chronic conditions like glaucoma (56-58).

V. Future directions

Personalized medicine approaches may also play a significant role in improving the treatment of glaucoma. By tailoring treatments to each individual's unique genetic makeup and medical history, healthcare providers can optimize outcomes and minimize side effects. Additionally, advancements in telemedicine technology could further expand access to care for those in remote or underserved areas. Collaborating with community organizations and implementing outreach programs can also help raise awareness about glaucoma and encourage early detection and treatment (59-61). Ultimately, by continuing to prioritize equity and accessibility in healthcare, we can work towards ensuring that all individuals have the opportunity to receive the care they need to preserve their vision and overall health. By working together to address barriers to care and increase education about glaucoma, we can make significant strides in preventing vision loss and improving quality of life for individuals at risk. Through a combination of technological innovation, community engagement, and proactive outreach efforts, we can bridge gaps in healthcare access and empower individuals to take control of their eye health. With a collective commitment to equity and accessibility, we can create a world where

everyone has the chance to maintain their vision and live their best life (62-65).

Integration of technology in monitoring and management of glaucoma can revolutionize the way we detect and treat the condition, making it easier for individuals to track their eye health and adhere to treatment plans. By leveraging telemedicine and digital tools, we can provide remote monitoring and personalized care to patients, especially those in underserved communities. This proactive approach not only improves patient outcomes but also reduces the burden on healthcare systems, ultimately leading to better overall eye health for everyone (66-68).

Collaboration between researchers, clinicians, and industry leaders is essential to further develop and refine these technological advancements. By working together, they can ensure that these tools are user-friendly, effective, and accessible to all individuals who need them. Additionally, ongoing research and innovation in this field will help to continuously improve the quality of care provided to patients with glaucoma, ultimately leading to better vision outcomes and quality of life for those affected by the condition. Together, we can make significant strides in the fight against glaucoma and help to preserve vision for millions of people worldwide. (68-70).

Conclusion

In conclusion, collaboration between researchers, developers, and healthcare professionals is crucial in advancing the treatment and management of glaucoma. By continuing to innovate and refine technological tools, we can make a real difference in the lives of those affected by the condition. Through ongoing research and dedication to improving patient care, we can work towards a future where vision loss from glaucoma is minimized, and individuals can enjoy a better quality of life. Together, we have the power to make a significant impact in the fight against glaucoma and preserve vision for millions around the world.

-Collaboration between researchers, developers, and healthcare professionals is essential for advancing glaucoma

treatment. By continually improving technological tools and dedicating ourselves to patient care, we can work towards minimizing vision loss and improving quality of life for those with glaucoma. Together, we have the power to make a significant impact in the fight against this condition and preserve vision for millions worldwide.

Ongoing research plays a crucial role in improving glaucoma diagnosis and treatment. By staying up-to-date on the latest advancements in the field, healthcare professionals can provide patients with more accurate diagnoses and personalized treatment plans. Research also helps to identify new therapies and interventions that can slow the progression of the disease and ultimately preserve vision. With a commitment to ongoing research, we can continue to make strides in the fight against glaucoma and improve outcomes for patients worldwide.

Potential impact on patient outcomes and quality of life

By understanding the latest research findings, healthcare professionals can tailor their approach to each individual patient, leading to better outcomes and improved quality of life. Through ongoing research, new technologies and treatment options can be developed to address the specific needs of patients with glaucoma. This dedication to advancing knowledge and treatment options will ultimately lead to better management of the disease and a higher standard of care for those affected by glaucoma.

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Cognizance & Awareness About The Profession Of Optometry Among The Rural & Urban Populations In Northern India.

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Abstract

Purpose: The major objectives of this study were to determine the level of awareness of optometry among Northern Indians in both rural and urban locations, as well as to measure the amount of awareness.

Methods: Between the rural and urban populations, cross-sectional descriptive research was done. The overall number of participants in this study was 272, including 153 men and 119 women. Data from the participants were gathered through a survey camp using an expanded selfstructured questionnaire.

Result: Out of 272 participants (148 from rural areas and 124 from cities), only 22.3% and 46.6% of the rural and urban participants, respectively, knew what optometry was, while the remaining 77.7% and 37.2% were unaware. Among contrast, participants' perceptions that an optometrist is an assistant to an ophthalmologist were 3.4% and 4.1% among rural and urban participants, respectively. Only 8.1% and 2.7% of participants recognised the distinction between the two professions. However, only 6.1% of participants in rural areas and 6.8% of participants in urban areas believe that optometrists are trained in the diagnosis and recognition of eye problems, and only 14.9% and 14.2% of participants in rural areas and urban participants, respectively, believe that they can independently prescribe eyeglasses and contact lenses. Using the Chi square and NPar tests in SPSS version 27, it was discovered that all variables were statistically

significant ($p < 0.05$) for all of them.

Conclusion: These results appear to point to a lack of understanding and familiarity with the field of optometry. There is a need to intensify the campaign in these regions through educational programs, awareness-raising events, posters outlining eye care, social media discussing the obligations and behaviours of eye care providers, and public displays showcasing the optometry profession.

Keywords: Optometry, Eye-care services, Primary eye-care, Optometrist.

1. Introduction

1.1 Optometry Definition According To AHD:

The American Heritage Dictionary defines an optometrist as a professionally trained person and the licensed person who examines visual abnormalities diagnoses problems or disabilities and recommends correction lenses or other treatments. (Midya et al., 2022; Mifflin, 2000)

1.2 According to WCO Definition of Optometry:

According to the World Council for Optometry (WCO), ophthalmologists are “the primary providers of eye and vision care, effective treatment of the most common causes of visual impairment (refractive errors), and cooperation in diagnosis, referral, and management can reduce the burden of other causes of vision impairment. (Midya et al., 2022)

1.3 Work Done by Optometry and Patients Care:

The primary eye doctor is an optometrist, and they offer full eye care, including refraction, prescriptions, detection, diagnosis, and management of eye illnesses, as well as rehabilitation of the visual system. (Kimbonguila et al., 2019)

The provision of comprehensive eye care services involves a diverse group of dedicated professionals working collaboratively to offer preventive, curative, and rehabilitative measures. Within this framework, clinical ophthalmic treatment is provided by both ophthalmologists and optometrists, each contributing their specialized expertise.

(Dandona & Dandona, 2001; Resnikoff et al., 2008)

Ophthalmologists, as medical doctors specializing in ophthalmology, undergo extensive training in the diagnosis, treatment, and management of various eye diseases and disorders. This comprehensive training includes medical school education and specialized residency programs. Equipped with advanced knowledge and skills, ophthalmologists are capable of performing intricate eye surgeries, prescribing medications, and providing medical interventions to address a wide range of ocular conditions.

On the other hand, optometrists are healthcare professionals who specialize in primary eye care. They receive specialized education through a four-year doctoral program in optometry.

Optometrists are trained to conduct thorough eye examinations, identify visual abnormalities, diagnose eye diseases, and prescribe corrective lenses. Their expertise lies in providing primary eye care services, such as prescribing and fitting glasses and contact lenses, as well as managing common eye conditions.

Despite their differing areas of specialization, ophthalmologists and optometrists often work collaboratively to deliver comprehensive clinical ophthalmic treatment. Ophthalmologists may refer patients to optometrists for routine eye examinations, vision screenings, and the prescription of corrective lenses. Optometrists, in turn, may refer patients to ophthalmologists for specialized medical or surgical interventions when required.

This collaborative approach ensures that patients receive a continuum of care, with ophthalmologists focusing on complex and specialized treatments while optometrists deliver primary eye care services. By working together, these professionals contribute to the overall wellbeing of patients, addressing their unique eye care needs and striving for optimal treatment outcomes.

It is essential to acknowledge that the specific roles and responsibilities of eye care professionals can vary across different regions and healthcare systems due to local

regulations, training programs, and available resources. Nonetheless, their combined efforts exemplify a coordinated approach to delivering high-quality clinical ophthalmic treatment within a broader eye care team.(Arvind et al., 2021)

There are several challenges to eye health, including the growth in avoidable blindness and visual impairment caused by underqualified healthcare workers, an unfair allocation of resources, and the inability to pay for treatment. To accomplish the objectives of the global action plan, it is essential to develop the requisite human resources, particularly optometrists, as well as sustainable service delivery methods. (Fatima & Ahmad, 2018) Diagnostic, technical, direct patient care and support services are all provided by an optometrist to address these issues. In both affluent and developing countries, ophthalmologists work in multidisciplinary teams that deliver primary care. (Fatima & Ahmad, 2018)

Optometrists play a vital role in the early detection and management of various eye disorders, including cataracts and glaucoma. However, their contributions extend beyond ocular health as they serve as the frontline defense in identifying systemic diseases that can manifest with ocular symptoms. Notably, conditions like diabetes and hypertension can have significant implications for both vision and overall health. (Ashraf & Mobeen, 2016; Ms Lakshmi Shinde, 2022; Smith, 2002)

Through comprehensive eye examinations, optometrists possess the expertise to recognize signs and symptoms that may indicate underlying systemic conditions. They are adept at identifying ocular manifestations of systemic diseases, such as changes in retinal blood vessels indicating hypertension or the presence of diabetic retinopathy in patients with diabetes. By detecting these ocular indications, optometrists can promptly refer patients to other healthcare professionals for further evaluation, diagnosis, and appropriate management of these systemic diseases.(Ashraf & Mobeen, 2016)

Optometrists' involvement in the detection and management of systemic diseases underscores their indispensable role within the healthcare system. Their ability to identify these

conditions during routine eye examinations enables early intervention, leading to timely treatment and improved patient outcomes.(Ashraf & Mobeen, 2016)

Moreover, optometrists are not limited to clinical practice alone. They actively engage in research activities to advance the field of optometry, enhance diagnostic and treatment approaches, and contribute to the development of innovative technologies and therapies. Furthermore, many optometrists actively participate in educational endeavors, imparting their knowledge and expertise to educate and mentor aspiring professionals, thereby shaping the future of the field.(Ashraf & Mobeen, 2016)

It is crucial to acknowledge that the scope of practice for optometrists may differ across countries and jurisdictions. Consequently, the specific responsibilities and duties of optometrists may vary based on regional regulations, level of training, and licensure. Nonetheless, their fundamental role in early detection of eye disorders, recognition of systemic diseases, and their contributions to research and education remain integral aspects of their profession. (Ashraf & Mobeen, 2016)

Important characteristics of optometry eye care services. (*Eye Care Services*, 2022; Salal Khan¹, Kamal Pant², 2020) The optometry profession encompasses a wide range of management, practice, managerial, service delivery, and public health tasks. These programs are unique to each country and are based on the legal, social, and educational frameworks that are in place there. (Thite et al., 2015) For the benefit of the general public, WCO worked to foster the creation of a worldwide standard for optometric treatment that is standardized. (Boniface ikenna eze¹ , Obiekwe Okoye¹, 2016) Optometry's primary focus is refractive error management since worldwide, uncorrected refractive error is the second leading cause of blindness and the primary factor in visual impairment.(Holden et al., 2008; Yorston, 1999) It has been shown that key factors affecting how well people use the eye care services that are available include their awareness and understanding of such services, their level of training, their professional duties and obligations, and many

more.(JJ Wang Mmed, P Mitchell Fraco, 1999) According to earlier studies, nothing is known about the similarities between ophthalmologists and optometrists.(Foster, 2005; M. Roy Wilson, 1994; Ryan Guffey MD 1, Nadia Juzych ScD 2, Mark Juzych MD, 2009) As far as we are aware, there isn't any recent research or information available regarding how well-informed Indians are about the distinctions between ophthalmologists and optometrists.(OSUCHUKWU, 2006). The major objectives of this study were to determine the level of awareness of optometry among

Northern Indians in both rural and urban locations, as well as to measure the amount of awareness.

The information gained from this study will provide key decision-makers and educators with a basic picture of the care and support of future participants in underserved communities, help them develop awareness campaigns for rural and urban populations, and help them develop knowledgeable human resources that will enable them to provide eye health services more effectively in the field. This study's primary goals were to ascertain how well-known optometry is among Northern Indians in both rural and urban areas and to raise awareness of it.

Methodology

This research involved both rural and urban residents of Northern India and was cross-sectional survey based. All professions included in the study – worker, businessperson, tailor, housewife, barber, serviceman, student, nurse, fisher, teacher, salesman – were included because they consented to take part. Delhi, in northern India, was the site of the research. The current study was carried out from July 2022 to May 2023.

Utilizing an approved questionnaire that has previously been used in a study of a similar nature in West Bengal, the responses for this study were gathered utilising clustered sample procedures. People (from both the rural and urban groups) that are who wished to participate were then provided access to the survey online or offline in the northern region of India through an optometrist awareness campaign once it had been updated to meet the study's objectives.

Twelve of the questions were closed-ended and assessed respondents' knowledge of the optometry field as well as their demographic background.

Inclusion Criteria:

Only Northern Indian groups who accepted to engage in this study were included in the current study. These populations were only rural and urban populations, between the ages of 18 and 70, both genders and others. Exclusion Criteria:

The population that was less than 18 years old or older than 70 years old, as well as those who did not consent to participate in the survey, were excluded from the current study. Other regions other than Northern India were also not included.

3.7 Statistical Analysis:

The statistical programme for social sciences (SPSS) latest version 27 was used to collect and analyse the data. Descriptive statistics were used to analyse values such as frequencies, means, standard deviations, and percentages of the data collected. The chi-square test and the NPar test are commonly employed statistical methods to examine the association between relevant variables. These tests are utilized when dealing with categorical data, where variables are divided into distinct categories or groups. They aid researchers in assessing whether there is a significant relationship between these variables.

The chi-square test is employed to determine if a statistically significant association exists between two categorical variables. It compares the observed frequencies in a contingency table to the expected frequencies under the assumption of independence between the variables. By calculating the chi-square statistic and degrees of freedom, it quantifies the level of discrepancy between observed and expected frequencies. If the resulting p-value is below a predetermined significance level (e.g., 0.05), it suggests a significant association between the variables.

On the other hand, the NPar test, or non-parametric test, is specifically designed to analyse the association between categorical variables when the assumptions of the chi-square

test are violated. It is used when the data do not meet the criteria for a chi-square test, such as when the sample size is small or when the expected frequencies in some cells are too low. The NPar test is a versatile alternative that does not require any assumptions about the distribution of the data. It provides a robust analysis by comparing the distributions of the variables across the groups using appropriate non-parametric methods.

In conclusion, the chi-square test and the NPar test are widely employed statistical techniques for assessing the association between relevant categorical variables. These tests play a crucial role in data analysis, allowing researchers to draw meaningful conclusions about the relationships between variables while considering the specific characteristics and assumptions of the data at hand.

Result

4.1 Demographic Data

Out of 272 participants, the study revealed that 83 (56%) of the men and 65 (43.9%) of the women lived in rural regions, while male percentages in urban areas were 70 (47.3%) and 54 (36.5%), respectively. This study has no hypothesis and uses non-parametric approaches. In the table below, 1 was allocated to each gender in both groups.

Table 1 Gender distribution rural and urban participants

Rural			Urban	
Gender	Frequency	Percent (%)	Frequency	Percent (%)
Male	83	56.1	70	47.3
Female	65	43.9	54	36.5

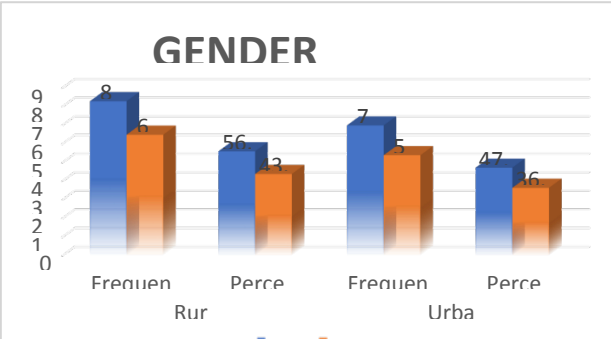


Figure 1 Gender distribution (rural & urban area)

The analysis showed that out of 272 subjects, (148 rural and 124 urban subjects) in the rural population 70 (47.3%) were literate & 78 (52.7%) were illiterate, and Urban population 110 (74.3%) were literate & 14 (9.5%) illiterate shown as Table 2

Table 2 literacy in both populations

Rural			Urban	
	Frequency	Percent (%)	Frequency	Percent (%)
LITERATE	70	47.3	110	74.3
ILLETERATE	78	52.7	14	9.5

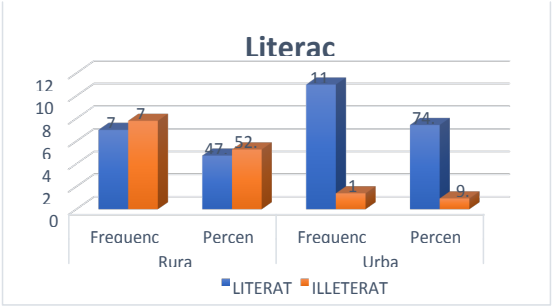


Figure 2 Literacy Rural and Urban Population

In this study, age is limited to 18 to 70 years old. Participants are included after calculating the total age distribution in rural and urban populations, shown as rural area total people numbering 148 and urban 124, and mean 41.35 and 33.08 in both populations. Urban and rural population standard deviations 13.642 and 8.712.

Table 3 Age distribution rural and urban participants

	N	Mean	Std. Deviation
Rural age	148	41.3514	13.64210
Urban age	124	33.0806	8.71276

4.3 Participants Responder:

After analysing the whole questionnaire, we found that knowledge about optometry in rural population 33(22.3%) people have knowledge about the optometry; 115(77.7%) peoples don’t have any kind of knowledge about the profession. And in urban population 69(46.6%) have the knowledge about the profession and 55(37.2%) persons don’t know about the profession. Knowledge about the difference between optometrists and ophthalmologists in rural areas 12(8.1%) have the knowledge about the difference between optometrists and ophthalmologists, participants have no knowledge between optometrists and ophthalmologists 13(8.8%); and 123(83.1%) participants marked they don’t know about anything & in urban areas 38(25.7%) have the knowledge about the difference between optometrists and ophthalmologists;13(8.8%) people have no knowledge between optometrists and ophthalmologists; and 73(49.3%) participants marked they don’t know about anything. The survey results indicate that opinions about optometrists vary between rural and urban populations. In the rural population, a small percentage (3.4%) consider optometrists as assistants to ophthalmologists, while a larger percentage (14.9%) disagree with this notion. The majority (81.8%) expressed uncertainty or lack of knowledge about the role of optometrists.

In the urban population, a slightly higher percentage (4.1%) acknowledge optometrists as assistants to ophthalmologists,

while a significant proportion (30.4%) hold a negative view or disagree with this statement. Similarly, a substantial percentage (49.3%) expressed uncertainty or lack of knowledge about the role of optometrists.

Regarding the utilization of optometrists for eye examinations, a significant proportion in both rural (45.9%) and urban (46.6%) populations reported having had their eyes examined by optometrists. However, a notable percentage in both populations (54.1% in rural and 37.2% in urban) indicated that they have not undergone eye examinations by optometrists.

When asked about the use of spectacles, a considerable proportion in both rural (34.5%) and urban (35.8%) populations reported having used them, indicating a need for vision correction. Conversely, a substantial percentage in both populations (65.5% in rural and 48.0% in urban) indicated that they have not utilized spectacles.

When it comes to knowledge about the drawbacks of spectacles, a significant proportion in both rural (37.2%) and urban (33.1%) populations demonstrate awareness of these drawbacks, while a notable percentage (62.8% in rural and 50.7% in urban) lack this knowledge.

Regarding the use of contact lenses instead of spectacles, a small percentage in both rural (3.4%) and urban (14.2%) populations report having used contact lenses, while the majority (96.6% in rural and 69.6% in urban) have not. (Table 4).

These findings highlight the need for further education and awareness campaigns to improve understanding and knowledge about the role of optometrists, especially in rural areas where a higher proportion of individuals express uncertainty or lack of knowledge. Enhancing awareness can promote better utilization of eye care services and ensure access to appropriate vision correction methods, such as spectacles.

Table 4 Participant's responses on knowledge about the Optometry profession:

Variables	Characteristics	Rural		Urban		P value
		Frequency	Percent (%)	Frequency	Percent (%)	
Knowledge about optometry	Yes	33	22.3	69	46.6	0.001
	No	115	77.7	55	37.2	
Knowledge about the difference between optometrists and ophthalmologists	Yes	12	8.1	38	25.7	0.001
	No	13	8.8	13	8.8	
	Don't know	123	83.1	73	49.3	
Opinion on optometrist is assistant of an ophthalmologist	Yes	5	3.4	6	4.1	0.002
	No	22	14.9	45	30.4	
	Don't know	121	81.8	73	49.3	
Have ever done your eye examination by an optometrist?	Yes	68	45.9	69	46.6	0.043
	No	80	54.1	55	37.2	
Have you ever used spectacles?	Yes	51	34.5	53	35.8	0.096
	No	97	65.5	71	48.0	
Knowledge about the benefits and drawbacks of spectacles	Yes	55	37.2	49	33.1	0.013
	No	93	62.8	75	50.7	
Have you ever used contact instead of spectacles?	Yes	5	3.4	21	14.2	0.00
	No	143	96.6	103	69.6	

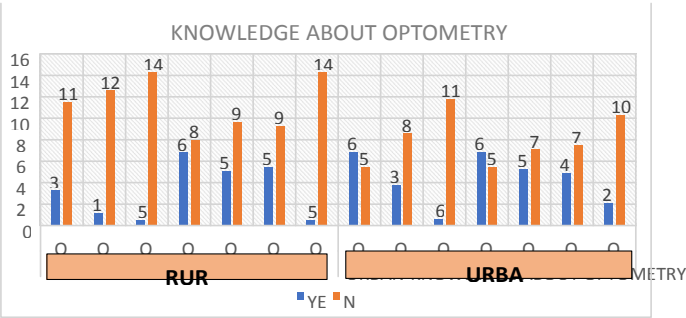


Figure 3 Knowledge about the optometry profession

The study investigated the level of knowledge and opinions about optometry among individuals residing in rural and urban areas. The results indicated that 22.3% of participants in rural populations had knowledge about optometry, while a higher proportion of 46.6% exhibited awareness in urban populations. This disparity suggests a significant difference in knowledge between the two groups.

Furthermore, the study explored the understanding of the distinction between optometry and ophthalmology. In rural areas, 8.1% of participants correctly recognized the difference, while 8.8% answered negatively, indicating a lack of understanding. Conversely, in urban areas, a greater proportion of 25.7% responded affirmatively, while 8.8% answered negatively. These variations highlight the disparity in knowledge levels between rural and urban populations.

The participants' opinions regarding optometrists as assistants to ophthalmologists were also examined. In rural populations, a meagre 3.4% agreed with this perception, whereas 14.9% disagreed, indicating a prevailing misconception. Similarly, in urban populations, only 4.1% agreed, but a higher proportion of 30.4% disagreed. A considerable percentage of participants in both rural (81.8%) and urban (49.3%) areas expressed uncertainty about the role of optometrists. These findings underscore the existence of misperceptions and uncertainty regarding the professional status of optometrists, particularly among the rural population.

Additionally, the study investigated the utilization of optometrists for eye examinations. The findings revealed that 45.9% of individuals in rural areas and 46.6% in urban areas had received eye examinations by optometrists. However, a significant portion of the population in both settings did not undergo such check-ups.

To determine the statistical significance of these findings, the NPar test was employed using SPSS version 27. The test confirmed that all the factors examined in the study (knowledge about optometry, understanding the difference between optometry and ophthalmology, opinions about optometrists as assistants, and eye examination utilization) were statistically significant with a pvalue less than 0.05. This statistical analysis strengthens the credibility and reliability of the study's findings.

In conclusion, the study's results highlight the disparities in knowledge, understanding, and opinions about optometry between rural and urban populations. The significant associations identified through statistical analysis emphasize the importance of targeted interventions and educational campaigns to improve awareness and address misconceptions regarding optometry, particularly in rural areas. The study findings reveal interesting insights into the perceptions of the rural and urban populations regarding the roles of optometrists and ophthalmologists. When it comes to prescribing glasses independently, a significant percentage of respondents in both rural and urban areas identified optometrists and ophthalmologists as independent prescribers. In the rural population, 14.9% recognized optometrists, 10.1% recognized ophthalmologists, 26.4% recognized both, and 48.6% were unsure. Similarly, in the urban population, 14.2% recognized optometrists, 4.7% recognized ophthalmologists, 45.3% recognized both, and 19.6% were unsure.

Regarding the conduct of eye examinations, the study found that there is a preference for a combination of optometrists and ophthalmologists in both rural and urban areas. In the rural population, 6.1% identified optometrists, 10.8% identified ophthalmologists, 36.5% identified both, and 46.6% were unsure. Similarly, in the urban population, 6.8%

identified optometrists, 4.7% identified ophthalmologists, 51.4% identified both, and 20.9% were unsure.

The study also examined the perception of primary eye care professionals. It was observed that in both rural and urban areas, a significant proportion of the population considered optometrists as primary eye care providers. In the rural population, 25.7% considered optometrists, 5.4% considered ophthalmologists, 13.5% considered both, and 55.4% were unsure. Similarly, in the urban population, 27.7% considered optometrists, 4.7% considered ophthalmologists, 25.0% considered both, and 26.4% were unsure.

These findings shed light on the understanding and awareness of the roles and responsibilities of optometrists and ophthalmologists among the rural and urban populations. It is evident that there is a considerable portion of respondents who are uncertain or lack knowledge regarding the specific functions performed by these eye care professionals. [Table 5]

Table 5 Participant's knowledge level about the role of an optometrist:

Variables	Characteristics	Rural		Urban	
		Frequency	Percent (%)	Frequency	Percent (%)
Which of them can prescribe Glasses/spectacles independently?	Optometrist	22	14.9	21	14.2
	Ophthalmologist	15	10.1	7	4.7
	Both	39	26.4	67	45.3
	Not sure	72	48.6	29	19.6
Which of them fits and prescribes the contact lenses?	Optometrist	11	7.4	33	22.3
	Ophthalmologist	2	1.4		
	Both	12	8.1	24	16.2
	Not sure	123	83.1	67	45.3
Which of them can operate an eye surgery?	Optometrist	0	0	0	0
	Ophthalmologist	53	35.8	65	43.9
	Both	54	60.8	7	4.7
	Not sure	69	6.1	52	35.1
Which of them can conduct an eye examination?	Optometrist	9	6.1	10	6.8
	Ophthalmologist	16	10.8	7	4.7
	Both	54	36.5	76	51.4
	Not sure	69	46.6	31	20.9
Which of them consider a primary eye care professional?	Optometrist	38	25.7	41	27.7
	Ophthalmologist	8	5.4	7	4.7
	Both	20	13.5	37	25.0

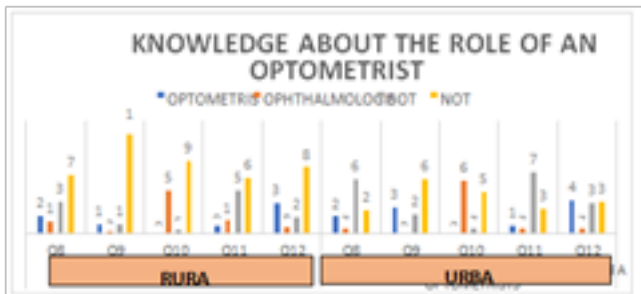


Figure 4: Knowledge about the role of an optometrist

5. Discussion:

Ophthalmologists and optometrists have a lot in common professionally, which leads to misunderstandings among the general public about the precise tasks and responsibilities that each performs in the system for visual health. The survey analysis reveals that, compared to the study conducted by Aldebas et al., which found that 68% of respondents were aware of optometry, 81.1% of rural respondents and 51.7% of urban respondents, respectively, were uninformed of optometry, and 18.9% and 48.3% were aware of the study (Aldebasi et al., 2018). Previous research indicates that 16.5% of respondents believe that ophthalmologists conduct eye exams, 37.8% believe that optometrists do so, 27.4% believe that both can perform eye exams, and 18.3% are unsure, while Okoye et al. study's showed that 18.5% of the participants knew the precise duties of both ophthalmologists and optometrists. (Boniface ikenna eze¹, Obiekwe Okoye¹, 2016)

When questioned about the distinction between an optometrist and an ophthalmologist, respondents indicated that just 4.9% and 14% of respondents in rural and urban areas, respectively, were aware of it. (Midya et al., 2022) The remainder 95.1% and 86% were unaware of the distinction. The previous study's rural and urban response rates of 29.3% and 32.6%, respectively, were lower than those of Guffy et al's (56%) and Eze's (55.6%) studies. (Midya et al., 2022)

According to the survey results, it was observed that there is a disparity in the awareness levels of the distinction between

optometry and ophthalmology among rural and urban populations. In rural areas, 22.3% of individuals demonstrated awareness of the distinction, while in urban areas, a higher percentage of 46.6% displayed awareness. This highlights a notable knowledge gap in both populations, with rural areas having a knowledge gap of 8.1% and 25.7%, compared to urban areas with a knowledge gap of 4.1% and 30.4%.

Furthermore, the survey findings indicated that optometrists performed eye exams on a comparable proportion of the population in both rural and urban areas. In rural areas, optometrists conducted eye exams on 45.9% of the population, while in urban areas, they performed eye exams on 46.6% of the population.

These findings underscore the importance of addressing the knowledge gap and promoting awareness of the distinctions between optometry and ophthalmology in both rural and urban populations. There is a clear need for educational initiatives and targeted awareness campaigns to enhance understanding among individuals regarding the distinct roles and responsibilities of these eye care professionals, particularly in rural areas.

It is essential to bridge the knowledge gap and ensure that individuals have access to accurate information about the services provided by optometrists and ophthalmologists. By doing so, individuals can make informed decisions about their eye care needs and seek appropriate services from the respective professionals.

According to the survey data, in rural locations, 14.9% of optometrists and 10.1% of ophthalmologists believe that they have the authority to independently prescribe glasses. In contrast, in urban areas, a higher percentage of optometrists (26.4%) and a lower percentage of ophthalmologists (4.7%) hold this belief. However, a significant proportion (48.6%) of respondents in urban areas express uncertainty regarding this matter.

Regarding eye examinations, the survey findings indicate that in rural areas, 6.1% of participants consider optometrists as the primary providers, followed by 10.8% for ophthalmologists,

36.5% for eye doctors (potentially including both optometrists and ophthalmologists), and 4.7% for ophthalmologists alone. The majority (51.4%) of respondents believe that both optometrists and ophthalmologists perform eye exams. In urban areas, a similar pattern emerges, with 27.7% perceiving optometrists as the main providers, 4.7% for ophthalmologists, and 25.0% for both. Additionally, a notable percentage (26.4%) of respondents in urban areas remain unsure about the primary eye care provider.

These findings highlight the recognition of optometrists as significant contributors to eye care services in both rural and urban areas. However, there appears to be some confusion and uncertainty among the public regarding the roles and responsibilities of optometrists and ophthalmologists. Clear and comprehensive communication, as well as educational initiatives, are necessary to enhance public understanding of the respective roles of these professionals in delivering eye care services.

It is crucial to provide accurate information to the public, emphasizing the expertise and specialized services that optometrists and ophthalmologists can offer. This will facilitate informed decision-making and help individuals make the best choices for their eye health.

Conclusion:

These results appear to show a larger lack of knowledge about the profession of optometry among rural participants in Delhi than among urban participants (Northern India). There is a need to intensify the campaign in these regions through educational programs, awareness-raising activities, posters that explain eye care, social media posts about the obligations and behaviours of eye care providers, and public exhibits of the optometry profession. According to this survey, the public has a poor awareness of the difference between ophthalmologists and optometrists. Raising public awareness of the duties and practices of eye care professionals through campaigns and social media must be a top priority for policymakers and the Ministry of Health. Additionally, it is advised that researchers carry out additional, comparable

studies among rural communities and take into account various techniques to include people on the street and those employed by businesses to obtain more generalizable results.

Limitations:

The present study had certain limitations that should be acknowledged to ensure a comprehensive understanding of its findings. One notable drawback was the absence of full eye examinations or the use of eye care accessories during the data collection process. The study solely relied on participant responses to assess their knowledge, opinions, and utilization of optometry-related services. Unfortunately, eye care accessories such as spectacles, contact lenses, sunglasses, or reading glasses were not administered or observed, which could have provided additional objective data regarding participants' eye care practices.

Another limitation stems from the reliance on self-reported data obtained through surveys and interactions with study participants. While these methods are valuable for gathering information, they are susceptible to various response biases. Social desirability bias and recall bias, for instance, can influence participants' responses, leading to potential inaccuracies. Participants may provide answers that align with social expectations or might struggle to accurately recall specific details. Thus, the findings should be interpreted with caution, considering the limitations inherent in self-report measures.

Furthermore, the study employed methods such as posters, lectures, and other means to disseminate information and raise awareness about optometry. While these approaches can effectively increase knowledge and awareness, they may not necessarily translate into changes in behaviour or actual utilization of eye care services. It is important to recognize the potential gap between knowledge or awareness and the subsequent actions or behaviours of individuals.

Moreover, the study focused exclusively on a specific population comprising individuals from rural and urban areas. This limited scope may restrict the generalizability of the findings to other populations or regions. Therefore,

caution should be exercised when extrapolating the results to broader contexts or different demographic groups.

To address these limitations in future research, it would be beneficial to incorporate objective measures, such as comprehensive eye examinations, alongside self-reported data. By integrating both types of data, a more holistic understanding of participants' eye health and practices can be obtained. Additionally, expanding the sample to include a more diverse and representative population, encompassing various socioeconomic backgrounds and geographical locations, would enhance the external validity of the findings. Longitudinal studies could also be conducted to track changes in knowledge, perceptions, and behaviours over time, providing valuable insights into the long-term impact of optometry awareness initiatives.

In conclusion, while the present study contributed valuable insights into optometry awareness, it is crucial to consider its limitations. By addressing these limitations in future research, a more comprehensive understanding of the relationship between knowledge, perceptions, and actual eye care practices can be achieved.

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

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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

First and foremost, we are immensely grateful to the researchers and authors whose work has been cited in this review. Their pioneering studies and insightful findings have provided a robust foundation for this narrative literature review. We also extend our thanks to the institutions and organizations that facilitated access to the various databases used in our research, including PubMed, Scopus, and Google Scholar. Their comprehensive repositories were instrumental in allowing us to gather a wide range of studies and articles.

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Current Approaches to Treating Presbyopia and Future Advancements

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Abstract

Presbyopia is a common age-related visual disorder that is characterized by a progressive loss of near-object focusing. If the ailment is not addressed or is treated incorrectly, it can significantly affect the quality of life for those who have it. Given the rising prevalence of presbyopia as the world's population ages, the vast number of patients who go untreated in some parts of the world, and the limited number of readily available corrective procedures, cataracts represent a substantial unrealized potential. Seniors who wear bifocal or advanced contact lenses are more prone to have reduced depth perception, confined fields of vision, and surround blur. These symptoms have also been linked to a higher likelihood of collisions. The age-related disorder known as presbyopia causes the lens of the eye to become less flexible, which makes it harder to concentrate on close objects. It usually starts at age 40 and gets worse with time. Eye strain, hazy near vision, and trouble seeing small text are typical symptoms. Contact lenses, progressive lenses, bifocals, or reading glasses can all be used to treat it. To treat presbyopia, some patients choose surgery like LASIK or lens implants.

As hand strength improves and age-related dry eye issues arise, it becomes more challenging to keep optical substitutes clean. Procedures to replace the clear lens, restore functional lodgings, or alter the retina's visual properties are examples of other restorative techniques. Many people later need visual aid, despite the fact that most surgical candidates report positive results after their procedures. They are now being researched for new methods to function in safe therapies.

The clinical odyssey and diagnostic process for presbyopia are described, and many therapies are examined. There are few readily available, efficient medical treatments for presbyopic people, and there are notable gaps in the available treatment choices for this prevalent condition, including refractive surgery, according to the data examined here.

Keywords: Presbyopia, Near vision problem, near addition correction, Characterization of the individual's condition, surgery.

Introduction

Presbyopia is a common age-related visual disorder that is characterized by a progressive loss of vision of objects at close proximity. Presbyopia is believed to be caused by a reduction in optic flexibility that prevents focal shift or potentially spindle fatigue.^{1, 2} A recent study suggests that an increase in ocular stiffness is probably the primary contributing element to this sickness, even if the precise etiology is uncertain. Although restorative therapies can restore peripheral vision, their use—typically through the use of spectacles—is limited in many parts of the world. In 2023, 826 million people were diagnosed with impaired near sight issues, out of the approximately one billion people who are believed to have operating cataracts.

This is probably because they don't wear glasses or they don't get enough therapy. If a clear correction is not obtained, presbyopia can have a number of negative effects on life's functionality. These results include difficulties with various tasks, such as pressing stitches or identifying small details on adjacent objects, as well as difficulties with understanding (an inability to understand text, increased hearing requirements, hazy vision, epiphora, migraine weariness, or a condition called as). This study summarizes the available data on cataract statistics, diagnosis, and treatment while highlighting the remaining gap in an effective, commonly used, and safe presbyopic therapy.

Importance of this research

Vision loss, a naturally occurring time-related condition that impairs nearsightedness, typically appears before the age of forty. Research on therapy is essential due to the significant prevalence of the aforementioned ailment and its negative impact on comfortable life. Today's rehabilitation choices include things like glasses, corrected perspectives, and operations like glass transplants and lasers. However, these therapies often have side effects, like eye discomfort, surgical risks, and the need for ongoing adjustments as cataracts grow. Future developments in the condition's treatment should be carefully examined since they have the potential to fundamentally alter how patients are cared for.

The advancements in medical treatments, such as droppers that increase the retina's malleability, and innovative surgical techniques that yield more precise and durable outcomes are at the core of this research. Additionally, the advancement of computerized eyeglasses and mild technologies may provide people with easier and more individualized options. By focusing on both existing practices and future developments, the current study addresses the urgent need for improved treatments that offer greater accessibility, protection, and performance. It provides a comprehensive overview for professionals and academics who wish to stay on the cutting edge of this quickly evolving field and contributes to the growing body of research targeted at enhancing the lives of countless individuals with the illness.

Presbyopia: Implications for Living with Its Occurrence

Up to 85% of those over forty also suffer from presbyopia, which is increasingly prevalent and severe as people age. It was estimated that 1.9 billion people globally suffered from presbyopia in 2024; by 2030, that figure is expected to rise to 2.1 billion. Although 94% of patients with severe near vision impairment from untreated cataracts live in poor countries, presbyopia is more frequent in places with longer lifespans. According to research, only 6–45% of patients in smaller economies have access to eye aids, despite the fact that many countries have cataracts. The high prevalence of undetected

cataracts in many parts of the world is caused by a lack of easily accessible and affordable diagnostic tools.

Undiagnosed or undercorrected cataracts have a substantial influence on a person's quality of life, regardless of the kind of everyday activities they engage in. The ill individuals may become much more successful at daily duties if they acquire the required modification. At the same time, rehabilitative resources like literature are widely accessible in developed countries. One may often overlook effective alternative presbyopia treatment options when using spectacles. Moreover, dependence on eyeglasses is one of the main causes of a drop in the level of living for people over 45.

The traits associated with the condition of astigmatism

In certain regions of worldwide, refraction is an urgent problem and is spreading like wildfire. Considering an upsurge in the frequency of farsightedness astigmatism and severely hazardous shortsightedness, and additionally an expansion in severely devastating eye illnesses, the sharp rise in the frequency of astigmatism worldwide has significant consequences for the general population.

Although both astigmatism and presbyopia are frequent visual disorders, their origins and consequences differ.

The age-related disorder known as presbyopia causes the lens of the eye to become less flexible, which makes it harder to concentrate on close objects. It often begins around age 40 and gets worse with time. It can be fixed with surgery, bifocals, or reading glasses.

A cornea or lens with an uneven shape is the source of astigmatism, which results in distorted or blurred vision at all distances. It may coexist with presbyopia and can happen at any age. Refractive surgery, contact lenses, and spectacles are examples of corrective measures.

To meet their visual demands, those with both disorders could require specialty lenses, including toric or bifocal lenses.

Refracted error is a specific type of incorrect visual perception. About 150 teenagers were divided into groups based on their

intelligence, shortsightedness, and a condition known as in order to examine the nature of aging and its relationship to stereoscopic corneal conditions. The optimal uncorrected vision, eye positioning, and medication use have all been gathered. The results showed that, among children aged 3-6, the median was higher for those with astigmatism and endovision than for those who were nearsighted. Additionally, there was a decrease in refractive defects among children under the age of six and as they grew older. There was no noticeable difference for children older than six. Consequently, it is believed that cataracts are linked to a disorder known as the chronological dispersion subtype.

Elements That Contribute to Presbyopia

There are a number of causes of presbyopia, but aging is the main one. The following are the main causes of presbyopia:

- Loss of Lens Flexibility: Over time, the eye's natural lens hardens and loses some of its elasticity, making it harder to change shape and focus on close objects.
- Ciliary Muscle Weakness: As we age, the muscles that control our lenses get weaker, making it more difficult to change focus across distances.
- Changes in Lens Proteins: The lens's capacity to focus is further diminished by structural alterations in the proteins that make it thicker and less transparent.
- Diminished Pupil Response: As people age, their ability to adapt to changing lighting conditions is impacted, which may make it harder to focus on close objects.

Genetic Factors: Presbyopia may be more likely to develop early in life if there is a family history of the disorder.

Environmental and Lifestyle Factors Presbyopia may develop early or worsen as a result of extended close-up work, excessive screen usage, or UV radiation exposure. Even while presbyopia is a normal aspect of aging, its effects can be controlled with the use of corrective devices like glasses, contact lenses, or surgery. Generally speaking, a too big or rectangular eye, rather than a rectangular one, is what causes visual impairment. It may also occur if the curve of the membrane is too severe. These changes cause light beams to overlap at a point close to the

eyeball's margin. The pictures sent by the optic nerve are interpreted as hazy by the central nervous system.

Vision loss often appears as early as age 40 in Western countries, although it has been demonstrated to appear earlier in countries closer to the poles, such as the two continents. It has previously been proposed that exposure to sunshine may cause the lens's crystals to deteriorate too quickly, hastening the onset of cataracts.

Compared to males in the same age range, women over 40 are more likely to have presbyopia. The increased requirement for cataract correction in women is thought to be caused by differences in the occupations they do and their visual needs, rather than inherent gender differences in tolerance mechanisms.

Evaluation and Treatment of Ocular Conditions

The largest worldwide providers of optical services are ophthalmologists, who often work in private practices rather than public ones. However, there are notable differences in the accessibility of optometric services across different countries. The majority of US ophthalmologists treat presbyopes on a regular basis through their private offices, in contrast to the more varied secondary eye therapy options in Europe.

According to research, persons in developed countries who did not get an eye exam before turning 50 are probably either farsighted or emmetropic. Usually, blindness is discovered around age 50. It has been noted that myopes in India seek therapy for their visual loss later than emmetropes and hyperopes in the same population. Presbyopes often recognize themselves during eye exams, and they may begin with prescription telescopes or reading glasses as a short-term solution for a decline in near-sharp vision. Presbyopes' financial circumstances may have an effect on how frequently they buy eyeglasses and eye therapy in the global neighborhood.

Other Options for Treating Presbyopia

Treatments for cataracts include prescription eye mechanisms, as well as with and without attention, corneal surgery to

change corneal imaging, replacement of a clear lens, or the ability to partially restore existing adaptations. Additionally, there are ongoing efforts to improve presbyopic vision.

Items that have lenses

No eyeglass material available today can fully replicate the flexibility of adaptation in aging eyesight, despite the fact that most people think that wearing frames is the most practical method to address vision loss indications. Some near-vision glasses only correct eyesight at a specific wavelength; to see far away, one must remove the glasses or use an extra piece. These glasses have a single target location across the lens, depending on the distance of the object. For cataracts, contact lens therapies include only-vision distance touch lens therapy with reading lenses providing the required near improvement, bi-multifocal treatment based on overlapping or contemporaneous vision ideals, and monovision rectification. Women are less likely than males to use lens implants because to cataracts, in part because of cosmetic concerns. 39,

Therapeutic and techniques

Because more individuals are opting to work into retirement and using computerized devices, older people have found long-lasting eyesight correction treatments particularly appealing. Improvements in lens development and a broader variety of surgeries in the recent past are also contributing factors to the increase in demand. The need for a reading device that focuses profundity or permits optic inserts can be greatly reduced or eliminated by using only one eye, multiple, extended-range lenses, and optical lens substitution (RLE), which substitutes a contact lens (IOL) for the native crystallographic lens in the optic nerve. One-eye monovision lens Installations are only for certain types of people, and a successful outcome depends on patients making informed decisions.

Methods of Correcting Scleral Error in Presbyopia

Schachar's theory of lodge scleral treatments is that by restoring zonular pressure and expanding the tropical scleral dimension across the ciliary structure, they seek to preserve or

enhance the eye's ability to adapt. Although the mathematical underpinnings of these procedures remain controversial, scleral treatments, such as laser scleral micro-excisions and scleral micro-inserts, are becoming more and more common.

Treatments for preventing Presbyopia

For people who require near eyesight, retinal implants provide a higher level of fulfillment and prescription autonomy. Through a simple process, they are inserted into the corneal tissue of one eye. Two advantages of this process are its reversible nature and its repeatability. The disadvantages of intraocular implants include the potential for deterioration of depth perception and distance vision, as well as the increased risk of kerato haze generation. The many types of intraocular fillings include ocular reshape implants, corrected carvings, and small-aperture carvings.

as being more significant than the expense; for near-vision modification, eyeglasses were

Unfulfilled Expectations in Presbyopia Patients

Even though the prevalence of cataracts has increased worldwide as the population has expanded, people's experiences with presbyopic treatments have not been well investigated, despite growing interest in the topic. People with the disease found it difficult to write and use technology, and wearing varifocal and other eyeglasses was uncomfortable, according to a recent study on online communication monitoring. Pre-sbyopic and pre-sbyopic respondents to an online survey ranked the comfort or effectiveness of their ophthalmic restoration higher than using multipurpose contact lenses. Multifunctional IOLs were also shown to improve the standard of living for patients compared to client satisfaction following presbyopic LASIK, which has been shown to be equivalent to comprehension glasses.

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Unmet Expectations in Patients with Presbyopia

Although cataract prevalence has increased internationally as the population has expanded, little is known about people's experiences with presbyopic therapy, despite growing interest in the subject. People with the illness had difficulty writing and utilizing technology, and wearing spectacles like varifocals was unpleasant, according to a recent research on online communication monitoring. Pre-sbyopic and pre-sbyopic respondents rated their ophthalmic repair more comfortable or effective than multifunctional contact lenses in an online survey. Multifunctional IOLs have also been shown to improve patients' quality of life when compared to customer satisfaction following presbyopic LASIK, which has been shown to be equivalent to comprehension glasses. There are now two main categories of therapeutic pharmacological options being researched: those that work by altering the eyes and those that aim to restore balance.

Using Student Adjustment to Indicatively Reduce Presbyopia Indications

Nearly all of the current prescriptions are part of the first group of products that contain ciliary contractions to improve field vision or parasympathetic-mediated inflammation and lens relaxation to temporarily reduce condition feelings. These therapies rely on improving immediate vision for six to eight hours. They include prx intraocular answer, Nyxol, CSF-1, acelcedine/brimonidine acids, FOV Tears, AGN-

190584, AGN-199201, a drug called pi carbs, and VISION-1. The most common side effects of AGN-190584 were migraine, corneal pressure, vision problems, and eye discomfort, reported by about 3% of those who got it. For emmetropic or presbyopic individuals, pilocarpine/diclofenac drops have been found to be an effective treatment, enabling visual dependence for close reading and writing. This was found in another extensive, eight-year prospective, nonrandomized, event series study. Over an extended length of time, it was successfully shown that a topical solution that contains both brimonidine and carbachol intake corrects eyesight loss more effectively than this medicine.

Therapy for the Basic Cause of Presbyopia

In an attempt to address the underlying causes of cataracts, the following category of medications looks at new ways that the condition works by examining the increasing disulphide levels in lenses and age-related lens flexibility. After 90 days of treatment, the antibiotic UNR844 was shown to have a median positive benefit of around one line (5 letters) over placebo and additional two lines (10 letters) above starting point in a different Spread 1/2 study (NCT02516306) with 75 participants aged 45 to 55. The improvement continued until seven weeks after implementation finished, when the trial was concluded. If successful, these techniques provide a strong alternative to near-eyeglasses or surgery and mark a major breakthrough in cataract care. Even if advancements in nontoxic therapy have been made, none of the aforementioned therapies are yet ready for routine usage.

In the upcoming decades, astigmatism medication will be produced.

DNA therapy, which alters gene activity and regulatory systems to try to reduce astigmatism and enhance vision, is one of the most promising research topics for treating astigmatism. Experts in astigmatism treatments are looking at the CRISPR-Cas9 technique as a possible astigmatism therapy. This technique allows for the change of some genes between points, such as those involved in axial measurement and diopter control. By carefully modifying the genes known

to change the structure and function inside your cornea, astigmatism can be repaired.

Regular genes are placed into the optic nerve muscle to enhance or restore the activity of genes associated with near vision. This approach is expected to concentrate on the pathogenesis of astigmatism and provide patients with long-term therapeutic advantages. The state-of-the-art field of gene therapy research presents new opportunities and promise for the treatment of astigmatism. More research is needed to assess their long-term effects, efficacy, and protection. Such gadgets are currently only being investigated in laboratory settings and in the early phases of human testing. Furthermore, the ethical and legal concerns related to gene therapy must be thoroughly discussed and taken into consideration.

Conclusion

Vision loss is a condition that is becoming more common as people age. However, people need to be aware that any current effective presbyopic correction treatment will result in a compromise in the sharpness and flexibility of eyesight available at different levels. There are currently no important drugs that address the lacking needs of presbyopic persons. Because untreated or insufficiently corrected vision loss can have a substantial impact on people's daily routines and general quality of life, it is imperative to find a unique and optimal solution—a therapy that offers genuine adaptability.

Because there are now no effective treatments for astigmatism, there also appears to be a lot of scientific curiosity. Although it wasn't thoroughly tested in tests, giving kids enough outdoor activity each week seems to be one of the simplest methods to prevent blindness. The bulk of the evidence supports this. According to some extensive study conducted worldwide, children who spend more time outside are less likely to acquire astigmatism than children who spend less time outside. To evaluate and give these interpretations further thought, more research studies are necessary. The pathogenesis, treatment, and prevention of presbyopia are all thoroughly summarized in this article, which will help the field's future development.

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The negative impact of frequent fasting on eye health

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Abstract:

Intermittent fasting (IF) is a well-known therapeutic dietary strategy that regulates metabolism and helps delay the onset of metabolic disorders. IF has been discovered to have both direct and indirect impacts on the degenerative alterations and physiological structure of the eye, and there is increasing research relating it to ocular illnesses. An outline of how IF controls the physiological elements of the choroid, retina, anterior region of the eye, and ocular vascular system is given on this page. We examined the potential as a remedy for several prevalent ocular disorders. Future investigations into the fundamental processes will provide a precise and uncomplicated approach to the treatment and prevention of eye disorders.

The eye is a vital sensory organ that receives most of the information from the environment. Lifestyle changes have led to a steady increase in eye disorders and the ocular side effects of metabolic diseases such as diabetes and hypertension. Chronic eye disorders have a substantial financial cost on families and society in addition to having a detrimental effect on patients' quality of life. Dietary interventions have shown potential for eye disease prevention and supplementary therapy due to their simplicity of adoption and application. Nevertheless, the data and ocular conditions are inadequate.

Retinopathies and other illnesses of the ocular surface can be significantly impacted by a variety of ocular biological variables. It is essential to comprehend how it impacts the eye's pathological changes and physical traits.

Index Terms –Frequentfasting, lowering of sugar, eye inflammation, irregular lifestyle, Prolong Diabetes.

Introduction

Intermittent fasting (IF), also known as intermittent energy restriction (IER), is a new type of fasting therapy that alternates casual and restrictive eating for a set amount of time with the aim of influencing an organism's metabolism through dietary changes. This simple dietary restriction diet has been shown to have many health benefits, including disease prevention and slowing down the aging process. In 1997, Weindruch and Sohal showed that calorie restriction techniques could increase longevity by lowering body weight and oxidative stress (1); in subsequent studies, these benefits have been extended to include diabetes, cardiovascular disease, cancer, and neurological disorders (2). The most common cause of IF diets today are time-restricted fasting, periodic fasting, and alternate-day fasting, and fasting for religious purposes.

A day of ordinary eating is followed by a day of fasting, which is known as alternate-day fasting. During the fast, make sure you drink enough water. It is currently the most common kind of IF. Periodic fasting is a type of diet where one or two days of the week are fasted and the other days are eaten regularly. The 5:2 light fasting technique, which limits food intake just twice a week, is the most popular kind of periodic fasting. Throughout the time-limited fast, participants only fasted during certain periods of the day. Religion-related fasting is a popular kind of IF that is motivated by religious beliefs.

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Throughout the time-limited fast, participants only fasted during certain periods of the day. Religion-related fasting is a popular kind of IF that is motivated by religious beliefs.

Retinopathies and other illnesses of the ocular surface can be significantly impacted by IF, which can alter a variety of ocular biological parameters. It is essential to comprehend how IF impacts the physical traits and pathological changes in the eye. This article outlines the benefits of IF for the eye and the prevention of ocular diseases by describing how it affects several biological parameters of the eye and discussing possible physiological causes of these effects.

Biological Factors Impacting the Eyes and Periodic Fasting

IF is a new eating pattern that has a big impact on how the body uses its energy. The anterior part of the eye, choroidal and retinal thickness, intraocular pressure (IOP), ocular blood circulation, insulin sensitivity, and sympathetic and parasympathetic tone can all be impacted by IF. It can also improve blood circulation and flow patency. It has a major impact on the local metabolism and structure of the eyes.

Frequent Fasting and the Distribution of Blood in the Eyes:

Hypertension has a major effect on ocular blood perfusion and vascular distribution. The retina and other peripheral organs, such as the kidneys and brain, have comparable vascular architecture and physiological traits (8). Localized arteriovenous stenosis and widespread retinal small artery stenosis caused by high blood pressure result in reduced retinal perfusion (9). Prolonged high blood pressure will cause the blood-retinal barrier to be destroyed, resulting in an exudative phase. Cotton wool spots and retinal hemorrhages cause macular edema and optic disc edema during this period (10).

Hua et al. also detected a substantial drop in vascular density in individuals with a 5–10 year history of hypertension; this change is likely related to the long-term consequences of hypertension (11). Early IF may reduce systolic and diastolic blood pressure in obese guys with prediabetes without resulting in weight loss. This improvement in blood pressure

is likely due to a drop in insulin levels during fasting (12). It has been shown that prolonged IF lowers the systolic and diastolic blood pressure of hypertensive individuals (13, 14). Under the same conditions, there was no discernible difference in overall blood pressure between the healthy fasting and non-fasting groups.

However, the maximal systolic velocity of the temporal short posterior ciliary artery, central retinal artery, and ophthalmic artery decreased by about 19.18, 43.60, and 13.92%, respectively (15). This decrease in blood pressure preserves normal ocular perfusion and improves ocular vascular density and structure (15).

The organism's sympathetic tone decreases and its parasympathetic tone increases during IF (16).

Parasympathetic tone declines and sympathetic nerves take control in hypertensive individuals with impaired autonomic function (17). This is because immune cells, under the influence of sympathetic nerves, create proinflammatory substances, and the brain receives this signal and increases sympathetic excitatory output (18, 19). On the other hand, sympathetic nerves can control the quantity of memory effector cells found in the body that are unique to hypertension (20). Blood pressure rises more as a result of these processes, which further constrict the body's blood vessels.

IF reduces blood pressure by peripheral blood vessel dilatation, myocardial contractility, heart rate, and pulse volume, as well as by stimulating the vagus nerve, which innervates the heart and has the opposite impact of sympathetic excitement (17). via modifying the sympathetic and parasympathetic nervous systems, IF can impact blood pressure via influencing ocular blood flow. Diabetes and other chronic metabolic diseases can potentially affect blood flow to the eye. The avascular zone at the center of the foveal center is frequently spherical or round. Around this area, neither the superficial nor deep capillary plexus has any cracks or holes. In diabetics, the superficial and deep capillary plexuses have a greater avascular zone in the central retinal notch (21).

A number of transcription factors are activated when diabetes is first developing. The retina's high levels of pro-inflammatory chemicals trigger a low-grade inflammatory response that destroys endothelium and pericytes, increases vascular permeability, dissolves the blood-retinal barrier, causes retinal edema, and progressively worsens retinal ischemia (22). Chronic hyperglycemia may exacerbate the condition by adding to the damage to the microvascular endothelium and causing oxidative stress in the body (22).

Thickness of the Retina and Frequent Fasting

The retina is the optic part of the eye, a visual sensory organ that is situated inside the choroid's inner layer. The choroid, a highly vascularized tissue located between the retina and the sclera, supplies the retina with the proper quantity of oxygen and nutrients and carries out a number of retinal-related functions (24). The retina has a rigorous self-regulatory mechanism when perfusion pressures fluctuate dramatically (26, 27), which may be why retinal thickness has not altered much during IF (25). In earlier studies on animals, similar self-regulation of retinal blood flow was noted (28). A similar phenomena occurs in the human body (29).

Unlike retinal thickening, IF can cause choroid thickening (30). The choroid's self-regulation may lead to a strong negative correlation between choroidal thickness and systolic blood pressure in the subchoroid, and IF may thicken the choroid by reducing systolic blood pressure (31, 32). Additionally, there is a connection between neuromodulation and subchoroidal thickness. In IF, choroidal thickness under the fovea increases (16, 25), cardiac blood flow reduces (33), and blood pressure lowers when parasympathetic tone rises and sympathetic tone falls. During the fasting phase, the choroidal thickness underneath the fovea increased by more than 3% compared to the non-fasting period (25).

Insulin sensitivity may affect the thickness of the choroidal layer at IF (34). The choroidal thickness is significantly reduced in patients with diabetes and diabetic retinopathy (DR) (35). The subcentral retinal recess had a roughly 37% reduction in choroidal thickness in comparison to healthy subjects,

suggesting that choroidal thickness is a very accurate early marker of DR. Therefore, it is expected that increased insulin sensitivity will have an impact on the change in choroidal thickness. Furthermore, the body has much larger quantities of nitric oxide throughout Ramadan (36). This promotion of endothelial dilatation and intravascular material leakage may be the reason of the increased choroidal thickness under the eye fossa (30).

Pressure inside the eye and sporadic fasting

IOP is the pressure that results from the interaction of the eye's contents and wall. Intraocular contents include the lens, vitreous humor, and aqueous humor; the aqueous humor greatly affects intraocular pressure. It is necessary to balance aqueous intake and outflow in order to maintain normal IOP. It is possible to prevent aqueous humor return and increase intraocular pressure by any factor that interferes with the regular functioning of the aqueous humor circulation route.

Intermittent Fasting and Biological Factors

Among the tissues in front of the lens are the anterior chamber, posterior chamber, atrial angle, lens suspensory ligament, conjunctiva, tear film, and others. The criteria that are commonly used in clinical practice are anterior chamber volume, corneal curvature, central corneal thickness (CCT), and AC depth. These standards are essential for eye disease screening and diagnosis in clinical practice. Intermittent fasting alters anterior chamber volume and depth, mostly due to dehydration. This fluctuation may be seen at various times during the fasting period, as well as in the fasting and non-fasting groups. The axial length and anterior chamber depth of the fasted group were much less than those of the non-fasting group.

Furthermore, during IF, the depth and volume of the anterior chamber changed during the day. According to Nowroozzadeh et al., anterior chamber depth increased by more than 26% during Ramadan compared to non-fasting periods. Anterior chamber depth values were greater in the morning than in the evening ($P = 0.01$), despite no discernible change in the eyes' axial length. Other studies have also been conducted

with similar results. Furthermore, it is hypothesized that IF may change the magnitude of anterior chamber depth via affecting IOP since anterior chamber depth and IOP are interrelated, with deeper anterior chamber depth being linked to lower IOP.

Retinopathy in Diabetics with Periodic Fasting

Nowadays, one of the main causes of visual impairment and blindness in adults is diabetic retinopathy (DR), one of the microvascular effects of diabetes. Pathogenic alterations include retinal inflammation, aberrant neovascularization, retinal ischemia, increased vascular permeability, and abnormalities of neurons and glia. At the moment, the primary therapies for DR are retinal laser photocoagulation, vitrectomy, and vitreous cavity injection. Because it is still unable to control the illness, this therapy is mostly used on patients with advanced DR, even though early prevention relies on dietary and lifestyle modifications to stop the disease from getting worse.

Fasting Intermittently Inhibits Abnormal Capillary Neogenesis in Diabetic Retinopathy

Abnormal callogenesis, disruption of the blood-retinal barrier, and decrease or loss of pericytes are important indicators of early DR. A stromal sheath envelops the endothelial cells of pericytes and retinal capillaries. Hypoxia, the production of late glycation end products, hypertension, and hyperglycemia may all impair the barrier function between pericytes and endothelial cells. Consequently, endothelial cells may generate additional capillaries because of a lack of proliferative control, and pericytes may experience death. Capillary degeneration brought on by a decrease in the ratio of pericytes to capillary endothelial cells in DR may make hypoxia worse. Furthermore, elevated levels of the intercellular adhesion factor ICAM-1 and vascular VCAM-1 result from the activation of the NF- κ B pathway, both of which support aberrant angiogenesis. By reducing blood glucose and inhibiting the synthesis of proinflammatory molecules, IF can enhance retinal microcirculation and decrease retinal neovascularization (22). The research above suggests that

IF, which has anti-inflammatory and anti-vascularization qualities, may soon be utilized as an adjuvant to treat DR.

Periodic Fasting and Inflammation of the Ocular Surface

Both the frequency and length of eye usage, as well as the prevalence of disorders affecting the ocular surface, have increased dramatically in modern culture. The main features of dry eye, a multifactorial ocular surface disease marked by an inability to maintain tear film homeostasis, are increased tear osmolarity, increased tear film instability, and the emergence of ocular surface inflammation. Since almost half of those with type 2 diabetes have symptoms, diabetes is a systemic risk factor for dry eye. Prolonged hyperglycemia directly damages the corneal epithelium, resulting in corneal ulcers and chronic corneal epithelial abnormalities. A vicious cycle is created when elevated tear osmolarity brought on by hyperglycemia causes mucin denaturation, reduced tear film stability, and then another rise in osmolarity.

Apart from directly harming the epithelium, hyperglycemia also lowers mucin, tear film stability, and conjunctival goblet cell density. The integrity of the corneal barrier is compromised, corneal sensitivity is decreased, ocular surface gland production and blink frequency are decreased, and dry eye development is accelerated because to the damage that hyperglycemia can do to corneal neurons and disrupt neurotrophic function.

Intermittent Fasting and its relation with Glaucoma

Glaucoma is the most prevalent neurological condition in the world. It is a progressive visual neuropathy that results in the death of retinal ganglion cells, which leads to permanent blindness. Pathologically high intraocular pressure is a significant glaucoma risk factor. While a tiny number of glaucoma cases are brought on by excessive aqueous humor production, the majority are brought on by limited aqueous outflows, such as trabecular sclerosis and constriction or even closure of the anterior chamber angle. A disturbance of the dynamic balance of the aqueous circulation results in glaucoma. Elevated IOP damages the visual nerve in two ways: mechanical compression and optic nerve ischemia. The

longer the increase in IOP, the more severe the deterioration in visual function. The primary objective of contemporary glaucoma therapy is still to lower IOP.

In conclusion

Intermittent fasting helps prevent the beginning of some eye disorders by improving the local environment surrounding the eyes and the body's metabolism. IF affects the availability of nutrients. Inadequate food intake triggers the body's glucose-ketogenic metabolic shift. Large levels of endogenous ketone bodies take the role of glucose, an essential energy source for the brain, muscles, eyes, and other organs. On the one hand, IF reduces the neurovascular harm brought on by consistently high blood sugar. Ketone bodies, on the other hand, work better as a fuel to reduce oxidative stress and inflammation in the eyes. A shift in nutritional status results in a drop in insulin and leptin and an increase in hormones related to metabolism, such as ghrelin and adiponectin.

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Impact of Bioptic Telescopes on Driving Performance in Low Vision Patients

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Abstract

Objective:

To evaluate the impact of bioptic telescopes on driving performance, safety, and quality of life in individuals with low vision.

Methods:

A review of literature on bioptic telescope use in driving, including studies on visual acuity improvement, training programs, and crash risk assessment.

Results:

Bioptic telescopes enhance distance recognition, allowing drivers to identify road signs and traffic signals more effectively. While challenges such as restricted field of view, reaction time adaptation, and situational awareness exist, structured training programs mitigate these issues. Research indicates that trained bioptic drivers do not exhibit a significantly higher crash risk compared to visually normal drivers.

Conclusion:

Bioptic driving programs incorporating pre-driving training, simulators, and supervised on-road practice contribute to safe driving performance. The ability to drive improves independence, psychological well-being, and social participation for individuals with low vision. However, regulatory inconsistencies, learning curve challenges, and field restriction remain concerns. Future research should

focus on optimizing bioptic telescope designs, integrating augmented reality features, and conducting longitudinal studies on real-world driving performance.

Keywords: Bioptic telescopes, low vision, driving performance, visual acuity, assistive technology,

Introduction

Driving, a fundamental aspect of independence and mobility, presents a significant challenge for individuals with low vision. For those with visual impairments, particularly those caused by conditions such as macular degeneration, diabetic retinopathy, or glaucoma, the ability to drive safely and confidently is often compromised (Gokul, 2021). As a result, individuals with low vision face limitations in their daily activities, social engagements, and overall quality of life. Given the profound impact of vision on driving ability, the development and utilization of assistive devices like bioptic telescopes has become an area of considerable interest in the rehabilitation of low vision patients.

A bioptic telescope is a small, compact optical device mounted on eyeglasses that allows individuals with low vision to magnify distant objects, thus enhancing their ability to see traffic signs, signals, pedestrians, and other vital driving cues. This device typically consists of a lens system that magnifies distant objects while the wearer uses their central vision to look through the telescopic lens when necessary, providing both a wide field of view and improved acuity for tasks such as reading road signs and recognizing hazards (Shaw, 2019). The primary goal of bioptic telescopes is to increase the visual range for low vision individuals, particularly in tasks that require visual acuity and quick decision-making, such as driving.

Despite the potential benefits, the impact of bioptic telescopes on driving performance remains a topic of ongoing research. While some studies report positive outcomes, indicating that bioptic telescopes can enhance visual functions crucial for driving, others suggest that their effectiveness may be influenced by factors such as the patient's visual condition, experience with the device, and the complexity of driving

environments (Davis et al., 2020). Concerns regarding safety, adaptation to new visual techniques, and the potential for overreliance on the device have also been discussed in the literature, as these factors may contribute to the risk of accidents and traffic violations (Pereira & Lima, 2018).

The potential benefits of bioptic telescopes for driving performance have prompted significant interest in their use as part of low vision rehabilitation programs. However, a comprehensive understanding of their impact on driving performance, including both the advantages and limitations of the technology, is critical for informing clinical practices and guiding future research. This review will examine existing evidence regarding the effectiveness of bioptic telescopes in improving driving capabilities among low vision patients, explore the challenges associated with their use, and consider the broader implications for driving safety and autonomy.

Methods

This narrative review aims to systematically analyze the existing literature on the impact of bioptic telescopes on the driving performance of individuals with low vision. A narrative review methodology was chosen to provide a comprehensive understanding of the current evidence, identify trends, and explore the overall effectiveness of bioptic telescopes in enhancing driving capabilities for individuals with low vision. The methodology involves the collection and synthesis of relevant studies, followed by a critical evaluation of their findings, limitations, and implications. The following steps outline the review process.

Literature Search Strategy

A thorough and systematic search of the literature was conducted to identify studies related to bioptic telescopes and their impact on driving performance in low vision patients. The search was carried out using electronic databases such as PubMed, Scopus, and Google Scholar. The search terms included a combination of keywords such as “bioptic telescopes,” “low vision,” “driving performance,” “visual impairment,” “assistive technology,” and “driving ability.” The search was limited to English-language studies published

between 2000 and 2024 to ensure that only the most recent and relevant research was included.

2. Inclusion and Exclusion Criteria

Inclusion criteria for this review were as follows:

- Studies that focused on low vision patients using bioptic telescopes for driving or other related activities.
- Studies that assessed the effect of bioptic telescopes on driving performance, including reaction time, accuracy, safety, and visual capabilities.
- Peer-reviewed articles, including randomized controlled trials (RCTs), observational studies, case studies, and reviews.
- Studies published in reputable journals or conference proceedings.

Exclusion criteria included:

- Studies that focused on non-driving-related outcomes, such as the use of bioptic telescopes in non-vehicular tasks (e.g., reading or sports).
- Articles that did not provide clear evidence on driving performance or lacked measurable outcomes.
- Studies involving participants without any visual impairment or those that focused on low vision caused by conditions unrelated to driving (e.g., cognitive impairments).

Data Extraction and Synthesis

Data extraction was performed by reviewing the abstracts, methods, and results sections of the selected studies. Key information such as participant characteristics (e.g., age, visual condition), type of bioptic telescope used, study design, outcomes measured, and the overall findings were recorded. To ensure consistency and accuracy, the data was cross-checked by two independent reviewers. In cases where discrepancies occurred, consensus was reached through discussion.

The synthesized data was organized thematically based on key areas of interest:

1. **Driving Performance Improvement:** Studies that evaluated the enhancement of driving skills, such as visual acuity, ability to read road signs, and reaction time.
2. **Safety Concerns and Limitations:** Studies discussing the safety implications of using bioptic telescopes while driving, including accident risk, adaptation challenges, and over-reliance on the device.
3. **Patient Experience and Adaptation:** Insights into the user experience, including the challenges and benefits reported by low vision patients adapting to bioptic telescopes.
4. **Comparative Effectiveness:** Studies that compared bioptic telescopes with other assistive devices or driving aids, such as monoculars, magnifiers, or electronic visual aids.

Quality Assessment

The quality of the included studies was assessed using a modified version of the Newcastle-Ottawa Scale (NOS) for observational studies, which evaluates the selection of participants, comparability of groups, and the assessment of outcomes (Wells et al., 2014). Randomized controlled trials, if available, were assessed for risk of bias using the Cochrane Risk of Bias tool (Higgins et al., 2019). The studies were rated as low, moderate, or high risk based on the criteria provided by these tools. This assessment was important for determining the reliability and validity of the findings and understanding the overall strength of the evidence.

5. Data Analysis and Synthesis

The results of the studies were analyzed and synthesized qualitatively to identify overarching patterns and trends. Since this is a narrative review, a meta-analysis was not performed. Instead, the findings were grouped based on thematic categories derived from the research questions. Data was synthesized into a narrative summary to highlight

the most significant contributions, areas of disagreement, and gaps in the literature. Special attention was given to the effectiveness of bioptic telescopes in improving driving performance, particularly in relation to visual acuity and safety.

Eligibility for Driving with Bioptic Telescopes

The legal and medical eligibility for bioptic driving varies by jurisdiction. Many states in the U.S. permit bioptic driving with specific vision criteria, such as a minimum visual acuity threshold (e.g., 20/200 uncorrected, 20/40 through the telescope) and successful completion of training programs (Bowers et al., 2016). In Europe and other regions, regulations differ, reflecting diverse perceptions of safety and adaptation.

Impact on Driving Performance

1. Visual Acuity and Object Recognition

Bioptic telescopes enhance distance visual acuity, improving the driver's ability to recognize road signs, traffic lights, and pedestrians at a distance. Studies indicate that bioptic drivers can meet essential recognition demands comparable to normally sighted individuals when trained adequately (Luo et al., 2011). However, adaptation challenges such as restricted field of view and difficulty in transitioning between telescope and ambient vision remain concerns.

2. Reaction Time and Situational Awareness

While bioptic telescopes improve distance recognition, concerns exist regarding reaction time and situational awareness. Since the telescope provides a magnified yet narrow field of view, quick scanning techniques are essential. Research shows that with proper training, drivers can efficiently use telescopic spotting while maintaining awareness of surrounding traffic (Owsley & McGwin, 2014).

3. Safety and Collision Risks

Safety studies suggest that bioptic drivers do not exhibit a higher crash risk compared to drivers with normal vision when trained appropriately (Bowers et al., 2016). A longitudinal study by Wood et al. (2013) indicated that

bioptic drivers demonstrated safe driving habits similar to those of visually normal drivers. However, improper use or overreliance on telescopic magnification without adaptive training can contribute to driving errors.

Training and Adaptation for Bioptic Driving

Successful bioptic driving requires structured training programs. These typically involve:

- **Pre-Driving Training:** Familiarization with bioptic telescope use for non-driving tasks such as reading distant text and identifying objects (Luo et al., 2011).
- **Simulator-Based Training:** Virtual driving environments help improve reaction times and visual scanning techniques (Szlyk et al., 2000).
- **On-Road Training:** Supervised practice to integrate bioptic spotting into real-world driving scenarios, emphasizing head and eye movements for quick adaptation.

Quality of Life and Psychological Aspects

Restoring driving ability enhances independence, employment opportunities, and social engagement for individuals with low vision. Studies highlight improved confidence and reduced depression among bioptic drivers compared to non-drivers with low vision (Bowers et al., 2016). However, challenges such as stigma, anxiety, and self-perceived competence influence individuals' willingness to adopt bioptic driving.

Limitations and Future Research

Despite the benefits, limitations exist:

- **Field Restriction:** The narrow field of view in telescopes poses challenges in high-speed or complex traffic conditions.
- **Learning Curve:** Extensive training is required for effective and safe use.
- **Regulatory Barriers:** Inconsistent regulations across regions limit accessibility.

Future research should explore improved bioptic designs, augmented reality integration, and real-world driving performance tracking to optimize safety and usability.

Conclusion

Bioptic telescopes offer a viable solution for individuals with low vision to regain driving privileges, significantly enhancing their autonomy and quality of life. Proper training and adherence to safety guidelines are crucial for maximizing benefits while minimizing risks. Continued advancements in technology and regulatory adaptations will further improve access and effectiveness of bioptic driving.

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