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Optometric Perspective on Prevention of Migraine with and without Aura

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Abstract

Objective: To investigate optometrists' perspectives on migraine prevention, focusing on visual manifestations, management strategies, and clinical challenges in integrating contemporary research into practice. Methods: A cross-sectional study surveyed 133 practicing optometrists across Lahore's eye hospitals using structured questionnaires. Data on migraine characteristics, interventions, and practice barriers were analyzed via SPSS-27, employing descriptive statistics, chi-square tests for categorical variables (e.g., migraine frequency vs. visual triggers), and Pearson correlations for continuous variables (e.g., migraine frequency vs. intervention efficacy). Results: Optometrists reported migraines predominantly in females (85.7%), with weekly presentations (35.3%) being most frequent. Visual symptoms affected 10–50% of patients in 60% of cases; zigzag auras (60%) were the most observed. Uncorrected refractive errors (30.4%) and digital eye strain (26.2%) were top triggers. Primary interventions included prescription glasses (44.7%) and prisms (37.1%), while blue-light filters were underutilized (18.3%). Key barriers were a lack of patient awareness (44.1%) and limited guidelines (33.8%). Although statistical associations were largely non-significant, digital eye strain showed near-significant links to migraine frequency ($p=0.060$). Migraine frequency positively correlated with perceived intervention efficacy ($r=0.203$, $p\leqslant0.005$). Conclusion: Optometrists validate the centrality of visual pathways in migraines, observing female predominance, zigzag auras, and refractive errors as key triggers. However, underuse of evidence-based interventions (e.g., spectral filters), coupled with diagnostic and collaborative challenges, highlights critical practice-research gaps. Near-significant trends warrant further investigation to optimize optometry's role in migraine prevention through interdisciplinary, biomarker-informed approaches.

INTRODUCTION

Migraine is common disabling neurological diseases with estimated 12% global prevalence and second leading cause of disability in the world (1, 2). It is a complicated neurovascular disorder that presents as an intermittent moderate to severe headache pain with or without photophobia, phonophobia, nausea, and vomiting (3, 4). Although about 15-33% of migraineurs have aura (transient visual or sensory disturbances, i.e. flashing lights, zigzag patterns, or blind spots, before the headache occurs), most migraineurs have migraine without aura (5, 6).

The complex interaction between migraine and the visual system has attracted more attention from neurological and optometric communities. Recent studies have shed light on the importance of visual triggers and ocular manifestations in the pathophysiology of migraine, making optometry a key part of complete migraine management (7). Photophobia, the most disabling symptom after the pain of the headache itself, is reported to occur in up to 69 percent of patients and is a pathognomonic symptom that is a major contributor to disability in migraine (8). Recent neurophysiological research has shown that melanopsin-containing intrinsically photosensitive retinal ganglion cells are central to migraine-related photophobia, and studies have shown a post retinal magnification of these signals in migraine patients (9).
Modern research based on the latest ophthalmic imaging methods, such as optical coherence tomography (OCT) and OCT angiography, demonstrated that there are considerable structural and vascular changes in the retinal tissues of migraine patients (10). Such results indicate possible retinal biomarkers of migraine, and recent studies in 2024-2025 have shown that the thickness of the retinal nerve fiber layer and the pattern of vascular density can change and be used as a diagnostic sign (11). Moreover,

migraine and dry eye disease are a major clinical correlation, where in large-scale studies, migraineurs were found to be 1.42 times more likely to develop dry eye disease, indicating a common trigeminal pathway malfunction (12).

Furthermore, recent therapeutic options are available with the anti-CGRP monoclonal antibodies approved between 2018-2024, revolutionizing the treatment of migraine prevention, and both episodic and chronic migraine (13). New interventions based on light, especially narrow-band green light therapy, have proven to be extremely promising in the treatment of migraines, and 2023-2024 studies have shown substantial improvements in headache frequency, photophobia, and sleep quality in patients with migraines (13, 14). Such changes are accompanied by an increasing awareness of the refractive error-migraine connection, with recent studies indicating strong correlations between uncorrected astigmatism and the frequency of migraines (15).

The optometric screening paradigm has changed significantly, and current research focuses on the incorporation of validated screening instruments like the ID-Migraine questionnaire into everyday practice in eye care (13, 16). This strategy is since optometrists have a special role in detecting undiagnosed migraineurs because a significant proportion of patients first consult eye care professionals to seek answers to visual complaints. Contemporary optometric management includes a full range of refractive error correction, special filtering lenses to treat photophobia, and environmental modification approaches to visual triggers (16). The current study investigates the multidimensional role of optometry in migraine prevention, with particular focus on incorporation of recent therapeutic advances, new imaging biomarkers, and evidence-based screening procedures. Integrating modern research evidence with current clinical practice, the present study aims to establish the best approaches to migraine prevention based on optometric care, which will ultimately lead to better patient outcomes and a decreased healthcare burden related to this common neurological disorder.

METHODS

This cross-sectional study was conducted over a period of four months in multiple eye hospitals in Lahore, Pakistan. A sample size of 133 practicing optometrists was calculated using a standard formula for comparing two proportions (migraine with aura at 72% and without aura at 42%), with a 95% confidence level and 11.5% margin of error (17). The sample was chosen using non-probability purposive convenience sampling, in which the focus was on actively practicing optometrists who had frequent exposure to migraine cases in clinical practice. Exclusion criteria were used to exclude non-practitioners, participants in other clinical trials, clinicians with no experience of migraine cases, and those who did not provide complete responses. The ethics committee of Superior University Lahore granted ethical approval (Ref.: IRB /FAHS/Allied/04/25/MS/AHS-3747), and all the participants signed an informed electronic consent before participating. Confidentiality of data was ensured by storing data digitally with a password that only the principal investigator could access, and the rights of the participants were identified with the right to withdraw and disclosure of risks. The data were collected using a structured questionnaire that was administered electronically and face-to-face, which provided quantitative data on optometric practices, perceived intervention efficacy, migraine characteristics observed, and collaborative approaches. Data was analyzed through SPSS version 27 and descriptive statistics, chi-square tests to test the relationship between categorical variables (e.g., migraine frequency and visual triggers), and Pearson correlations to test the relationship between continuous variables (e.g., migraine frequency and perceived effectiveness of intervention) were utilized. The outcomes are illustrated in figures and tabulation.

RESULTS

Figure 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.

Table 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

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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.

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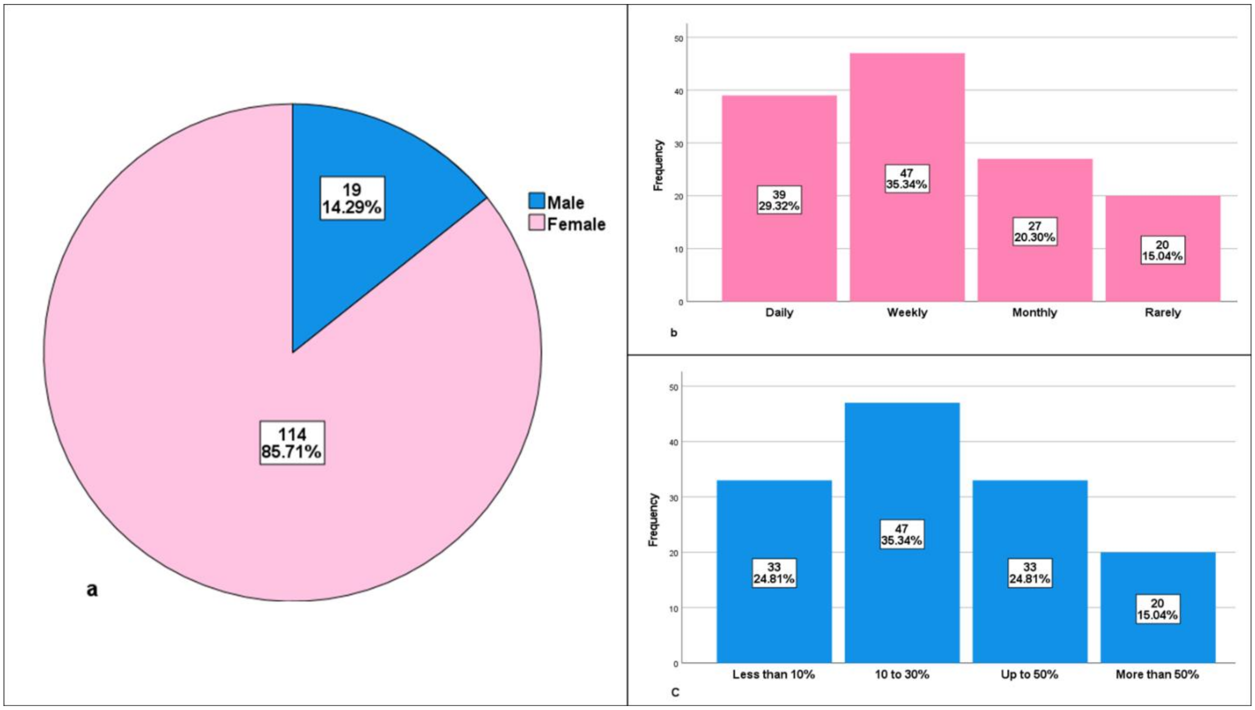

Figure 1: Demographic Characteristics i.e. a: Gender Distribution of Affected Patients (as Observed by Practitioners), b: Frequency of Migraine Cases Encountered, c: Visual Symptoms Associated with Migraine

TABLE 1: 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

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	Digital Eye Strain	75	26.2
Optometric Interventions to Prevent Migraine	Prescription glasses for refractive errors	88	44.7
	Blue light filtering lenses	36	18.3
	Prismatic lenses	73	37.1
Counselling Provided to Migraine Patients	Limiting screen time	114	41.3
	Following the 20-20-20 rule	68	24.6
	Wearing glasses with antiglare coatings	94	34.1
Challenges in Managing Migraine	Lack of Awareness	94	44.1
	Limited guidelines	72	33.8
	Difficulty in diagnosing Visual Symptoms	47	22.1

Table 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 (χ^2=7.419, p=0.060), and perceived effectiveness of optometric interventions approached significance with visual sensitivity (χ^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.

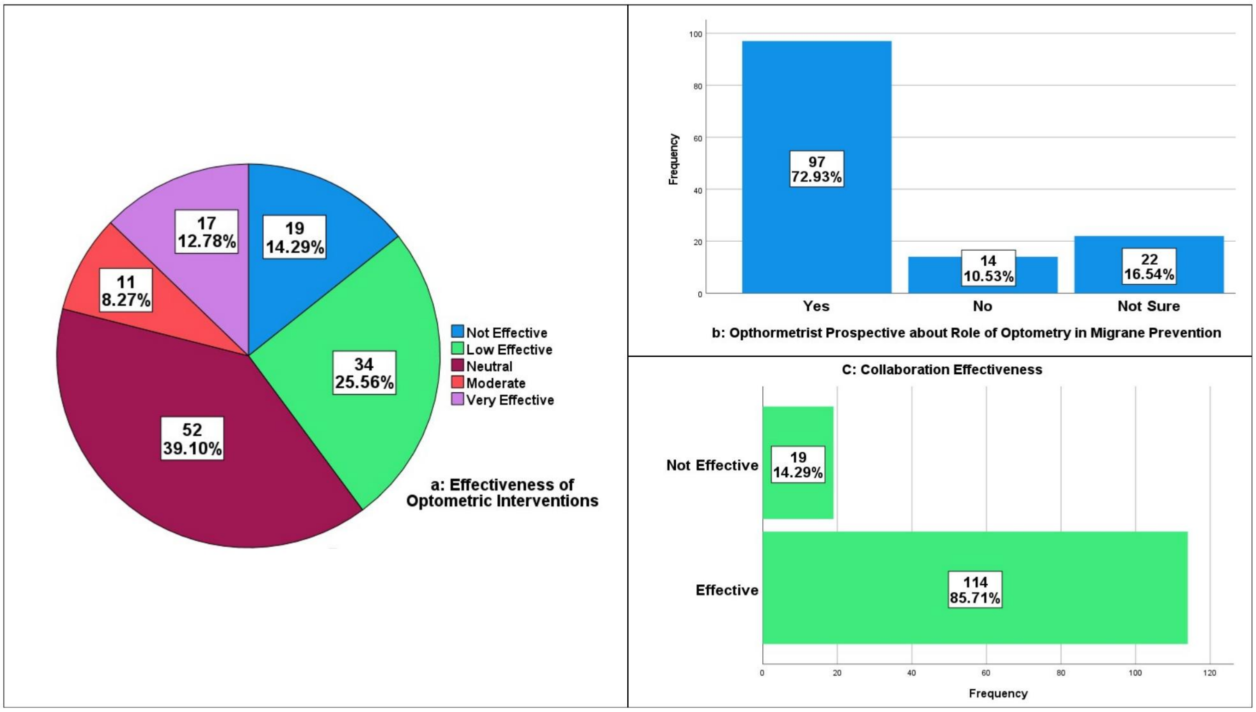

Figure 2: Optometrists' Perspectives on Migraine Prevention Efficacy: a; Effectiveness of Optometric Interventions, b; Role of Optometry in Migraine Prevention, c; Collaboration Effectiveness

TABLE 2: 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

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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

The correlation analysis shown in Table 3 showed a significant positive correlation between migraine frequency and perceived effectiveness of optometric interventions ($r=.203$, $p \leqslant 0.005$), 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=2.001), 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.

TABLE 3: 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≤0.005, **:P≤0.001

DISCUSSION

The current study documented migraines in female patients (85.7%) is consistent with the epidemiological trends across the world that women have 2-3 times higher prevalence because of hormonal effects on trigeminal-vascular pathways (18). The gender difference (20.7% prevalence in women versus 9.7% in men worldwide) is explained by the effect of estrogen on cortical excitability and calcitonin gene-related peptide (CGRP) signaling, which is supported by the recent reviews of sex differences in migraine pathophysiology (18, 19). In a similar way, the dominance of zigzag-pattern auras (60%) supports known neurovascular models of cortical spreading depression, in line with neuro-ophthalmology literature accounts where such patterns ("fortification spectra") are the classic visual aura (20, 21). However, the reporting of photophobia as a trigger (22%) is in stark contrast to its almost universal recognition as an attack symptom (>90% of migraineurs) 9, and this may indicate that optometrists underestimate the role of photophobia as both an initiator and a symptom (20-22).

The refractive error (30.4%) and digital eye strain (26.2%) are among the key visual triggers is mechanistically supported by the work that has connected astigmatism with the strain of the trigeminal nerve and the exposure to screens with increased photophobia due to the involvement of ipRGCs (23). However, the lack of statistically significant correlations between refractive error and migraine frequency (p=0.161) in the present study is contrary to the recent case-control evidence showing that astigmatism is an independent risk factor (OR=1.8, p=0.04) (23, 24). This difference could be due to methodological shortcomings (e.g., sampling bias) or reflect the multifactorial nature of migraine, wherein refractive errors synergize with neurological weaknesses, but not in isolation (23, 24).

Furthermore, a strong dependency on corrective lenses (44.7%) instead of spectral filters (18.3%) seems to be incompatible with the precision light therapy Level I evidence. The narrow-band green light (520±10 nm) decreases the intensity of a headache by 60% and photophobia by 43% in migraineurs by selectively stimulating melanopsin pathways (21, 25), whereas blue-light filters show limited efficacy in photophobia treatment (21, 25). This highlights the lack of evidence-practice translation, which is further complicated by the fact that practitioners do not have high confidence in the efficacy of interventions (only 12.8% rated methods as very effective), even though they theoretically support the preventive role of optometry (72.9%). The low utilization of validated screening instruments such as ID-Migraine, which was reported by 92% of optometrists in the current study, is reflective of the larger trends, with 81% asking about migraines without having standardized procedures (26, 27). Remarkably, a 2020 trial demonstrated that short educational interventions can raise ID-Migraine adoption by 45%, with 86 percent of users maintaining its use, which indicates the existence of solutions to this gap that can be implemented (26, 27).

The trends that are close to significance in this research, digital eye strain (p=0.060) and prism use (p=0.117), are supported by new neurobiological models. The relationship between digital eye strain and migraine frequency could be attributed to photophobia mediated by ipRGCs, where screen exposure enhances thalamocortical pain signaling through melanopsin-containing retinal ganglion cells (28). Likewise, the marginal correlation of prism adoption with decreased migraine burden is consistent with the fact that 8% of migraineurs have binocular vision dysfunction (BVD), and prism correction alleviates symptoms in 72% of comorbid patients (29). The high correlation between the frequency of migraines and the perceived benefit of interventions (r=0.203, p=0.005) implies that high-frequency patients are more sensitive to subtle visual corrections- a fact that is replicated in reports where specific optometric care lessens disability in refractory patients (23, 29).

The systemic fragmentation of migraine care is reflected in reported barriers, lack of guidelines (33.8%), and diagnostic uncertainty (22.1%). Although 85.7% of optometrists worked with neurologists, only 14.3% considered it to be very effective,

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compared to integrated care models in which co-managed CGRP inhibitor protocols cut emergency visits by half (29). This mismatch can be attributed in part to siloed training: neurologists are taught to think about trigeminal pathways, and optometrists are taught to think about ocular comorbidities such as dry eye disease (DED), which has neuroinflammatory pathways in common with migraine (30). These gaps were further aggravated by the COVID-19 pandemic, whereby stress-related migraine outbreaks demonstrated the necessity of interdisciplinary telehealth models (31). The limitations of this study are that it is cross-sectional and thus no causal inferences can be made, convenience sampling was geographically limited, practitioner-reported data may be subject to recall bias, and the study lacked sufficient power to establish near-significant trends such as the association between digital eye strain and migraine frequency (p=0.060), which is compounded by the fact that no objective biomarkers were used. Future studies need to be longitudinally validated using retinal imaging/pupillometry, precision light therapy (520nm) testing, standardized screening procedures, neurologist-optometrist co-management pathways, and gender-specific hormonal-visual interactions to further evidence-based migraine prevention in optometric practice.

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.

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