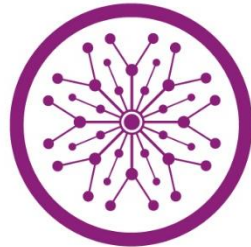


Optometric Perspective on Prevention of Migraine with and without Aura



SUPERIOR UNIVERSITY

**Thesis Submitted to
The Superior University Lahore
In Partial Fulfillment of the
Requirement for the degree of
Master of Science in Allied Health Sciences**

**By
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SU91-MSAHW-F23-079
Session : 2023-2025**

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No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Allied Health Sciences, The Superior University, Lahore in partial fulfillment of the requirements for the degree of Master of Science in the field of “**Allied Health Sciences**” in Faculty of Allied Health Sciences at The Superior University, Lahore.

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DEDICATION

This work is dedicated to my beloved parents and sister, whose unwavering moral and financial support enabled me to pursue my education and reach this milestone.

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In the name of Allah, the Most Gracious, the Most Merciful.

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TABLE OF CONTENTS

Author's Declaration.....	i
Plagiarism Undertaking	ii
Research Completion Certificate	iii
CERTIFICATE OF APPROVAL	iv
DEDICATION	v
ACKNOWLEDGEMENT	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	viii
LIST OF FIGURES.....	ix
LIST OF ABBREVIATIONS	x
ABSTRACT	xi
Chapter 1	1
INTRODUCTION.....	1
RATIONALE OF STUDY	8
AIM AND OBJECTIVES	9
Chapter 2	10
LITERATURE REVIEW	10
Chapter 3	26
METHODOLOGY	26
3.1.ResearchDesign.....	26
3.2.ClinicalSettings	26
3.4.SamplingTechnique	26
3.5. Duration of Study	26
3.6.SelectionCriteria.....	26
3.6.1. Inclusion Criteria.....	26
3.6.2. Exclusion Criteria	26
3.7.EthicalConsideration.....	26
3.9.DataAnalysis	27
3.10. Gantt Chart.....	27
Chapter 4	28
RESULTS	28
Chapter 5	34
DISCUSSION.....	34
CONCLUSION	37
REFERENCES	39
APPENDICES	44
ENGLISH CONSENT FORM.....	44
QUESTIONNAIRE.....	45

LIST OF TABLES

Table	Description	Page no
Table 4.1	Descriptive Analysis of Clinical Patterns Observed among Patients of Migraine and Challenges in Management	29
Table 4.2	Chi-Square Analysis of Associations between Optometric and Migraine Factors	31
Table 4.3	Relationships among Preventive Optometric Strategies, Visual Sensitivity, and Migraine Parameters	33

LIST OF FIGURES

Figure	Description	Page no
Figure 4.1	Demographic Characteristics i.e. a: Gender Distribution of Affected Patients (as Observed by Practitioners), b: Frequency of Migraine Cases Encountered, c: Visual Symptoms Associated with Migraine	42
Figure 4.2	Optometrists' Perspectives on Migraine Prevention Efficacy: a; Effectiveness of Optometric Interventions, b; Role of Optometry in Migraine Prevention, c; Collaboration Effectiveness	43

LIST OF ABBREVIATIONS

IRT	Item Response Theory
VHIT	Video Head Impulse Test
VNG	Video Nystagmography
VM	Vestibular Migraine
CM	Chronic Migraine
NbGL	Narrow-Band Green Light
VIP	Vasoactive Intestinal Peptide
CGRP	Calcitonin Gene Related Peptide
PACAP	Pituitary Adenylate Cyclase Activating Polypeptide
GON	Greater Occipital Nerve
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
BoNT-A	Botilium Toxin Type A
FAZ	Foveal Avascular Zone
MIDAS	Migraine Impairment Disability Assessment Scale
PRT	Photophobia Relief Test
HARE	Headache Related to Refractive Error
MA	Migraine with Aura

ABSTRACT

Introduction: Migraine, with or without aura, is a common neurological disorder that significantly affects patients' quality of life. While conventional treatments often focus on pharmacological and neurological approaches, growing evidence suggests that visual and environmental factors play a crucial role in triggering migraines. Optometry, therefore, holds potential in identifying and managing the contributing factors.

Objective: This study aims to evaluate the role of optometric perspective in the prevention of migraine with and without aura.

Methods: This cross-sectional study was conducted over four months in various eye hospitals in Lahore, using a non-probability purposive convenience sampling technique. A total of 133 optometry professionals were recruited based on a calculated sample size using 95% confidence level and specific migraine proportions. Inclusion criteria focused on practicing optometrists, while those involved in clinical trials or with incomplete responses were excluded. Data were collected through structured questionnaires distributed online and in person. Ethical approval was obtained, and participants gave informed consent. Data were analyzed using SPSS version 27, ensuring confidentiality and anonymity throughout the research process.

Results: Most optometrists reported seeing more migraine cases in females, with visual symptoms like aura and photophobia being common. Uncorrected refractive errors, digital eye strain, and light sensitivity were frequently identified as triggers. While many believed optometric interventions like glasses and blue light lenses could help prevent migraines, their perceived effectiveness varied. Counseling on screen time and visual hygiene was common. Challenges included limited guidelines and patient awareness. Collaboration with other healthcare providers existed but was often rated as only moderately effective.

Conclusion: The study concludes that while most statistical associations between optometric factors and migraine were not significant, trends suggest that visual triggers particularly digital eye strain and uncorrected refractive error may influence migraine frequency. A significant correlation between migraine frequency and perceived effectiveness of optometric interventions highlights the potential role of optometry in migraine management, especially for visually sensitive individuals.

Keywords: Migraine, Aura, Visual Triggers.

Chapter 1

INTRODUCTION

Migraine is a neurological condition that can be paralyzing, migraine is diagnosed using clinical criteria. These criteria have the drawback of failing to adequately account for the variety of migraine, including its underlying genetic and neurological components. Biomarker research has accelerated due to this complexity in an effort to better characterize diseases and find new therapeutic targets. Additionally, we go over the developments in merging and integrating data from several biomarker modalities. Through these initiatives, precision medication is being developed for use with future migraine sufferers. [1]

The distinctive sign of migraine, a common neurologic illness, is periodic episodes of moderate to severe pain in the head, frequently accompanied by light and sound sensitivity, nausea and vomiting. Sometimes an aura brief visual or sensory abnormalities like light flashes, zigzag patterns, or blind spots occurs before a migraine. Although it lacks these early visual cues, migraine without aura is just as incapacitating. About 12% of people worldwide suffer from migraines, which significantly lower quality of life and cause disability. Effective preventive and treatment techniques are crucial because, despite their frequency, the precise processes causing migraines are still not fully understood. According to optometry, avoiding migraines entails locating and reducing visual triggers. Important tactics consist of refractive error correction involves prescribing the proper glasses or contact lenses to lessen eye strain brought on by untreated vision issues. [2]

Migraines continue to be the second most prevalent cause of disability in the globe. The diagnosis, which is made primarily on the history and clinical examination, frequently does not need imaging. Migraines can be divided into a number of groups according to the frequency of headaches and the presence or absence of an aura. Both the migraine itself and its recurrence can be prevented with treatment.[3]

In ophthalmology, photophobia is often defined as an abnormal sensitivity, or intolerance, to light, especially as experienced by the eyes. This description, usually referred to as photo-oculodynia, tries to explain how people with various eye disorders may pathologically find typically innocuous visual stimuli unpleasant. Initially, the definition of photophobia was expanded to include headache or eye pain in order to correctly record the symptoms of migraineurs. Later, it was changed to more accurately reflect what patients felt as a general aversion to light during an attack or an exacerbation of headache by light.

Patients frequently report photophobia as the most incapacitating condition, second only to the headache itself. [4]

This study created an integrated model combining migraine headache intensity scores and the incidence of nausea, photophobia, and photophobia. Two phase 3 clinical studies that were carried out while eletriptan was being developed provided the data. The analysis was limited to the placebo arm. A method based on item response theory (IRT) was contrasted with a traditional proportional odds model.[5]

Migraines, both with and without aura, are debilitating neurological conditions that significantly impact the quality of life. These conditions often present with visual symptoms, such as photophobia, blurred vision, and scotomas, which underline the critical role of optometrists in identifying and managing such cases. This study aims to explore these dynamics, emphasizing the need for interdisciplinary collaboration to enhance patient outcomes and reduce the burden of migraines on individuals and healthcare systems.[6]

Dizziness from migraines is one of the most common complaints. Abnormal eye movements may be the cause of migraine-related dizziness. Possible pathophysiological foundations for migraine dizziness may be highlighted by brain imaging and eye movement alterations. Our goals are to evaluate eye movement using the video head impulse test (vHIT) and video nystagmography (VNG), and to look into the metabolic profile of the occipital lobe in those who have vestibular migraine (VM). [7]

Dry eye (DE) symptoms are common among migraineurs. It is unknown, therefore, if DE profiles are comparable in migraineurs and non-migraine sufferers. To close this gap, we compared the profiles of people with migraine and those who do not suffer either, and we assessed DE symptoms and indicators, including those that could indicate nerve damage, in a sizable cohort of people with DE symptoms.[8]

Despite a number of factors in the mental, physical, and social health domains have been connected to various ocular surface disorders, the majority of emphasis has been focused on aspects of dry eye disease (DED). The symptoms of DED have also been linked to sleep disturbances, which affect both the quantity and quality of sleep. Obesity and the use of face masks are two variables that have been connected to meibomian gland disorders within the category of physical health. [9]

Pulsating headaches are the hallmark of migraine, which is often frequently accompanied by phonophobia, photophobia, and/or gastrointestinal symptoms including nausea and vomiting. Between 15% and 33% of people who suffer from migraines get an aura either before or

during the headache. To the best of our knowledge, migraine with myoclonus is quite uncommon. [10]

Independent neurophysiological links between a number of visual characteristics and headache condition symptoms have been discovered in earlier research. An exposure-based therapy for migraine symptoms may be affected if this is the case and correlations between visual variables and symptoms may be demonstrated. [11]

A neurologic condition known as chronic migraine is linked to significant disability, lost productivity, and a significant global economic cost. New therapies for this frequently difficult illness have dramatically increased during the last five years, including neuromodulatory devices and calcitonin gene related peptide antagonists. [12]

Despite being one of the most prevalent and incapacitating neurological conditions, chronic migraine (CM) is frequently misdiagnosed and inadequately managed. According to one study, just 25% of CM patients were correctly diagnosed, and only 4.5% of people sought medical attention for a migraine, were given a proper diagnosis, and were given minimally effective acute and preventative medication therapies. Migraines are the second most prevalent cause of years spent incapacitated. Accessing care, getting a proper diagnosis, and receiving the right therapy are all extremely difficult for those with chronic migraine (CM). [13]

Nosedá et al. observed almost ten years ago that blue light specifically aggravates migraines in blind individuals with light-sensitive migraines. A novel retino-thalamo-cortical pathway that connects brain regions that process vision to circuits that mediate the classical pain of migraines and to circuits involved in sensory as well as cognitive processing (thinking, memory, and attention) was found in a series of follow-up pre-clinical and clinical studies.

They then noticed that in migraine sufferers with normal vision, narrow bands of light that selectively activate long-wavelength cones or short-wavelength cones (i.e., photoreceptors activated by red and blue light, respectively) make the headache worse, whereas a narrow band of green light (NbGL, 520 ± 10 nm) selectively activates medium-wavelength cones and relieves the headache. On the other hand, NbGL encouraged emotions of calm and relaxation in addition to relieving headaches. Animal studies demonstrating that exposure to NbGL attenuates responses of thalamic trigeminovascular neurons (4) and produces long-lasting antinociceptive effects, possibly by eliciting anti-inflammatory responses or modulating the endogenous opioid system, corroborate these human observational studies. [14]

Migraine is a neurological problem rather than a vascular one. Willis originally proposed the idea that migraine pain resulted from vascular relaxation at the end of the 17th century and

Wolff's early studies that connected the severity of migraine to carotid artery pulsations corroborated this notion. Medication used to alleviate migraine symptoms, such as sumatriptan, also caused vessels that were dilated during migraine episodes to tighten. Furthermore, further research revealed that pharmacologically induced headaches were associated with an enlarged middle meningeal artery, which sumatriptan may counteract. VIP merely causes a little headache and temporary vasodilation, but CGRP and PACAP have been demonstrated to cause migraine-like headaches and prolonged vasodilation in humans. [15]

Exposure to flashing light for instance, has also been recognized as a cause for migraine symptoms. Visual pain is cited by up to 69% of patients as a contributing cause to their attacks. Finding and avoiding triggers has long been the traditional recommendation for preventing migraine episodes. The primary finding indicates that, although the difference was not statistically significant, patients' interictal photophobia diminished following both therapies. Interestingly, the advantages of the Dark phase (light deprivation) appeared to be more rapid than those of the Flash intervention (light exposure), but the latter may have its effects later.

The study also examines the possibility that patients' eyestrain during the Dark intervention may have contributed to the decrease in photophobia, therefore casting doubt on the initial theory.[16]

Photophobia in migraine may be exacerbated by intrinsically photosensitive retinal ganglion cells (ipRGCs), which contain melanopsin. We discovered that the way cone and melanopsin signals are weighted and combined to cause visual pain is the same for migraineurs and non-migraine sufferers. Rather, migraine is linked to an increase in ipRGC signals for pain. Since we did not see an improvement in pupil responses or a shift in other behaviors associated with ipRGC function, this effect of migraine on ipRGC signals is exclusive to photophobia. Our results imply that photophobia in migraine is caused by a postretinal amplification of ipRGC signals. [17]

Validated instruments were used to measure photophobia prior to and one week following the intervention. While there was no discernible difference in the control group, the results indicated that patients who had the GON block had significantly improved photophobia ratings. The variation was not statistically significant, despite the fact that individuals with migraine without aura generally benefited more from the medication. According to these results, GON block could be a helpful treatment for migraine-related photophobia, especially in those who do not have aura. [18]

A very common main headache condition, migraines disproportionately affect women and are a major cause of impairment worldwide, particularly for women who are of reproductive age. With an estimated 45.1 million years lived with disability, they rank sixth among the most incapacitating illnesses globally. Prophylactic and acute (abortive) therapies are the two main categories of migraine therapy. Although triptans and NSAIDs are frequently used for short-term relief, the latter are frequently better tolerated over the long term, even if they are contraindicated in some individuals. [19]

The part that vascular dysfunction plays in the pathogenesis of migraines, indicating that nociceptors may be activated to produce headache pain by cerebral artery dilatation followed by distal microvessels constriction. 240 individuals are involved in this randomized, double-blind, placebo-controlled study, which evaluates secondary outcomes such as photosensitivity and vascular biomarkers in addition to changes in migraine patterns during a 12-week period. These nutraceuticals may provide a safe, non-pharmacologic preventative alternative for migraine treatment if they prove to be successful. [20]

A debilitating neurovascular condition, migraine frequently strikes people in their prime working years. It has been proposed that ischemia damage to ocular tissues, which may be evaluated using optical coherence tomography (OCT), is caused by transient vascular alterations during migraine attacks. In a recent study, the thickness of the right inferior parafoveal ganglion cell layer was significantly reduced in migraineurs compared to healthy controls. Although there were thinning patterns in some retinal and choroidal assessments, these trends fell short of statistical significance. [21]

Botulinum toxin A (BoNT-A) commonly used to treat persistent migraines, has also showed promise in reducing related symptoms such dry eye and photophobia. After receiving BoNT-A therapy, 76 migraine patients in a retrospective research showed a considerable reduction in their photophobia and dry eye symptoms, especially those who had severe baseline dry eye. The fact that these benefits were unaffected by the amount of the tear film points to a neurological substrate rather than an eye surface defect, most likely involving common trigeminal pathways. [22]

The relationship between migraine and dry eye disease (DED), a major retrospective case-control study with over 72,000 patients revealed that comorbid DED was much more common in migraineurs. After controlling for confounding variables, migraineurs had 1.42 times the odds of developing DED. Despite the inability to prove causation, the results point to a significant clinical correlation, suggesting that migraineurs may be more susceptible to DED and that treating both disorders at the same time may be beneficial. [23]

A common and frequently incapacitating symptom of migraine, traumatic brain injury (TBI), and dry eye disease (DED) is photophobia. These disorders often co-occur and may have similar neurological causes, such as central nervous system and peripheral nervous system dysfunction. Across all illnesses, photophobia has been tightly associated with the neuropeptide calcitonin gene-related peptide (CGRP). Even while modern therapies like botulinum toxin, CGRP inhibitors, and specialty eyeglasses provide some relief, many patients still have chronic difficulties. This emphasizes the need for new, neurologically based treatments to cure photophobia, especially in DED patients who don't respond to traditional therapy. [24]

Head discomfort and related symptoms including nausea, vomiting, photophobia, phonophobia, and occasionally vision problems are hallmarks of this complicated neurological condition. According to research, migraine is often linked to magnesium deficit in blood and cerebral fluid, which may play a major part in the pathophysiology of the condition. With growing interest in transdermal magnesium distribution as a therapeutic alternative, magnesium has therefore been extensively researched and utilized in the prevention and treatment of migraines. [25]

The evidence points to a common pathophysiological process, perhaps including peripheral and central sensitization through trigeminal pathways, despite several limitations, such as the use of self-reported data and diagnostic codes. Future treatment strategies may be guided by this overlap, especially for individuals who come with overlapping symptoms like photophobia, hyperalgesia, or ocular discomfort that cannot be well explained by tear film insufficiency alone. [26]

A research examined the relationship between the degree of photophobia and several elements of impairment and productivity in migraineurs using data from the American Registry for Migraine Research (ARMR). The results showed a clear correlation between higher photophobia ratings and increased disability related to migraines, decreased productivity at work, and impaired everyday activities. These findings underline the need for focused interventions to regulate light sensitivity in this population and emphasize photophobia as a significant and sometimes overlooked factor to the burden of migraine. [27] Researchers examined structural and vascular alterations in the retina of migraineurs thanks to recent developments in ophthalmic imaging, including spectral domain and swept-source optical coherence tomography (OCT) and OCT angiography. The possible effects of migraine on ocular tissues have been highlighted by OCT angiography, which has also shown indications of vascular dysregulation and microstructural damage in migraine-affected eyes.

It is therefore challenging to make definitive judgments on the degree and clinical relevance of retinal changes in migraine. These findings, however, are pertinent to clinical practice as they might help eye care professionals monitor and treat patients who have a history of migraines, especially if there are mild visual symptoms.[28]

It was a case-control study with 60 patients with neurological migraine diagnoses and 60 matched controls. Every participant had a retinoscopy to measure refractive error and a routine headache screening. The results showed that there were no appreciable variations in spherical error or spherical equivalent across groups. Astigmatism was the only variable that was shown to be substantially linked with migraine in multiple logistic regression analysis ($p=0.04$). These findings imply that those with migraine may have greater or uncorrected astigmatism more frequently. Thus, it is advised that migraineurs undergo routine optometric testing to make sure their refractive problems are appropriately detected and fixed. [29]

In a cross-sectional research that looked at this idea, contrast discrimination thresholds were assessed in 30 individuals aged 21–34 and 196 participants aged 10–17. These findings imply that visual processing continues to develop throughout adolescence and that perceptual systems may be modified by changes in neurotransmitter activity throughout this period. Interpreting visual symptoms in disorders like migraine, which frequently appear or worsen in adolescence and are linked to altered sensory processing, requires an understanding of these age-related variations. [30]

The vast majority of optometrists were not aware of any validated screening measures, despite the fact that the majority reported actively asking about migraine and feeling competent in recognizing it. Nearly half of the participants in the follow-up research incorporated the ID-Migraine tool into their practice after the educational intervention, and the majority expressed a strong desire to keep using it. These results demonstrate that when given easily available and useful materials, optometrists are both willing and able to incorporate migraine screening into standard care. [31]

RATIONALE OF STUDY

This study aimed the potential of optometry in reducing migraines with an emphasis on environmental variables and visual strain. In order to manage migraines holistically, it sought to assess optometric therapies. The findings, which may emphasize optometrists' proactive role in migraine prevention, may improve management practices.

AIM AND OBJECTIVES

To evaluate Optometric Perspective on Prevention of Migraine with and without Aura.

Chapter 2

LITERATURE REVIEW

A 2022 research paper by A. R. Artemenko, E. Filatova, Y. D. Vorobyeva, T. P. Do, M. Ashina, and A. B. Danilov suggests that light is frequently reported as a migraine trigger, though this may be a case of false attribution. As a result, prospective validation is necessary to prevent unwarranted avoidance. To bridge existing knowledge gaps, future research should examine both the direct and indirect effects of sunlight and other environmental factors on migraines. This would support the development of evidence-based treatment approaches applicable in healthcare settings, workplaces, and other environments.[2]

To investigate the underlying cause of photophobia in individuals with migraines, a study conducted in 2019 analyzed the electrical waveforms produced in the retina and visual cortex of forty-six interictal migraineurs and compared them to those of forty-two healthy controls. These findings suggest that heightened light sensitivity in migraineurs may primarily originate from the retinal rods rather than the retinal cones or the visual cortex. Clinically, this insight may help explain why individuals with migraines perceive even dim light as excessively bright, while those without migraines experience normal lighting conditions, making their environment feel much darker in comparison. [4]

A total of seventy-three primary studies, eleven review articles, and eight meta-analyses were found focusing on the optical and vascular outcomes in migraine patients. The findings consistently demonstrated that migraineurs had an increased foveal not vascular zone (FAZ) (as determined by OCTA), decreased retinal artery density, and decreased retinal thickness (as determined by OCT). Additionally, these retinal Patients with chronic migraine and migraine with aura showed more noticeable changes than those with episodic migraine and migraine without aura. Certain regions, like the fovea, seemed to be especially susceptible to these vascular alterations. Although general conclusions are consistent, methodological and analytical variation make direct comparisons between research difficult. Based on the information that is currently available, optical coherence tomography and OCTA may function as retinal indicators in migraineurs. [6]

The study was divided into two groups. The first group included 25 people with vestibular migraines (VM) who met the most recent Barany Society criteria. Twenty healthy volunteers of the same age made up the second group. Among the patients, twenty-eight percent reported positional vertigo, while sixty-eight percent experienced spontaneous vertigo. Ninety-two percent exhibited non-paroxysmal positional nystagmus during dizziness

episodes. In seventy-two percent of the cases, the brain MRI revealed no abnormalities. Additionally, ninety-two percent of VM patients demonstrated chemical changes in the occipital lobe. Statistical analysis showed a correlation between lactate peaks and the presence of non-paroxysmal positional nystagmus. A strong statistical correlation was found between non-paroxysmal positional nystagmus and lactate maxima in the occipital cortex of patients with VM. [7]

A planned cross-sectional study of DE symptoms in Miami VA patients was conducted. Thirty-one out of two hundred fifty individuals met the International Classification of Headache Disorders criteria for migraine, based on a validated test. Migraine sufferers were notably younger (fifty-seven years vs. sixty-two years) and more likely to be female (twenty-six percent vs. six percent) compared to the control group. When compared to controls, migraineurs exhibited more severe DE symptoms and ocular pain (mean Ocular Surface Migraineurs demonstrated a unique DE symptom profile but a similar DE sign profile compared to controls without migraine. This suggests that nerve dysfunction, rather than abnormalities of the ocular surface, may be the underlying cause of DE symptoms in individuals with migraines. [8]

Cross-sectional studies have established a connection between DED and chronic pain syndromes, such as fibromyalgia, migraine, and chronic pain syndrome, with a primary emphasis on DED symptoms. The strongest correlations identified were between alcohol consumption and tear film disturbances along with DED symptoms, cocaine use and reduced corneal sensitivity, and tobacco use and tear instability. [9]

A uncommon case of migraine with aura and myoclonus is described in this report. The patient, a 46-year-old man, experienced a pounding headache on his right side, vomiting, and a visual aura. Involuntary motions of the left lower extremities started as the headache got worse. The myoclonus and ocular problems had totally gone by the day following hospitalization. By the third day, the headache was gone. [10]

A study was conducted to examine the relationship between seasonal variations in migraines and photophobia. Data on visual triggers, visual symptoms, and interictal light sensitivity were gathered using a cross-sectional online survey. The findings indicated a significant difference in interictal light sensitivity and photophobia across the three participant groups ($P < .001$, eta squared [η^2] = zero point zero eight four). A chi-square test of independence ($P < .001$) demonstrated a significant association between photophobia and visual aura in individuals with headache disorders, as eighty-six out of one hundred thirty-six participants reported experiencing both or neither of the visual symptoms. These findings suggest a link

between specific visual stimuli and individuals prone to headaches, highlighting the potential for further research into exposure-based therapies for migraine management. [11]

The epidemiology, diagnostic standards, and risk factors for chronic migraine are described in this review. It covers the benefits and drawbacks of evidence-based medication and non-pharmacological treatments as well as the fundamentals of patient-centered care for adults with chronic migraine, paying particular attention to comorbidities and differential diagnosis, clinical reasoning, initiation and monitoring, cost, and accessibility. Lastly, it addresses how to treat chronic migraine in certain groups, such as children, pregnant women, and the elderly, and it takes into account upcoming issues and new findings in the area. [12]

The study was carried out in two stages among NbGL Lamp buyers. Buyers of the Lamp were requested to engage in a week-long diary study and fill out a survey during Phase I. In particular, after utilizing the NbGL during acute episodes, individuals were asked to utilize their judgment, impression, and perception to determine if their headaches had improved or not.. According to an open-label, real-world study, using a lamp during a migraine episode may help with pain and photophobia alleviation, anxiety reduction, and better sleep. The rigor of this interpretation is limited by the lack of a blinded simultaneous control population and a thorough diagnostic. The respondents' improvements in headaches may take precedence over improvements in photophobia, anxiety, and sleep. [14]

Wolff, who linked the intensity of migraine to carotid artery pulsations, backed the historical view that migraine was predominantly a vascular condition, which Willis originally put forward in the 17th century. This theory was further confirmed by the efficacy of vasoconstrictive medications like sumatriptan, which prevented the dilatation of cranial arteries like the middle meningeal artery that is seen during migraine attacks. Notably, VIP resulted in modest aversion and somewhat brief vasodilation. Despite corrected blood pressure, CGRP-induced light aversion persisted. Caffeine and endothelin-1, two of the agents, did, however, lessen the intensity of light aversion. According to the proposed hypothesis, perivascular CGRP causes mice to exhibit light aversion through both vasomotor & non-vasomotor processes. [15]

A research on photophobia in migraineurs that especially looks at how exposure to and lack of light affects the condition. Out of 147 screened individuals, 21 were included—10 migraine patients and 11 healthy controls A notable point is that the exclusion process was stringent, with 126 potential participants being ruled out due to various factors, such as age, psychiatric conditions, or insufficient photophobia severity. At baseline, flickering light induced activation in V1 was higher in patients than in controls; however, activation

normalized after the Flash and Dark interventions. Mean interictal photophobia decreased after both interventions, but differences relative to the baseline did not survive correction for multiple comparisons. [16]

Three groups of 20 volunteers, each were the subjects of our study. Participants were gathered through digital social media and ranged in age from 25 to 40. The Penn Online Evaluation of Migraine, which applies the International Classification of Headache Disorders-3-beta criteria, was used to create the headache classification. It was also necessary for migraineurs to support interictal photophobia. Our research shows that light-induced discomfort is a signal that combines melanopsin and cone inputs rather than being the result of melanopsin's sole action. By locating key areas where log changes in modeled ipRGC contrast are associated with linear modulations of neuronal activity, the modeling technique we used here offers a way to explore this localization. [17]

Photophobic migraineurs who visited a headache clinic were included in this observational, prospective case-control research. There were 41 individuals in the trial; 13 were controls and 28 were given the GON block. There were no discernible variations in the groups' initial photophobia ratings. Although the results were not statistically significant, migraine patients without aura seemed to gain more from the intervention than those with aura. There were no discernible changes on the other evaluated scores after the intervention. According to these results, GON block could be a useful treatment option for reducing photophobia in migraineurs, especially those who don't have aura. [18]

In 2020, a study was conducted by A.A. Berger, A. Winnick, D. Popovsky, A. Kaneb, K. Berardino, A. M. Kaye, et al. Migraines are a common kind of primary headache that disproportionately afflict women (17.4% and 5.7% of the US population, respectively, for a total of 12%). In addition to significant medical expenses, they are linked to high rates of morbidity and disability. They are estimated to be responsible for 45.1 million years of living with a disability, or 2.9% of the years lost to disability globally. For conventional abortion, the first line of treatment is usually non-specific analgesics and NSAIDs, which are helpful in lowering mild to moderate episodes. For severe incidents, the triptans and other 5HT (1)-agonists are commonly utilized as second-line therapies. [19]

In 2023 a study concluded that an increased sensitivity to light and sound, frequent throbbing headaches, and nausea are the hallmarks of migraine, a common and upsetting neurological disorder. The study protocol involves administering two nutraceutical-based treatments orally as a preventive measure for chronic, recurrent migraines, allowing for a direct clinical assessment of outcomes. However, the research has certain limitations, including a fixed-dose

regimen for each treatment group and the absence of in vivo radiological techniques such as MRI, which could provide insights into cerebrovascular changes related to the treatment outcomes. [20]

In a study conducted in twenty twenty-three, researchers recruited twenty-nine participants, including thirteen individuals with migraines (average age: twenty-eight years, plus or minus eight point eight years; twelve females and one male) and sixteen age-matched controls (average age: twenty-six point six years, plus or minus six point nine years; nine females and seven males). A licensed optometrist performed a detailed eye examination and administered the Migraine Impairment Assessment for each participant. No significant differences were observed in other ganglion cell layer parameters, including choroidal thickness. Additionally, no significant correlation was found between MIDAS scores, headache frequency, and ocular thickness measurements. The study concluded that individuals with migraines exhibited a notably thinner right inferior parafoveal ganglion cell layer, while other parameters did not show significant differences. [21]

There was no observed correlation between pre-injection PRT findings and pre-injection ratings of migraine, photophobia, or dry eye symptoms, even though these symptoms showed significant associations (p less than zero point zero five). After receiving BONT-A treatment, improvements in dry eye, migraine, and photophobia symptoms were significantly linked (p less than zero point zero five), but these improvements did not correspond to pre-injection PRT scores. Overall, BONT-A treatment led to a significant reduction in photophobia among migraine patients undergoing therapy, as well as a noticeable decrease in dry eye symptoms in those with severe baseline symptoms, regardless of initial tear film volume. [22]

72,969 patients over the age of 18 from medical institutions connected with the University of North Carolina were included in this retrospective case-control research between May 1, 2008, and May 31, 2018. These findings suggest that DED is more prevalent among migraine sufferers than in the general population. While this association indicates a potential increased risk of DED in individuals with migraine headaches, it should be noted that the relationship may not be causal, as the results could be influenced by unknown confounding factors. [23]

In addition to being common in the population as a whole, photophobia is a common co-occurring symptom of DE, migraine, and TBI. In all three cases, neuronal dysfunction of peripheral and centrally located components is associated with photophobia in humans and several animal models. Patients with chronic photophobia, particularly those with DE whose symptoms are not managed by conventional medications, should be evaluated for treatment

approaches that target brain pathways (e.g., oral neuromodulators, transcutaneous nerve stimulation). [24]

The pathophysiology of migraine is significantly influenced by magnesium deficiencies. Magnesium has been widely used to prevent and cure migraines. With a focus on transdermal magnesium administration, this review outlines the function of magnesium in migraine pathophysiology as well as possible applications of magnesium in migraine prevention and therapy. [25]

Both migraine and dry eye are common ailments that have a big impact on society and the economy. Clinically, individuals with dry eye symptoms may also show symptoms of migraine, such as photophobia, hyperalgesia (pain in reaction to touch or wind), and increased periorbital receptive fields. These symptoms suggest that dry eye disease has a neuropathic component that is consistent with the pathophysiology of migraines. The review supports the idea of treating nerve abnormalities and stresses the significance of evaluating nerve function in those with dry eye complaints. Clinicians may be able to improve results for some dry eye patients by utilizing treatments that have been shown to be beneficial in reducing migraine discomfort. [26]

The study used the Photosensitivity Assessment Questionnaire (PAQ) to measure the intensity of photophobia and investigated its relationship to migraine-related disability using the Migraine Disability Assessment (MIDAS) and work-related outcomes using the Work Productivity and Activity Impairment (WPAI) questionnaire. The results of this study highlight how much photophobia affects migraineurs' day-to-day life. Of the 1,084 individuals, those with more severe photophobia reported more substantial activity limits, more absenteeism, and worse job impairment. The relationship between photophobia and headache frequency, severity, and the presence of anxiety and despair exacerbated these effects even more. In view of photophobia's involvement in decreasing job productivity and raising migraine-associated disability, the study emphasizes the necessity of treating it as part of an all-encompassing strategy to migraine therapy. [27]

McKendrick and Nguyen (2022) evaluated the results of recent ocular imaging to determine retinal involvement in migraineurs in their narrative review. Subtle structural alterations in the retina are highlighted in the review using data from OCT angiography and spectral domain and swept source OCT. Notwithstanding these drawbacks, the authors stress the need of raising awareness among eye care providers and offer useful recommendations for the observation and treatment of migraine patients, promoting an integrated strategy that takes into account both neurological and ocular health indicators. [28]

Patients who believe that visual abnormalities might serve as migraine headache triggers are frequently seen by optometrists. In order to address this clinical problem, Momeni Moghaddam et al.'s study from 2022 investigated the possible connection between migraine and refractive defects. It compared 60 patients with neurologically diagnosed migraines to 60 age- and sex-matched controls who did not have migraines in a case-control study. Retinoscopy was used to measure the refractive errors, and because of the strong association between the eyes, only the data from the left eye was examined. One noteworthy discovery, though, was that the migraine group's mean astigmatism was significantly greater than the controls'. In the final logistic regression model, astigmatism was the sole significant variable, indicating a possible association between uncorrected astigmatism and the incidence of migraines. Optometrists may help avoid migraines by treating minor visual abnormalities, which would promote a more comprehensive approach to migraine treatment. [29]

Perceptual center-surround contrast suppression, a visual phenomena in which the presence of a surrounding pattern lessens the apparent contrast of a core pattern with similar characteristics, was examined by Nguyen et al. (2023) in order to understand its developmental history. Their cross-sectional study, which involved 30 adults and 196 adolescents between the ages of 10 and 17, sought to determine how processes of visual suppression change as people grow. The findings showed that contrast suppression strength significantly varied with age, with early adolescents (particularly those between the ages of 12 and 13) showing much poorer suppression than adults. The results are especially pertinent to disorders involving disturbed excitatory-inhibitory balance in the brain, such as migraine. It is crucial to comprehend these developmental shifts in visual perception because they might serve as early warning signs for neurological disorders like migraines and guide age-appropriate therapeutic or preventative measures that focus on visual cortex function. [30]

During normal eye care visits, Nguyen et al. (2020) investigated the function of optometrists in detecting undiagnosed migraine patients and assessed the effect of educational interventions on enhancing migraine screening practices. According to their cross-sectional study, the majority of optometrists (92%) were not aware of validated migraine screening tools like the ID-Migraine questionnaire, despite the fact that a significant portion of them (81%) asked about migraines during clinical assessments and that many of them felt confident in identifying migraine (72%). The detection and treatment of migraine, especially those that may manifest with ocular symptoms, can be greatly improved by providing optometrists with basic tools and information. Timely diagnosis and referral will eventually improve patient outcomes. [31]

Headaches related to accommodative spasm (AS), convergence insufficiency (CI), and refractive error (HARE) are common ocular causes of headaches. Frontal headaches are a common symptom of these disorders, and they tend to get worse near the end of the day, especially after prolonged visual activity. Corrective lenses are the main tool used to treat HARE, which is usually more severe in people with greater levels of uncorrected refractive error. On the other hand, CI and AS can cause more severe symptoms like strabismus and diplopia and call for more involved treatments including prism correction, medication, orthoptic exercises, or even surgery. [32]

A complicated and poorly understood sensitivity to light, photophobia is frequently seen in neurological and ophthalmological conditions, especially in migraineurs. It is now known that these symptoms result from aberrant photic signal processing that involves both non-image-forming (melanopsin-mediated) and conventional image-forming (cone and rod) visual pathways. [33]

Over 35 million Americans suffer from migraine headaches, which are the third leading cause of disability globally. They have a negative impact on quality of life and have major financial repercussions. The four forms of migraine headaches are rhinogenic, occipital, temporal, and frontal. Every kind has a trigger point that is clearly documented. Botulinum toxin type A may be an effective treatment for migraine headaches, which frequently do not improve with medication. Another approach for releasing trigger sites is migraine surgery. An average success rate of 90% was observed in a comprehensive evaluation of the literature on migraine surgery, with migraines either completely eliminated or improved by more than 50% following the procedure. [34]

Although the exact pathophysiological cause of white matter hyper intensities (WMHs) is still up for dispute, they are frequently seen in those who have migraine with aura. The elevated incidence of ischemic stroke and endothelial dysfunction in this group support the vascular etiology suggested by some research, while non-vascular factors including inflammation have also been suggested. This finding, which is consistent with previous studies reporting a high prevalence of thrombophilic conditions in this group, suggests the need for comprehensive thrombophilia screening in affected individuals. It also calls for further research to clarify management strategies, particularly regarding patent foramen ovale and paradoxical embolism. [35]

Visual disturbances including photophobia, aura, and ocular pain are common among migraine patients and can affect visual quality of life (VQoL). According to the HIT-6 questionnaire, photophobia and dry eye symptoms were also substantially linked to a higher

influence on headaches. According to these results, dry eye may be a manifestation of allodynia, a hypersensitive condition that is known to occur in chronic migraine, and it may play a major role in the intensity of headaches as well as visual discomfort. The authors highlight a significant but frequently disregarded target for optometric intervention by suggesting that treating dry eye symptoms may enhance VQoL and lessen the overall suffering of migraine. [36]

Often misdiagnosed as ocular, headaches and face pains are seen in emergency rooms and outpatient clinics, especially when they coexist with visual or periocular issues. The diagnostic difficulties that occur in eye care settings when primary headache diseases, including tension-type headaches or migraines, resemble symptoms usually associated with ocular pathology are highlighted by Pandey et al. (2023). This overlap can result in incorrect diagnosis and improper treatment, which prolongs patient suffering and delays the start of efficient therapy. The study offers ophthalmologists and optometrists a methodical way to distinguish between primary headache syndromes and actual headaches of ocular origin. It promotes a thorough visual and neurological evaluation, a meticulous clinical history, and awareness of warning signs that call for an immediate referral. [37]

Patzkó et al. (2024) investigated the neurovascular changes in the retina and optic nerve head in order to better understand the ocular consequences of migraine, among those who suffer from episodic migraine. The results add to the mounting evidence that migraine is a neurological disorder with vascular dysfunction that may potentially affect the visual system. This emphasizes how crucial it is to perform regular ocular examinations for migraineurs, especially when there are no visual symptoms. In addition to helping to better understand the pathogenesis of migraines, these tests may also be used as non-invasive biomarkers for risk assessment and illness monitoring. [38]

The conundrum of migraine's high frequency and great genetic persistence in spite of its incapacitating character is examined by Pensato et al. (2023). According to the authors, migraine is an adaptive evolutionary reaction to an imbalance in brain energy rather than just a pathological disease. They contend that migraineurs' brains are more susceptible to stimuli that drain energy stores because they have metabolic vulnerabilities and inter-ictal cortical hyperexcitability. The study makes the case that migraine may have had a survival role by encouraging energy saving during times of metabolic stress, according to a more comprehensive evolutionary and biobehavioral viewpoint. However, these defensive reactions can turn maladaptive and cause migraine chronification if they are activated too frequently as a result of ongoing stress or environmental overload. According to this theory,

episodic migraine could be a remnant of a once-helpful biological defense, while chronic migraine is a breakdown of adaptive control. [39]

Pinheiro et al. (2020) looked at how migraine-affected women's postural control and photophobia relate to one another. In order to evaluate their balance while standing quietly, the study contrasted 14 migraineurs with 14 non-migraine controls in various lighting scenarios. The lighting conditions were extreme visual discomfort (2000 lx), visual discomfort threshold (400 lx), and ambient light (270 lx). The findings demonstrated that under all lighting conditions, but particularly at higher light intensities, migraine patients exhibited much more postural sway (as shown by the sway area of the center of pressure). This has therapeutic implications for migraine management that go beyond pain management since environmental changes (such changing the lighting) may be taken into consideration to enhance everyday functioning and lessen discomfort in this population. [40]

Using spectral domain optical coherence tomography (SD-OCT), Raga-Martínez et al. (2022) carried out a cross-sectional observational research to assess structural alterations in the retina of individuals with chronic migraine. Ninety chronic migraine sufferers and ninety age- and sex-matched healthy controls were compared for retinal nerve fiber layer (RNFL), ganglion cell layer (GCL), and macular thickness. The macula, RNFL macular, and GCL mean thicknesses were all lower in chronic migraine sufferers than in controls ($p < 0.05$), and the superior quadrant of the peripapillary RNFL was significantly thinner. These results imply that, maybe as a result of recurrent migraine episodes altering the visual pathway, chronic migraine may be linked to detectable neurodegenerative alterations in the retina. For identifying these alterations, optical coherence tomography seems to be a useful, non-invasive diagnostic technique. The work emphasizes the need for more research to establish OCT's value in the diagnosis and monitoring of chronic migraine and supports the potential relevance of retinal thickness measures as a biomarker for axonal damage in migraine. [41]

In their case-based analysis, Rodrigues and Gouveia (2022) highlighted an uncommon but important complication: chronic monocular vision loss in migraine patients. The study highlights cases when individuals suffer from long-lasting or even permanent visual impairment in one eye, despite though visual abnormalities in migraine, especially migraine with aura, are usually temporary and bilateral. This article highlights the possibility of severe ocular consequences and expands the clinical range of migraine.[42]

Using optical coherence tomography angiography (OCTA), a non-invasive imaging method that visualizes the retinal and choroidal microvasculature, Romozzi et al. (2023) examined the microvascular involvement in migraine. The purpose of the study was to determine if

migraineurs, particularly those who have aura, exhibit quantifiable alterations in the retinal microvasculature that would be indicative of cerebral or systemic vascular dysfunction. These results lend credence to the theory that migraines are caused by systemic microvascular malfunction, which is seen in the retina as well as the brain. The work indicates a connection between changes in the cerebral and retinal microvasculature and the pathophysiology of migraine, and it supports the usefulness of OCTA as a possible technique for identifying vascular modifications in migraine patients. [43]

A retrospective observational study was carried out by Schiano di Cola et al. (2022) to evaluate the efficacy of galcanezumab, a monoclonal antibody that targets CGRP, in treating ictal photophobia and migraine frequency. Enrolled patients had been receiving monthly galcanezumab medication for at least six months and had a history of severe photophobia during migraine attacks. Remarkably, ictal photophobia was significantly reduced in 68.1% of patients, with many reporting relief in the first month of treatment. Patients with episodic migraines and those who responded well to triptans had a stronger reaction. These results highlight the long-term advantages of CGRP antagonists, such as galcanezumab, in reducing the frequency of headaches and easing incapacitating sensory complaints, both of which enhance the general quality of life for patients. [44]

Experimental studies have shown that the strength of cortical spreading depression (CSD), a wave of neuronal and glial depolarization thought to be responsible for the aura phenomena, decreases with age. Among the 343 patients who were examined, younger people were far more likely to display classic aura characteristics including headache with photophobia or phonophobia, gradual start, consecutive symptoms, and protracted persistence. These results highlight how aura and headache characteristics diminish with age, which could make it more difficult to diagnose MA in older patients. In terms of clinical practice, this emphasizes the necessity of increased awareness and careful evaluation when distinguishing MA from vascular events such as stroke in older adults. [45]

Although the role of CGRP has been well investigated in the pathophysiology of adult migraines, little is known about its relevance in pediatric headache problems. By measuring blood CGRP levels in children with migraine and tension-type headache (TTH) during the interictal period and comparing them to healthy age-matched controls, Sekelj Fures et al. (2024) sought to close this gap. 178 people were recruited for the study, who were then further stratified by age at which headaches began (<7, 7–12, >12 years), and split into three groups: migraine (n = 66), TTH (n = 59), and control (n = 53). The results provide credence to the idea that CGRP is involved in the pathogenesis of juvenile migraine and that age and

aura phenotype may have an impact on its expression. This may help direct the development of targeted therapeutics for juvenile migraineurs and highlights the significance of age-specific biomarker profiling in pediatric headache diagnoses. [46]

By specifically inhibiting the calcitonin gene-related peptide (CGRP) receptor, a crucial element in migraine pathophysiology, ubrogepant offers a new development in the acute treatment of migraine. The patient's headaches were severe (rated 7.5/10), frequent (10–12 days per month), and extended (lasting 36–60 hours) before to ubrogepant. As indicated by her high MIDAS score, these headaches severely hindered her ability to operate on a daily basis. The patient's condition significantly improved after starting ubrogepant treatment. After less than five months of treatment, her migraine frequency declined to five days per month, its duration decreased to less than twelve hours, and its severity decreased to three out of ten. These results add to the increasing amount of research demonstrating the potential of CGRP-targeting medications to customize and enhance migraine treatment, especially in chronic or resistant instances. [47]

Over one billion people worldwide suffer from migraines, a neurological condition that is widely acknowledged as a leading cause of disability. The epidemiology of migraine is complicated and impacted by several factors, such as socioeconomic level, geography, sex, race, ethnicity, and education. Although it is yet unknown whether these elements are the main causes of migraines or their effects, or more likely, both, they are closely related. The interplay between migraine manifestation and these environmental and demographic factors emphasizes the necessity of focused public health initiatives. To separate these associations and find modifiable risk variables, further epidemiological research is crucial. In groups at risk of developing chronic migraine, this may open the door to early intervention, which would lessen disability and enhance quality of life. [48]

This case report uses optical coherence tomography (OCT) to provide strong evidence that migraine episodes are caused by retinal ischemia. The results show retinal changes that coincided with a migraine attack that resulted in monocular vision loss, including acute inner retinal thinning, hyperreflectivity in the photoreceptor layer, and greater structural demarcation of retinal layers. These OCT characteristics point to a distinct mechanism of migraine-induced retinal damage since they differ from those seen in more prevalent retinal vascular disorders like central retinal artery blockage or Susac syndrome. These observations highlight how crucial it is to perform a thorough ocular examination on patients who exhibit visual loss during migraine attacks. [49]

The patient in this case study is a 35-year-old woman who has migraine with aura and MRI evidence of small-vessel ischemic alterations. Transesophageal echocardiography with a bubble study verified the grade 4 PFO and high RoPE score found in the diagnostic workup. This instance highlights how crucial it is to take cardiac examinations into account when young individuals present with migraine and aura, especially if neuroimaging shows ischemia abnormalities. This data supports new research that indicates some patients, particularly those with high RoPE scores and ischemia findings, may benefit from interventional closure, even though routine PFO closure is not currently advised only for the treatment of migraines. To determine which subgroups of migraineurs might benefit clinically from such cardiovascular treatments, more research is necessary.[50]

After traumatic brain injury (TBI), photophobia, also known as light sensitivity, is a common and incapacitating symptom that has a major negative impact on a patient's quality of life and functional independence. This review highlights the multifaceted character of photophobia by synthesizing existing views on its pathogenesis. The research also emphasizes how TBI patients frequently have co-occurring illnesses including migraine and dry eye, which can make photophobia symptoms worse. According to This, a thorough and interdisciplinary approach is essential for the differential diagnosis and treatment of post-traumatic photophobia because of the complex interactions between brain and ocular variables. This comprehensive viewpoint is essential for helping doctors design interventions that target the various systems at play, which may improve long-term results for those with chronic photophobia following brain injury. [51]

In their 2020 study, Venkateswaran et al. investigated how periocular injections of botulinum toxin A (BoNT-A) affected photophobia and ocular discomfort in patients who did not have migraines but had neuropathic ocular pain symptoms as burning, dryness, and light sensitivity. These results imply that the positive effects of BoNT-A on dryness and photophobia can be mediated by neuromodulatory processes separate from changes in the ocular surface. This demonstrates how BoNT-A may be used therapeutically to treat neuropathic-like ocular symptoms, expanding the scope of treatment beyond migraineurs to include people with photophobia and refractory ocular discomfort. [52]

Menstrual migraine, a unique subtype of migraine that is closely linked to menstruation, affects between one-fifth to one-quarter of female migraineurs in the general population. In specialized headache clinics, the number can reach seventy percent. Compared to their non-menstrual migraine episodes, women who suffer from menstrual migraines typically experience perimenstrual attacks that cause noticeably more disability. Interpreting treatment

results is further complicated by the fact that many clinical trials do not clearly discriminate between migraines that coincide with menstruation by coincidence and those that actually qualify as menstrual migraines. Given the unique pathophysiology of menstrual migraine and the significant hardship it places on afflicted women, more targeted study is desperately needed. A large percentage of female migraineurs who suffer from this difficult ailment may find their quality of life improved with increased research funding in this area. [53]

Although migraine is well known for its characteristic headache, the condition also includes a wide range of related symptoms that frequently cause greater distress than the headache itself. Allodynia (pain from ordinarily non-painful stimuli), vertigo, osmophobia (sensitivity to odors), and phonophobia (sensitivity to sound) are some of these symptoms. This expanded knowledge emphasizes necessity of considering migraine as a complex illness, encouraging a more thorough and cohesive approach to both its pathogenesis and treatment. [54]

Patients frequently complain of headaches when they see optometrists, but little is known about the connection between headache and refractive problems, especially when employing comprehensive and in-depth classification criteria. The practical value of the results from earlier research on this subject has been diminished by small sample numbers or limited diagnostic categories. By analyzing a sizable sample of people between the ages of 10 and 40 in a clinical optometry context, the current study fills this knowledge gap by investigating relationships between the presence of headaches and particular types of refractive errors as well as headache subclassifications according to anatomical location. The study discovered that among participants with headaches, temporal and temporo-frontal headaches were the most commonly reported pain regions. Comprehensive refractive error profiling and extended headache classification may enhance diagnosis and treatment approaches, possibly lessening the impact of headaches. In order to enable uniform, comparable data collecting in subsequent studies on the relationship between refractive errors and headaches, the study also emphasizes the necessity of a standardized research protocol. [55]

One of the main symptoms of migraines is photophobia, which greatly increases the suffering and impairment of the patient. The exact mechanisms driving photophobia are still not well known, though. Wilkins et al. (2021) draw attention to the function of intrinsically photosensitive retinal ganglion cells (ipRGCs), which are sensitive to light intensity and have been linked to the development of conventional photophobia, which is typified by pain or discomfort brought on by light. There are significant clinical and research ramifications to this improved understanding of photophobia in migraine. Subsequent research contrasting the retinal and cerebral components of photophobia may reveal unique pathophysiological

pathways and pinpoint particular migraine biomarkers. By targeting the cortical hyper excitability and multisensory sensitivity that underlie migraine-associated photophobia, these discoveries may enable tailored medicines that enhance patient quality of life and symptom management. [56]

According to Youssef and Mack (2020), children's migraines can present in a variety of ways, and as they become older, their symptoms and intensity frequently change. This diversity makes diagnosis and treatment more difficult, emphasizing the need for doctors to approach pediatric migraine with caution and adaptability. When treating persistent migraines, which can be particularly difficult to manage in children, this all-encompassing approach is especially crucial. Additionally, Youssef and Mack point out that new knowledge about pediatric migraine has increased the range of treatment choices accessible, giving children with both episodic and chronic migraine hope for better results. In order to improve health and developmental trajectories and lessen the long-term impact of migraine on young patients and their families, early detection and customized therapies are essential. [57]

Zelevansky et al. (2021) used objective measurements like electromyography and post-illumination pupil response to examine the distinct roles of melanopsin and cone luminance pathways in photophobia. Their research showed that a model that combines melanopsin and cone luminance action spectra best explains photophobia thresholds in both healthy people and migraineurs, pointing to a combined mechanism underlying light sensitivity. In addition to suggesting that environmental lighting modifications—specifically, lowering melanopsin activation—could be a viable technique to reduce photophobia in this population, their findings offer a neurophysiological explanation for why migraine patients may find even moderate light uncomfortable. [58]

Zhang et al. (2022) added a neural network approach to the pathophysiology knowledge of migraines by investigating the hypothalamus's function in mediating migraine and ictal photophobia. In order to differentiate between ictal (during an attack) and interictal (between attacks) phases, the study assessed the directional connectivity between the hypothalamus and different brain areas in patients with migraine without aura (MWOA) using Granger causality analysis (GCA) using fMRI data. The study links the development of photophobia to the hypothalamus's connections to the visual cortex and the trigeminovascular system, positioning it as a key hub in a multisystem migraine network. These results demonstrate that migraine is a complicated neurovascular disorder involving central autonomic and sensory integration centers rather than only a peripheral nociception disorder. Therefore, focusing on

hypothalamic circuits could lead to novel treatment options for migraine-related photophobia. [59]

Zhang et al. (2024) used a two-sample Mendelian randomization analysis to show strong evidence for causal links between lifestyle factors and migraine risk. This approach helps to overcome confounding and reverse causality, which frequently restrict observational studies, by using genetic variants as instrumental variables. The results of the study point to modifiable risk and protective factors that may be incorporated into migraine management prevention techniques. There may be useful advantages to dietary interventions that encourage oily fish and moderate coffee consumption as well as behavioral changes that limit screen time. Further supporting the need for interdisciplinary approaches in migraine prevention is the protective connection of educational achievement, which suggests larger socioeconomic determinants of neurological health. [60]

A study in (2022) examined the connection between migraine headaches and refractive errors, focusing on the possible visual triggers of migraine in those who are afflicted. This study adds to the increasing amount of evidence pointing to a neuro-ophthalmic connection in migraine pathophysiology, given the part that visual strain and ocular pain play in triggering or intensifying migraine episodes. In order to ascertain the prevalence of uncorrected or under corrected ametropes in migraine patients, the study evaluated the patients' refractive status. The findings showed that a sizable percentage of migraineurs had refractive abnormalities, including astigmatism and myopia, indicating that untreated visual demands could be a factor in the frequency or intensity of headaches. These results are consistent with recent clinical observations that show photophobia and visual discomfort are prevalent in migraineurs and may be caused by retinal overstimulation or persistent accommodative stress. The study highlighted the clinical significance of a thorough optometric evaluation in patients presenting with recurrent headaches by finding a higher prevalence of refractive defects in migraine patients. [61]

Chapter 3

METHODOLOGY

3.1. Research Design

Cross sectional study

3.2. Clinical Settings

Eye Hospitals, Lahore.

3.3. Sample size

Sample size was calculated 133 participants, using a confidence level 95%, level of precision 11.5%, proportion of migraine with aura 72%, and without aura 42%.

$$n = \frac{Z_{1-\frac{\alpha}{2}}^2 [P_1(1-P_1) + P_2(1-P_2)]}{d^2}$$

3.4. Sampling Technique

Non-Probability Purposive Convenience Sampling technique

3.5. Duration of Study

4 months after synopsis approval

3.6. Selection Criteria

3.6.1. Inclusion Criteria

- Practicing Optometry Professionals

3.6.2. Exclusion Criteria

- Involvement in other clinical trials
- Non-practicing optometrists
- Those who have not encountered migraine cases in practice
- Incomplete survey response

3.7. Ethical Consideration

The rights of study participants were protected, and the guidelines established by the Superior University Lahore ethical committee was adhered to during the research process. Prior to the study, each participant got a briefing, and they filled the online informed consent form attached with questionnaire. The information gathered and data collected kept private and confidential. The study maintained the anonymity of all participants. Participants was aware that there were no risks or disadvantages associated with the research. Additionally, participants were made aware that they were free to leave the research at any point while it

was underway. Electronic information was locked with a password and only the lead investigator had access to it.

3.8. Data Collection Procedure

Optometrists recruited from local clinics and hospitals received an online invitation, some was provided with questionnaire in person. A structured questionnaire, used to obtain quantitative data on their practices and perceptions related to migraine prevention strategies. The ethical aspect was emphasized, and all participants was provided with informed consent, and their privacy and confidentiality was ensured at all levels of data handling.

3.9. Data Analysis

All the Data was entered and analyzed by Statistical Package for the Social Sciences version 27 (SPSS-27).

3.10. Gantt Chart

Activity	1 month	2 month	3-4 month
Ethical Approval	✓		
Baseline Data	✓		
Intervention implementation		✓	
Data Collection		✓	
Data Analysis			✓
Report Writing			✓

Chapter 4

RESULTS

Figure 4.1 illustrates that optometrists largely reported that they clinically observed migraines more commonly among female patients (85.71%) as compared to males (14.29%), which is consistent with epidemiological trends of migraine prevalence. In terms of clinical frequency, the most frequent cases of migraine were presented to the practitioners every week (35.34%), followed by daily presentations (29.32%), monthly and rare cases were reported at 20.30% and 15.04% respectively. In the context of evaluating the prevalence of visual symptoms, optometrists reported that 10-30% of their migraine patients had visual symptoms such as aura or photophobia (35.34% of respondents), and 24.81% reported fewer than 10% of their patients with visual symptoms. A notable proportion reported higher symptom prevalence, with 24.81% noting symptoms in up to half of their migraine patients and 15.04% observing symptoms in more than half of cases, highlighting the significant role of visual manifestations in migraine presentation within optometric practice.

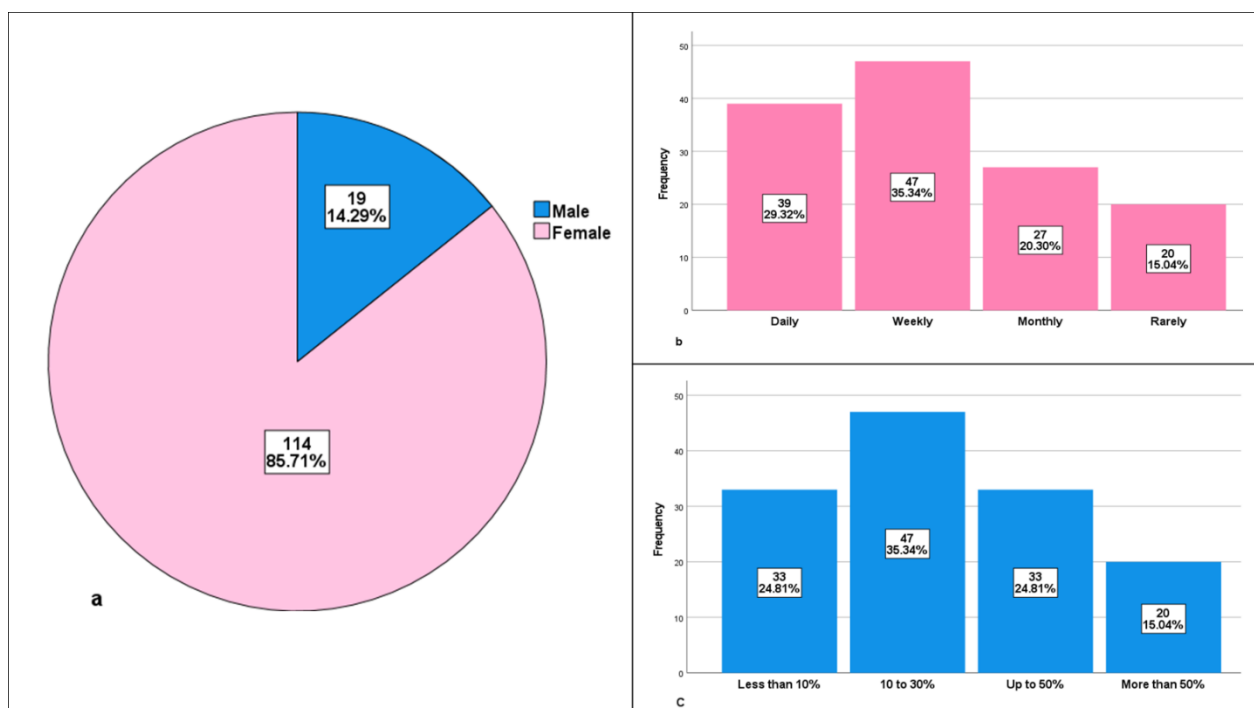


Figure 4.1: Demographic Characteristics i.e. a: Gender Distribution of Affected Patients (as Observed by Practitioners), b: Frequency of Migraine Cases Encountered, c: Visual Symptoms Associated with Migraine

Table 4.1 shows that the most frequent visual aura was observed by optometrists as zigzag lines/patterns (60%), which is significantly higher than blind spots and flashes of light (20% each). In the case of migraine triggers, the most common visual factor was uncorrected refractive error (30.4%), followed by digital eye strain (26.2%) and photophobia (22%). Prescription glasses were the most used intervention (44.7%) in clinical management, with prismatic lenses being popular (37.1%), and blue light filters being less popular (18.3%). Screen time restriction was the most common advice given in patient counseling (41.3%), followed by anti-glare coating (34.1%) and the 20-20-20 rule (24.6%). However, practitioners indicated that they had great difficulties with the absence of patient awareness (44.1%) and insufficient clinical guidelines (33.8%) as key obstacles, and the inability to diagnose visual symptoms (22.1%) as an additional barrier. The patterns as a whole point to the existence of critical clinical priorities and gaps in the system of optometric migraine management.

Descriptive Analysis of Clinical Patterns Observed among Patients of Migraine and Challenges in Management

Variables	Sub-categories	F	%
Types of Visual Aura	Zigzag lines/patterns	114	60
	Blind Spots	38	20
	Flashes of Light	38	20
Visual Factors Contributing to Migraine	Uncorrected Refractive Error	87	30.4
	Binocular Vision Disorder	61	21.3
	Photophobia	63	22
	Digital Eye Strain	75	26.2
	Prescription glasses for refractive errors	88	44.7
Optometric Interventions to Prevent Migraine	Blue light filtering lenses	36	18.3
	Prismatic lenses	73	37.1
	Limiting screen time	114	41.3
Counselling Provided to Migraine Patients	Following the 20-20-20 rule	68	24.6
	Wearing glasses with antiglare coatings	94	34.1
	Lack of Awareness	94	44.1
Challenges in Managing Migraine	Limited guidelines	72	33.8
	Difficulty in diagnosing Visual Symptoms	47	22.1

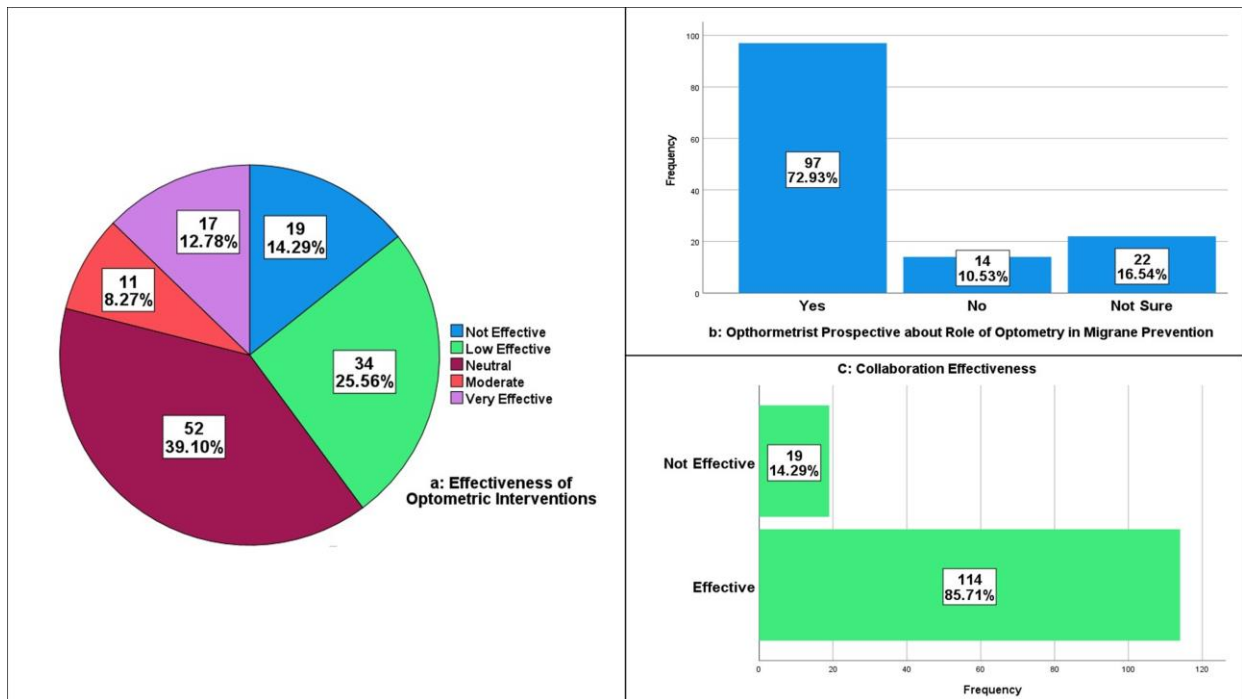


Figure 4.2: Optometrists' Perspectives on Migraine Prevention Efficacy: a; Effectiveness of Optometric Interventions, b; Role of Optometry in Migraine Prevention, c; Collaboration Effectiveness

Table 4.2 examined that the relationships between optometric variables and migraine characteristics did not reach statistical significance ($p > 0.05$), two clinically relevant trends emerged: digital eye strain showed a near-significant association with migraine frequency ($\chi^2=7.419$, $p=0.060$), and perceived effectiveness of optometric interventions approached significance with visual sensitivity ($\chi^2=20.314$, $p=0.061$). Additionally, uncorrected refractive error ($p=0.161$) and prism use ($p=0.117$) demonstrated suggestive but non-significant links to migraine patterns. These near-threshold findings collectively indicate that visual triggers, particularly digital eye strain—and optometric management strategies may meaningfully influence migraine presentation in clinical practice, warranting deeper investigation despite the absence of definitive statistical associations in this cohort.

Chi-Square Analysis of Associations between Optometric and Migraine Factors

Variable Pair	Chi-Square Value (χ^2)	df	p-value
Migraine Frequency × Uncorrected Refractive Error	5.153	3	0.161
Migraine Frequency × Binocular Vision Disorder	3.370	3	0.338
Migraine Frequency × Photophobia	3.131	3	0.372
Migraine Frequency × Digital Eye Strain	7.419	3	0.060
Migraine Frequency × Screen Trigger	2.307	3	0.511
Migraine Frequency × Glasses for Refractive Error	0.985	3	0.805
Migraine Frequency × Prisms for Binocular Vision	1.481	3	0.687
Visual Sensitivity (%) × Glasses-RE	0.187	3	0.980
Visual Sensitivity (%) × Prisms-BV	5.883	3	0.117
Preventive Role of Optometry × Visual Sensitivity (%)	3.350	6	0.764

Optometric Effectiveness × Visual Sensitivity (%)	20.314	12	0.061
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Table 4.1: The correlation analysis shown in Table 3 showed a significant positive correlation between migraine frequency and perceived effectiveness of optometric interventions ($r=.203$, $p\leq 0.005$), which means that those with more frequent migraines reported higher levels of benefit of the intervention, such as corrective lenses or prisms. In contrast, no statistically significant relationships were observed between the preventive role of optometry, general intervention effectiveness, or visual sensitivity percentage (all $p>.05$), although there was a weak positive trend between optometric effectiveness and visual sensitivity ($r=.116$). Also, there was a statistically significant, but insignificant negative correlation between visual sensitivity and type of effectiveness ($r=-.005$, $p=.2001$), and migraine frequency itself was not meaningfully correlated with other variables. Taken together, these results indicate that patients with greater migraine burdens might find the optometric interventions more effective, but the overall trends of the relationship between visual variables and migraine outcomes are not clinically clear in this population.

Relationships among Preventive Optometric Strategies, Visual Sensitivity, and Migraine Parameters

	1	2	3	4	5
Preventive Role of Optometry	1				
Optometric Effectiveness	-0.078	1			
Visual Sensitivity	-0.073	0.116	1		
Migraine Frequency	0.056	-0.033	-0.105	1	
Effectiveness Type	-0.016	0.007	-0.005**	.203*	1

*: $P\leq 0.005$, **: $P\leq 0.001$

Chapter 5

DISCUSSION

This study explored the optometric perspective on the prevention of migraine, particularly in relation to visual symptoms and interventions. The results reveal several key insights into how eye care professionals view the relationship between visual factors and migraine, as well as how they approach prevention and interdisciplinary management.

One of the most striking findings was the high proportion of respondents who observed migraines to be more prevalent in female patients. This supports a well-established trend in migraine research, where hormonal factors especially related to the menstrual cycle are believed to contribute to a higher frequency of migraines in women. Additionally, many eye care professionals reported encountering migraine patients regularly, suggesting that migraines are a frequent and relevant concern within optometric practice. This also highlights the importance of training and awareness within optometry to better understand and support migraine sufferers.

Visual symptoms like aura, photophobia, and visual disturbances were reported in a notable proportion of migraine cases. While 35.3% of respondents observed these symptoms in 10–30% of patients, a significant portion saw them in up to 50% or more. The most frequently reported visual aura was zigzag lines, followed by blind spots and light flashes. This aligns with the clinical definition of migraine with aura and reinforces the need for optometrists to differentiate visual aura from other ocular or neurological conditions. The recognition of such symptoms can guide timely referrals and improve patient outcomes.

A major part of the study focused on identifying visual triggers and evaluating the perceived effectiveness of optometric interventions. Respondents strongly associated migraines with uncorrected refractive errors, digital eye strain, light sensitivity, and binocular vision issues. These associations reflect what many patients also report that visual stress or poor visual hygiene may provoke or worsen migraines. A majority of participants (72.9%) believed that optometric interventions could help prevent migraines, though responses varied when it came to evaluating their effectiveness. Glasses and blue light filtering lenses were among the most recommended interventions, which may indicate a preference for accessible and easy-to-implement strategies. However, the mixed views on effectiveness with most respondents choosing “neutral” or “low” highlight a gap in clinical confidence, perhaps due to limited research or lack of standardized protocols in this area.

Counseling appeared to be a common part of migraine prevention, with most professionals providing advice on screen time limits, the 20-20-20 rule, and the use of anti-glare lenses. These practical tips reflect a preventative, low-cost approach aimed at reducing visual strain an effort that could be especially impactful in patients who experience visually-triggered migraines. Yet, the challenges in managing migraine were also clear: lack of patient awareness, limited evidence-based guidelines, and diagnostic uncertainty were all flagged as significant hurdles. These concerns underline the importance of advancing research in optometry's role in migraine care, as well as improving education for both practitioners and patients.

Finally, the study highlighted a promising yet underdeveloped area: collaboration between optometrists and other healthcare professionals. While many respondents indicated that they do collaborate, most found the effectiveness of this teamwork to be only moderate or neutral. This points to a need for more structured, integrative care models where optometrists, neurologists, and general practitioners can work together in managing complex migraine cases especially those with significant visual components.

Although most Chi-square analyses did not reach statistical significance, several patterns observed in the data suggest clinically relevant associations. Digital eye strain demonstrated a near-significant relationship with migraine frequency, reinforcing growing concerns about the impact of screen exposure on visual comfort and headache disorders. Similarly, trends linking uncorrected refractive error and prism use to migraine and visual sensitivity suggest that small misalignments or uncorrected prescriptions may act as persistent triggers. These findings are especially meaningful for optometrists, as they highlight an opportunity for early detection and management through refractive correction and visual ergonomics. The overall weak collaboration effectiveness reported between optometrists and other healthcare providers also points to a need for more structured interdisciplinary approaches in migraine care.

The significant positive correlation between migraine frequency and perceived effectiveness of optometric interventions suggests that patients experiencing more frequent episodes may place higher value on visual treatments. This reinforces the role of optometrists not just in vision correction, but also in broader migraine prevention strategies. Although correlations between visual factors and migraine were generally weak, the near-significant relationship between uncorrected refractive error and migraine frequency adds weight to the argument that subtle visual stressors may contribute to the initiation or worsening of migraine episodes. These findings emphasize the importance of comprehensive visual assessments in patients

with recurrent headaches and suggest that increased awareness, patient counseling, and targeted visual interventions could enhance both prevention and quality of care.

The findings of this study closely correspond with existing literature emphasizing the role of visual sensitivity and photophobia in migraine pathology. Nearly half of the optometrists surveyed identified photophobia as a frequent migraine trigger, which aligns with research suggesting its origin lies in heightened retinal rod activity rather than the cones or visual cortex. This may explain why migraine patients often perceive normal lighting as excessively bright. Additionally, 60% of optometrists reported observing zigzag lines as the most common aura, reinforcing the link between visual symptoms and migraine reported in prior studies. While blue light filtering lenses and prisms were commonly prescribed interventions, their effectiveness was perceived as limited by most practitioners, indicating that although visual aids are widely used, their therapeutic impact may vary based on individual sensitivity and type of visual trigger. [4]

Furthermore, this study supports previous findings showing a strong association between photophobia and visual aura among migraine sufferers. A large proportion of optometrists in this study observed both symptoms co-occurring in 10–30% of their patients, echoing earlier studies that found a statistically significant relationship between these two visual disturbances. Although most associations in this study were not statistically significant, some such as those involving digital eye strain and refractive error approached significance and suggest optometrically manageable risk factors. The positive correlation between migraine frequency and perceived effectiveness of optical interventions highlights the growing role of optometrists in migraine management. These findings emphasize the importance of visual hygiene education, early refractive correction, and environmental counseling as part of a collaborative approach to reducing migraine burden, especially in visually sensitive individuals. [11]

CONCLUSION

This study concludes that optometrists observe migraines predominantly affecting female patients and frequently encounter cases in clinical practice most commonly on a weekly basis. Visual manifestations, particularly zigzag-pattern auras, photophobia, and other disturbances, feature significantly in patient presentations, highlighting the critical role of visual pathways in migraine pathology. Practitioners identify uncorrected refractive errors and digital eye strain as key visual triggers, deploying corrective lenses and prismatic adaptations as primary interventions while emphasizing screen-time management in counseling. Despite strong professional consensus on optometry's preventive role, confidence in intervention efficacy remains limited, compounded by systemic challenges including insufficient clinical guidelines and diagnostic uncertainties. While statistical associations were largely non-significant, clinically relevant trends such as the link between digital eye strain and migraine frequency and heightened perceived benefit among high-frequency sufferers suggest meaningful biological relationships warranting deeper investigation. Overall, the findings support the integration of optometric evaluation in migraine care, particularly for patients with heightened visual sensitivity, and highlight the need for enhanced interdisciplinary collaboration.

Limitations

The sample size was limited to 133 respondents, which may not fully represent the broader optometric community. Additionally, the study relied on self-reported data, which can introduce bias due to subjective interpretation or recall errors. The gender imbalance among respondents, with a majority reporting female-dominant migraine cases, may have influenced the generalizability of findings. Furthermore, most statistical associations were not significant, possibly due to limited statistical power or variability within the sample. Lastly, the cross-sectional design restricts the ability to infer causal relationships between optometric factors and migraine patterns. Future research with larger, more diverse samples and longitudinal designs is recommended to strengthen these findings.

Recommendations

Based on the findings of this study, it is recommended that optometrists take a more proactive role in identifying and managing visual triggers associated with migraines, particularly in patients reporting frequent headaches or visual disturbances. Comprehensive eye examinations should include assessment for uncorrected refractive errors, binocular vision dysfunction, and digital eye strain, as these may contribute to migraine onset. Incorporating preventive counseling such as advice on screen hygiene, the 20-20-20 rule, and use of blue light filtering lenses can further enhance patient outcomes. Interdisciplinary collaboration between optometrists, neurologists, and general practitioners should be strengthened to ensure holistic care. Additionally, future studies with larger and more diverse samples, as well as longitudinal designs, are recommended to better understand the long-term impact of optometric interventions on migraine prevention.

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APPENDICES

ENGLISH CONSENT FORM

Principle Investigator:

Laiba Naseer

(MS Student in Superior University Lahore)

The title of this research is the **“Optometric Perspectives on Prevention of Migraine with and without Aura”**

Risks and Discomforts

This research will not be known to pose any dangers.

Potential Benefits

It will provide benefit in the future to find out the efficacy of optometric perspective in prevention of migraine with and without Aura.

Protection of Confidentiality

We'll take every precaution to keep your privacy safe. No publication that comes out of this study will reveal who you are.

Voluntary Participation

It is entirely voluntary for you to participate in this research project. You have the freedom to decline participation and to revoke your permission at any moment. If you choose not to participate in this study or withdraw, you won't face any consequences.

CONSENT

**I have been given permission to ask questions and have read this consent form.
I agree to take part in this research.**

Participant's signature: -----

Date: -----

A copy of this consent form should be given to the participant.

QUESTIONNAIRE

Optometric Perspective on Prevention of Migraine with and without Aura

Section 1: Demographic and Professional Background

1. What is your professional qualification?
 1. Optometrist
 2. Researcher in optometry
 3. Optician
 4. Orthoptist
2. How many years of clinical experience do you have?
 1. Less than 5 years
 2. 5–10 years
 3. 11–20 years
 4. More than 20 years
3. How often do you encounter patients with migraines (with or without aura) in your practice?
 1. Daily
 2. Weekly
 3. Monthly
 4. Rarely
 5. Never

Section 2: Clinical Perspectives on Migraines

4. In your experience, what percentage of migraine cases are associated with visual symptoms (e.g., aura, photophobia, visual disturbances)?
 1. Less than 10%
 2. 10–30%
 3. Up to 50%
 4. More than 50%
5. In your clinical experience, which gender is more commonly affected by migraines?
 1. Male
 2. Female
 3. Both equally

4. I have not observed a pattern
6. Which of the following visual factors do you believe contribute to migraines in your patients? (Select all that apply)
1. Uncorrected Refractive errors (uncorrected myopia, hyperopia, astigmatism)
 2. Binocular vision disorders (convergence insufficiency, strabismus)
 3. Light sensitivity (photophobia)
 4. Screen use/digital eye strain
7. Do you believe optometric interventions (e.g., corrective lenses, prismatic lenses, and vision therapy) can help prevent migraines?
1. Yes
 2. No
 3. Not sure
8. If yes, which interventions have you found most effective? (Select all that apply)
1. Prescription glasses for refractive errors
 2. Prismatic lenses for binocular vision issues
 3. Blue light filtering lenses
 4. Vision therapy/exercises
9. On a scale of 1 to 5, how effective do you believe optometric interventions are in preventing migraines? (1 = Not effective, 5 = Very effective)
1. Not Effective
 2. Moderate
 3. Neutral
 4. High
 5. Very Effective

Section 3: Migraine with Aura vs. without Aura

10. In your experience, do patients with migraine with aura present with different visual symptoms compared to those without aura?
1. Yes
 2. No
 3. Unsure
11. What visual symptoms do patients with migraine with aura typically report in your practice? (Select all that apply)
1. Zigzag lines or patterns
 2. Temporary blind spots

3. Light flashes
12. Do you believe optometric interventions are more effective for migraine with aura or without aura?
 1. More effective for migraine with aura
 2. More effective for migraine without aura
 3. Equally effective for both
 4. Unsure
13. How often do migraine patients report screen use as a trigger?
 1. Frequently
 2. Occasionally
 3. Rarely
 4. Never
14. Do you counsel migraine patients on preventive measures related to vision?
 1. Yes
 2. No
15. If yes, what advice do you commonly give? (Select all that apply)
 1. Limit screen time
 2. Take frequent visual breaks (20-20-20 rule)
 3. Wear recommended lenses
 4. Maintain proper posture during near work

Section 4: Challenges and Recommendations

16. What are the biggest challenges in managing or preventing migraines from an optometric perspective? (Select all that apply)
 1. Lack of patient awareness about visual triggers
 2. Limited evidence-based guidelines for optometric interventions
 3. Difficulty in diagnosing visual triggers
 4. None of these
17. Do you collaborate with other healthcare professionals (e.g., neurologists, general practitioners) in managing migraine patients?
 1. Yes
 2. No

PERMISSION LETTER



OFFICE OF THE DEAN-FAHS

SUPERIOR UNIVERSITY

Ref.: IRB/FAHS/Allied/04/25/MS/AHS-3747

Date: 18th March 2025

Program: MS Allied Health Sciences

Name: Laiba Naseer

Registration: SU91-MSAHW-F23-079

Subject: Ethical Approval Letter

The Research Ethical Committee convened on Dated: **17th March, 2025** to discuss your protocol titled "**Optometric Perspective on Prevention of Migraine with and without Aura.**"

No further corrections and recommendations were suggested. The above-mentioned protocol has been approved after considering various research issues including ethical concerns with condition that the researcher will submit completion report at the end of his/her research.

Prof. Dr. Muhammad Naveed Babur
Dean/Convener REC
Faculty of Allied Health Sciences
Superior University, Lahore

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UAN: 042 111 00 00 78 | www.

ETHICS COMMITTEE LETTER

Certificate of Approval

This is to certify that the research work presented in this thesis, titled "**Optometric perspective on prevention of migraine with and without aura**" was conducted by "**Laiba Naseer**" under the supervision of "**Fatima Zahid**"

No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Allied Health Sciences, The Superior University, Lahore in partial fulfillment of the requirements for the degree of Master of Sciences in the field of "**Allied Health Sciences**" in Faculty of Allied Health Sciences at The Superior University, Lahore.

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For MPhil and PhD

This is certified that the thesis entitled: **Optometric Perspective On Prevention Of Migraine With And Without Aura.**

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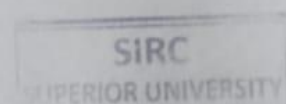
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