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Assessment of Tear Film Instability In Glaucomatous Patients Using Anti-Glaucoma drugs

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None declared.

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ABSTRACT

Purpose: This study aimed to evaluate the effects of anti-glaucoma medications on tear film stability and ocular surface health in glaucoma patients by assessing changes in visual function, tear production, and related symptoms.

Methods: A total of 150 glaucoma patients aged 18 to 60 years were recruited from a clinical setting. Visual acuity was measured using standard charts. Tear film stability and tear production were assessed through Tear Break-Up Time (TBUT) and Schirmer's tests, respectively. Participants completed the Ocular Surface Disease Index (OSDI) questionnaire to report symptoms such as dry eye and ocular discomfort. Information on anti-glaucoma medications including prostaglandin analogs, beta-blockers, alpha agonists, carbonic anhydrase inhibitors, miotics, and combination therapies was recorded. Demographic data, glaucoma type, duration, and medication history were collected via standardized forms to analyze medication impact on ocular surface health.

Results: The majority of participants were aged 41–50 years, with balanced gender distribution. Most exhibited moderate to severe visual impairment (mean visual acuity: right eye 0.34 ± 0.15; left eye 0.32 ± 0.17) and had glaucoma for over three years, predominantly open-angle type. Prostaglandin analogs were the most frequently used medications. Common ocular surface symptoms included dry eyes and blurred vision. Post-treatment TBUT increased from 2.80 to 2.87 seconds, and Schirmer's test values improved from 2.68 to 2.90 mm; both changes were statistically significant. Correlation analyses indicated weak but significant associations between medication type and ocular surface parameters, suggesting a modest effect on tear film stability.

Conclusion: Anti-glaucoma medications induce mild but significant changes in tear film stability and dry eye symptoms. Despite side effects, treatments remain effective and well tolerated. Regular ocular surface monitoring is advised to optimize patient comfort and treatment outcomes.

KEYWORDS Glaucoma, anti-glaucoma medication, tear film stability, dry eye, Schirmer's test.

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INTRODUCTION

Glaucoma accounts for 8% of the 39 million blind people worldwide, making it the second most frequent cause of blindness. Treatment options include lasers, topical antiglaucoma medications, and surgical techniques including trabeculectomy. The goal of treatment is to reduce intraocular pressure. Intraocular pressure is the only risk factor for glaucoma that may be changed. Optic nerve injury can be prevented from worsening by lowering intraocular pressure. [1] Tear shortage, a decreased lipid layer, changed tear composition, and abnormalities or inflammation of the ocular surface are all associated with tear instability. Between the eye and its surroundings, the ocular surface and its constituent parts create a barrier of defense. In order to preserve a smooth, refractive surface for sharp vision, the tear film is essential for lubricating and shielding the ocular surface. Environmental elements including wind, pollution, and low humidity present frequent difficulties for it. Ocular health and tear film stability are also compromised by disease conditions.[2]

Antiglaucoma drugs can cause severe problems with the conjunctiva, cornea, and eyelids, including ocular surface toxicity and anomalies in the tear film. Visual loss, non-compliance, and glaucoma progression are possible outcomes. Up to 49–59% of people using these drugs have ocular surface diseases. Poor ocular surface health is a result of these issues. In order to improve treatment outcomes and stop more damage, it is essential to address ocular surface disease. [3] A preservative or an active ingredient in eye drugs may be the primary cause of toxicity and ocular surface problems. Preservatives come in two varieties: oxidative and detergent. Benzalkonium chloride and other detergent preservatives have a dose-dependent impact by lysing cell membranes and building up in ocular tissue. They also shorten the time it takes for tears to break up, damage the lipid layer of the tear film, and cause ocular surface diseases. Sodium chloride, which has a slight cytotoxic effect but an excellent safety profile, is used in oxidative preservatives such Stabilized Oxychloro Complex. [4]

Primary Angle Closure Glaucoma affects 2.54 million people in India, while Primary Open Angle Glaucoma affects 6.48 million. Primary Angle Closure Glaucoma causes blindness twice as frequently as Primary Open Angle Glaucoma. Glaucoma accounts for 1.96% of the nation's total illness burden, contributing to 0.6 million disability-adjusted life years. Poor patient adherence to therapy is a significant obstacle in the management of glaucoma in India. One major risk factor for progressive visual field loss is noncompliance.[5] Traditionally, the tear film is separated into three layers: lipid, aqueous, and mucin. A two-layer concept, however, is suggested by the Tear Film and Ocular Surface Society Dry Eye Workshop II: a superficial lipid layer and an interior mucoaqueous layer. Meibum from the meibomian glands makes up the lipid layer, which shields the ocular surface, stabilizes the tear film, and stops evaporation. The most prevalent type of dry eye illness is evaporative dry eye, which is frequently brought on by meibomian gland dysfunction. Dry eye disease is caused by disruption of tear film homeostasis. Topical intraocular pressure-lowering drops are used to treat glaucoma, a persistent visual neuropathy.[6]

Topical eye drops to reduce intraocular pressure are the traditional first-line treatment for ocular hypertension and open-angle glaucomas, including exfoliation glaucoma and primary open-angle glaucomas. Incisional glaucoma procedures are frequently regarded as therapy alternatives for people taking anti-glaucoma drugs. Usually, these operations are performed when medicine is not enough.[7] Reducing aqueous humor production (CAIs, β-blockers, α2 agonists), lowering outflow resistance in conventional channels, and increasing outflow in conventional pathways (PGs, α2 agonists) are the three basic methods for lowering intraocular pressure. These systems aid in controlling intraocular pressure and halting the advancement of glaucoma. [8] Although topical administration is the most practical way to treat anterior disorders, it has a number of drawbacks, such as poor corneal permeability, quick pre-corneal clearance, and higher administration frequency. Consequently, poor bioavailability results from just < 5% of the medication reaching its target site. Rapid tear secretion eliminates the residual medication. These elements lessen the efficacy of treatment.[9]

As the world's population ages, glaucoma-related irreversible vision loss is expected to impact 111.8 million individuals by 2040, up from an estimated 64.3 million in 2013. Intraocular pressure is the sole risk factor that can be changed to prevent vision loss, even if the pathophysiology of glaucoma is yet unknown. For the majority of adult glaucomas, medical care is the main course of treatment; within the past 50 years, there have been notable developments in new therapeutic agents. [10] he objective of study is to determine the impact of the anti-glaucoma drugs on the stability of tears in glaucoma patients.

METHODOLOGY

The study design was Cross-sectional study design.The study's sample size was determined using a paired t-test with a 95% confidence level, 0.80 power, and an effect size of 0.46243. The parameters included a mean of 64.1 for group 1, 68.3 for group 2, standard deviations of 5.3 for group 1 and 11.7 for group 2. [1] Based on these calculations, the required total sample size to detect statistically significant differences was 150 participants. However, to account for an expected 10% dropout rate during the study, the sample size is adjusted to 168 participants to maintain the desired power, a 5% margin of error, and 95% power, as calculated by G-Power version 3.1.9.7. The sample was taken by using Non-Probability convenient sampling technique. The duration of the study was 06 months after approval from BASR. The research was conducted in accordance with the rules and regulations established by the Ethical Committee of Superior University. The rights and dignity of all participants were upheld throughout the study.Written informed consent was obtained from each participant prior to data collection.All collected information and data were treated with strict confidentiality.Participants remained anonymous throughout the course of the study.The participants were informed that there were no known risks or disadvantages associated with taking part in the research.They were also made aware of their right to withdraw from the study at any stage without any consequences.No identifying information of any participant was disclosed in any reports or publications resulting from the research.Participation in the study was entirely voluntary. Participants had the freedom to decline involvement or withdraw their consent at any point, without facing any penalties or negative consequences.

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Over the course of six months, 150 individuals were recruited from the outpatient department of the Rural Health Center (RHC), Hujjan, Sargodha, to provide data for the current study. In order to efficiently recruit eligible cases within the constraints of time and resources, a non-probability convenience sampling strategy was used. All of them were approached in the clinic waiting area, and those who met the eligibility requirements were given a clear description of the aim, objectives, methods and potential risks of the study in an easy-to-understand manner. To guarantee that the participants were involved voluntarily, the informed consent of all the participants was taken in writing.

Not every participant was eligible to take part in the research. The inclusion criteria that were measured were that the subjects had to be at least 18 years old and had to be diagnosed with glaucoma and have to be on topical anti-glaucoma medication. These medications were prostaglandin analogues, beta-blockers, carbonic anhydrase inhibitors, alpha agonists and the fixed-combination therapy which was the representation of the normal pharmacological regimens applied in the conventional practice. Patients with systemic or ocular diseases, such as autoimmune diseases, persistent ocular allergies, and severe forms of the dry eye disease, which have been known to affect the stability of the tear film, were excluded. Individuals who had contacts on before and those who had undergone eye surgery in the past few days were also filtered out with an exception of those who had only gone through with the simple cataract removal surgery. The outcome was that the confounding factors that would have influenced the health of ocular surface were reduced.

The systematic proforma that was designed to address this study was used to collect clinical and demographic data after the recruiting was completed. The age, the sex, the type and the duration of glaucoma, and the current treatment periodic table were all preliminarily registered. The standardized Snellen chart was used to measure visual acuity in the two eyes under the relevant light conditions and make the findings. Intraocular pressure (IOP) was also measured to verify the efficacy of the disease control, as well as to rule out uncontrolled or intricate cases, which might distort the outcome.

Validated questionnaires were used in measuring subjective ocular surface complaints. The frequency and intensity of the symptoms such as dryness, blurred vision, gritty or foreign body sensation and eye pain were assessed using the Ocular Surface Disease Index (OSDI). This was done using a questionnaire of tear film stability and questionnaire of side-effects of the anti-glaucoma drugs. Patient-reported outcomes recorded under these measures were the rate of artificial tear use, the perceived side effects of medicines, history of replacing medicines due to intolerance and the overall weight of the therapeutic benefits versus painful effects of treatment.

Furthermore, a subjective assessment of tear film generation and stability was done as well. To calculate Tear Break-Up Time (TBUT), fluorescein dye was put in the conjunctiva sac. The number of seconds that elapse between the last blink time and the first dry time of ocular surface was measured. The measure of outcome employed in Schirmer test was the length of the wetting in millimeters, in which case standard filter paper strips were inserted into the lower conjunctival fornix of each eye and allowed to remain there that is, five minutes. The two tests were conducted in a controlled setting in order to reduce variability and improve reproducibility.

All of the assessments carried out according to questionnaires and clinical assessments were again repeated within four to six weeks to be able to compare the results of the evaluations with each other over time and record any temporary changes in symptoms or tear film parameters. Such a follow-up evaluation allowed knowing better about the subjective and objective changes on the ocular surface related to the anti-glaucoma therapy, depending on the state of the participants before and after the treatment.

The outcome tools in this study were Demographic and medical history form (age, gender, duration of glaucoma, current anti-glaucoma medications), Ocular Surface Disease Index (OSDI) questionnaire – standardized tool to assess ocular surface symptoms, Tear film stability questionnaire – subjective rating of tear film quality and fluctuations, Anti-glaucoma medication side-effects questionnaire – self-reported side effects and perceived impact on tear film.

Tear Break-Up Time: A popular technique to evaluate tear film instability is the fluorescein tear breakup time. A fluorescein strip is applied to the lower portion of the eye during the process, and the patient is asked to blink multiple times before keeping their eyes open. The interval between a blink and the emergence of the first dry spot or break in the tear film is monitored using a slit lamp with a cobalt blue filter. An aberrant tear film is suggested by a TBUT of less than 10 seconds, while symptoms of dry eyes are indicated by values below 5 seconds. [32]

Schirmer's Test: A diagnostic method for evaluating tear production, especially in cases of dry eye syndrome, is the Schirmer test. The patient is made to close his/her eyes and place filter paper strips in the lower eyelid of each eye and wear them five minutes. Subsequently, the degree of the wet area on the strip is recorded; when it is less than 5mm it means there is a tear deficiency and when it is greater than 15mm then it means there is normal tear production. Anesthetic may or may not be administered in the test depending on whether basal tear production or reflex tear production is under measurement. [33].

RESULTS

The sample population consisted of 150 individuals whose gender was evenly represented (52.7% women and 38.0% men) and whose age (41-50 years) was mostly the same (38.0). Vision changes were also noticed in both the eyes and the overwhelming number of the participants were either 6/60 vision or with the ability to count fingers. The average visual acuity score of right eye was about 0.34731154073, and the left eye showed 0.31731317146, which showed moderate and severe visual impairment. Most of them over three years had glaucoma, most of them of open-angle type (46.0%). The most common medications were the prostaglandin analogs (46.0 percent), beta-blockers (24.7 percent). Ocular surface symptoms like dry eyes were also common among the participants with the mean score of 1.11 on frequency of dry eye, 0.35 on gritty sensation, 0.52 on sore or achy eyes, and 1.49 on blurred vision. In terms of medication effects, 65 percent of those participants had experienced side effects (mean = 0.65), 40 percent

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of them had switched medication because of tear film disturbance (mean = 0.40) and 70 percent of them said that the medication benefits were more than the side effects (mean = 0.70). The Tear Break-Up Time (TBUT) increased in a pre-treatment mean of 2.80 +/-, 0.23 seconds to an after treatment mean of 2.87 +/-, 0.22 seconds. The test results by Schirmer also improved as the mean was 2.68 0.20 before the treatment and 2.90 0.21 after the treatment. These improvements were statistically confirmed to be significant ($p < 0.05$) using one-sample t-tests. ANOVA showed that there were significant dissimilarities that connected to the forms of glaucoma, anti-glaucoma drug, and ocular manifestations. The Pearson correlation analysis revealed significant albeit weak relationships between the up to type of medication and post-treatment TBUT ($r = 0.11$) and Schirmer values ($r = 0.10$), and between TBUT and Schirmer ($r = 0.10$), implying a certain connection between treatment and the ocular surface stability.

Table 1: Age of the participants

		Frequency	Percent
VA	18-28years	21	14.0
	29-40years	43	28.7
	41-50years	57	38.0
	51-60years	29	19.3
	Total	150	100.0

The table gives the age distribution of 150 participants which are divided into four age groups. The highest percentage of the subjects, 38.0% (n=57), belongs to the 4150 years bracket. The second-largest group comprises of age 29 to 40 years which is a percentage of 28.7 (n=43). Others are 51 years between 60 years (19.3% n=29) and 18 28 years (14.0% n=21) which forms the smallest proportion of the total sample. In general, the sample consists of adults and is mostly middle aged, the age groups distributed evenly.

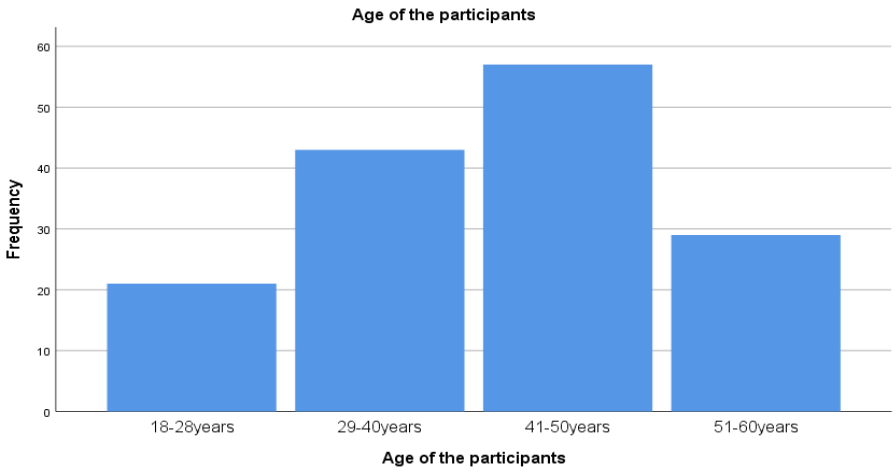

Figure 1: Age of the participants

Table 2: Gender of the participants

		Frequency	Percent
Gender	Male	71	47.3
	Female	79	52.7
	Total	150	100.0

The table gives the summary of the composition of the 150 participants according to gender. The female sample is slightly dominant as they comprise 52.7% (n=79) of the entire sample, and male is 47.3% (n=71) of the sample. This means that there was a relatively equal distribution of genders among the respondents.

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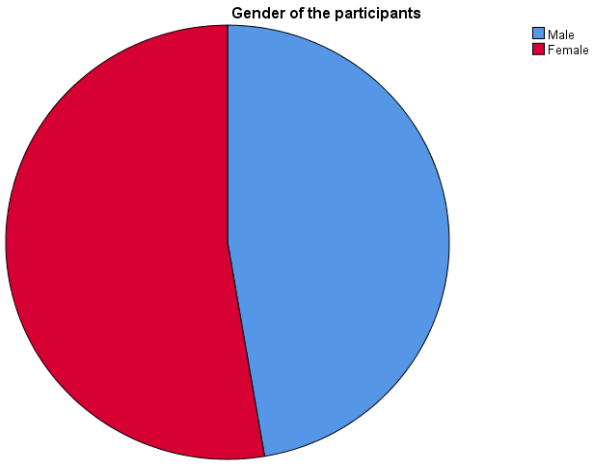

Figure 2: Gender of the participants

Table 3: Baseline Visual Acuity in Right and Left Eyes (N = 150)

Visual Acuity	Frequency (RE)	Percent (RE)	Frequency (LE)	Percent (LE)
Counting Fingers (CF)	50	33.3%	45	30.0%
6/60	61	40.7%	65	43.3%
6/36	39	26.0%	40	26.7%
Total	150	100.0%	150	100.0%

The table shows gender distribution of these 150 participants. The females constitute a small majority of the sample, including 52.7% (n = 79) of the participants, whereas 47.3% (n = 71) of the sample is made up of the males. This depicts a fairly proportional representation of both genders in study population.

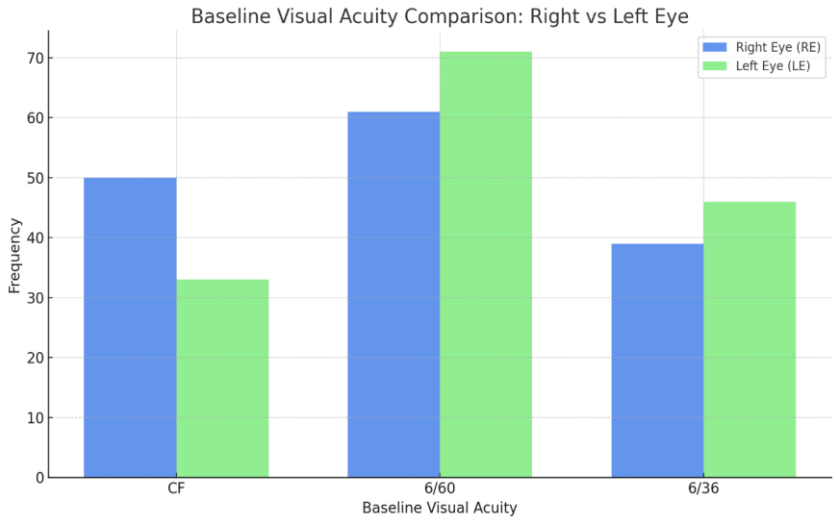

Figure 3: Baseline Visual Acuity in Right and Left Eyes

Table 4: Duration of glaucoma

		Frequency	Percent
Types	Upto 6months	14	9.3
	6monthsto 1year	15	10.0
	2-3years	15	10.0
	2-3years	19	12.7
	3-5years	45	30.0
	morethan 5years	42	28.0
	Total	150	100.0

The table presents the cases of the duration of glaucoma among 150 participants. The highest proportion (30.0, n = 45) has been diagnosed with the glaucoma period between 3-5 years, and the next group of over 5 years glaucoma period is also close at 28.0 (n = 42). Individuals who have glaucoma of 2-3 years comprise 12.7% (n =19) of the sample. The ones with shorter ones have 10.0% (n=15) in 6 months to 1 year, 10.0% (n=15) in 2 to 3 years (note: repeated?), and 9.3% (n=14) with glaucoma up to 6 months.

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Generally, the statistics show that the participants had a different length of stay of glaucoma with most of them having had the condition over three years.

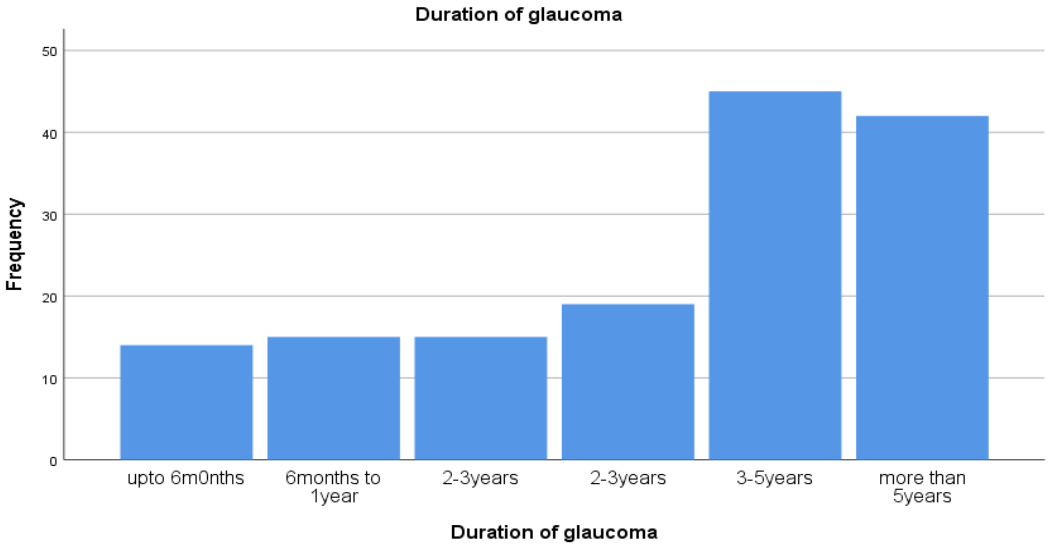

Figure 4: Duration of glaucoma

Table 5: Type of Glaucoma

Type of Glaucoma			
		Frequency	Percent
Valid	Open angle glaucoma	69	46.0
	Angle closer glaucoma	37	24.7
	Normal tension glaucoma	14	9.3
	Congenital glaucoma	10	6.7
	Pigmantary glaucoma	11	7.3
	Pseudoexfoliative glaucoma	9	6.0
	Total	150	100.0

The table shows the allocation of the types of glaucoma among the 150 participants. The most common of them is open angle glaucoma with the prevalence of 46.0 percentage (n = 69) in the sample. The next one is angle-closure glaucoma (n = 37) which consumes 24.7%. Others are normal tension glaucoma with 9.3% (n = 14), pigmentary glaucoma with 7.3% (n = 11), congenital glaucoma with 6.7% (n = 10), and pseudoexfoliative glaucoma with 6.0% (n = 9). Within this distribution, it is evident that there is a prevalence of open angle glaucoma in the study population, although there are other less prevalent types included in the study population.

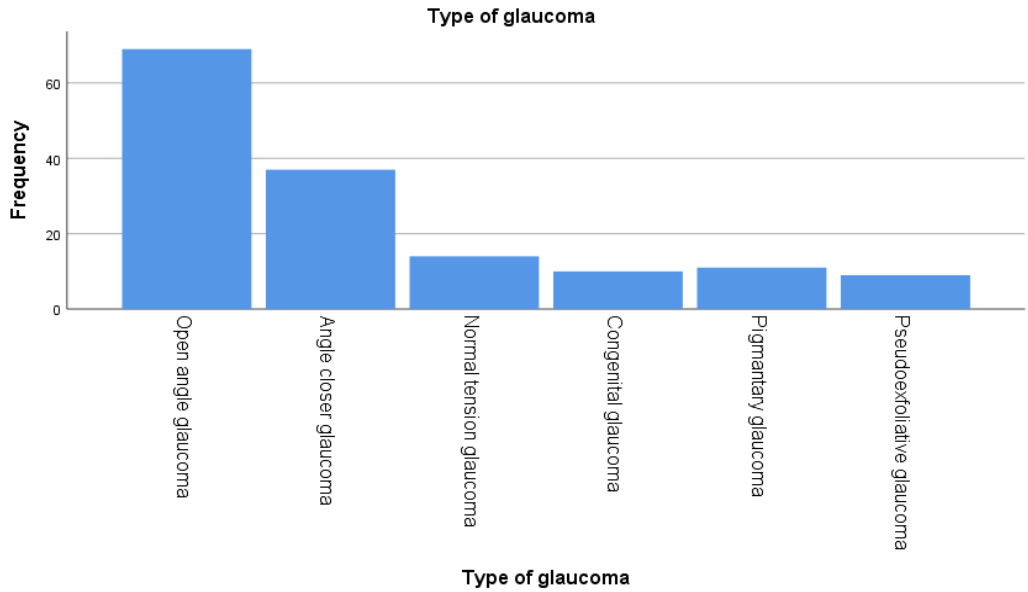

Figure 5: Type of Glaucoma

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Table 6: Types of anti-glaucoma medication(s)

		Frequency	Percent
Types	Postagaladin analogs	69	46.0
	Beta-Blockers	37	24.7
	Alpha agonists	14	9.3
	Carbonic anhydrase inhibitors	10	6.7
	Miotics	11	7.3
	Combination medications	9	6.0
	Total	150	100.0

The table shows the table of the various forms of the anti-glaucoma drugs used by the 150 respondents. Prostaglandin analogs is the most utilitarian type of medication with 46.0% (n = 69) of the participants using it. The second most common is beta -blockers with 24.7% (n = 37). The other drugs are alpha agonists (9.3, n=14), miotics (7.3, n=11), carbonic anhydrase inhibitors (6.7,n=10) and combination drugs (6.0,n=9). This information shows that the anti-glaucoma treatments in this sample are more biased towards prostaglandin analogs and beta-blockers.

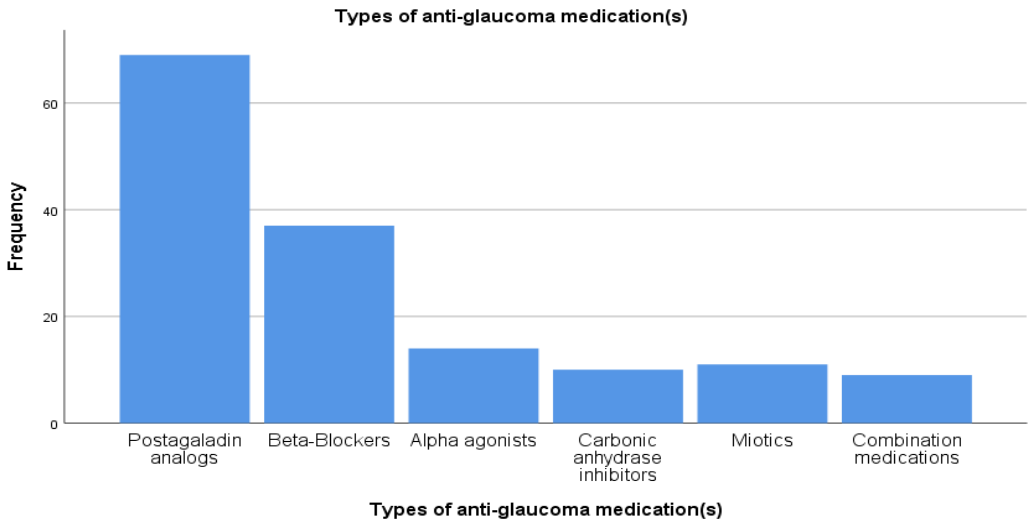

Figure 6: Types of anti-glaucoma medication(s)

Table 7: Ocular Surface Disease Index (OSDI)

Question	Never (0)	Sometimes (1)	Often (2)	Always (3)
1. Eyes feeling gritty or sandy?	0.10	0.30	0.50	0.50
2. Eyes feeling sore or achy?	0.15	0.40	0.35	1.5
3. Blurred vision?	0.05	0.80	1.00	2.1
4. How often do you experience dry eyes?	0.10	0.15	0.80	1.40

The table shows the frequency of four eye-related symptoms reported by the participants on a scale of 0 (Never) to 3 (Always). In the case of the symptom of "Eyes feeling gritty or sandy the responses are distributed with low frequency of Never (0.10) and greater frequencies in categories of Often (0.50) and Always (0.50). On the question, Eyes feeling sore or achy, the responses are of an average of 1.5 (Sometimes), 0.40 (Often) and 0.35 (Always), which is a moderate frequency. Depending on the frequency, blurred vision has more frequent occurrences of higher frequencies with higher frequency representing more frequent experiences, such as Sometimes (0.05), often (0.80), and always (1.00) mean of 2.1. Finally, the question: How often do you experience dry eyes? has most of its answers in the category of Always (0.80), the average score of which is 1.40, which indicates that the participants are not very unanimous that they do not have dry eyes.

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Table 8: Anti-Glaucoma Medication Side Effects

Questions	Yes	No	Not Sure
1. Have you noticed any side effects from your anti-glaucoma medication(s) affecting your eyes?	0.65	0.20	0.10
2. Have you had to change your anti-glaucoma medication due to side effects affecting your tear film?	0.40	0.35	0.25
5. Do you think the benefits of your current anti-glaucoma medication outweigh the side effects on your tear film?	0.70	0.10	0.20

The table briefly gives the perception of the participants concerning the side effects of their anti-glaucoma drug(s) on their eyes and tear film. Most (65) of them said that they had noticed side effects and 20% of the participants have never experienced side effects and 10% were not sure. In terms of medication change because of tear film side effects, 25% were not sure, 35% had not changed and 40% had changed. Moreover, 70% of the sample thought that the positive effects of their current medication are more than side effects on their tears film, 10% of the sample disagreed and 20% were not sure. On the whole, these answers are indicative of the fact that the vast majority of the participants can be described as being well-informed about the side effects and who tend to think that the therapeutic benefits warrant the continued usage.

Table 9: Baseline Clinical Assessment

TBUT in sec	Pre-Frequency	Pre-Percentage	Post- Frequency	Post-Percentage
≥ 10sec	12	8.3%	16	10.7
|5-9sec	40	26.7%	30	20.0%
2-4sec	50	33.3%	55	36.7%
≤ 2sec	48	32.0	49	32.7%

The data in the table compares the Tear Break-Up Time (TBUT) without and after the treatment in the participants. The percentage of TBUT of 10 seconds or above rose to 10.7 percent (n=16) after the treatment as compared to 8.3 percent (n=12) prior to the treatment. TBUT value of 5-9 seconds reduced 26.7 (n= 40) to 20.0 (n= 30). There was a slight increase in participants with TBUT of 2 to 4 seconds, which varied with the change in 33.3 to 36.7, (n=50 and n=55), respectively. relative to the participants with TBUT of 2 to 4 seconds, which stayed relatively constant, with change of 32.0 to 32.7 (n=48 and n=49), respectively. All in all, these findings indicate that there is a marginal growth in tear film stability following treatment.

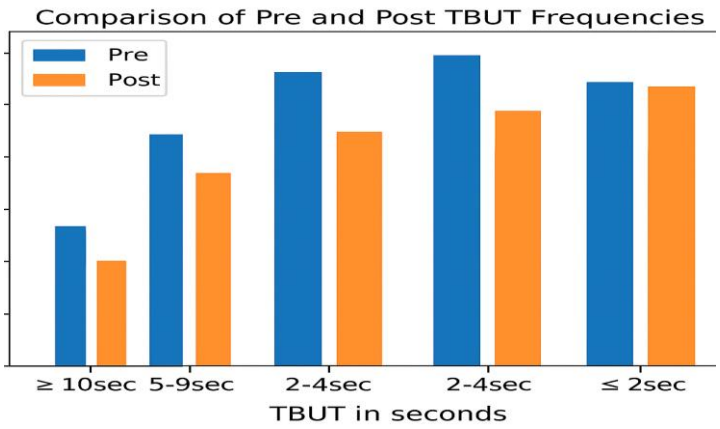

Figure 7: Baseline Clinical Assessment

Table 10: Pre-Post comparison of Schirmer's Test

Schirmer's in mm	Pre-Frequency	Pre-Percentage	Post- Frequency	Post-Percentage
≥ 15 mm	14	9.3%	14	9.3%
10-14 mm	54	36.0%	32	21.0%
5-9 mm	40	26.7%	51	34.0%
≤ 5 mm	28	53.0%	53	35.3S%

The table is used to compare the results of Schirmer test in millimeters before and after treatment of the people involved. The proportion of participants who produced tears ≥15 mm did not change during the pre- and post-treatment (9.3% n = 14). Ten-phenol ones of 101014 mm dropped to 21.0% (n = 32) and the 59 mm dropped to 34.0%. The percentage of tear production ≤ 5 mm in proportion altered between 53.0 (n= 28) before treatment to 35.3 (the figure does not appear to be clear- please check) after treatment. All in all, these results show alterations of distribution of tear production post-treatment.

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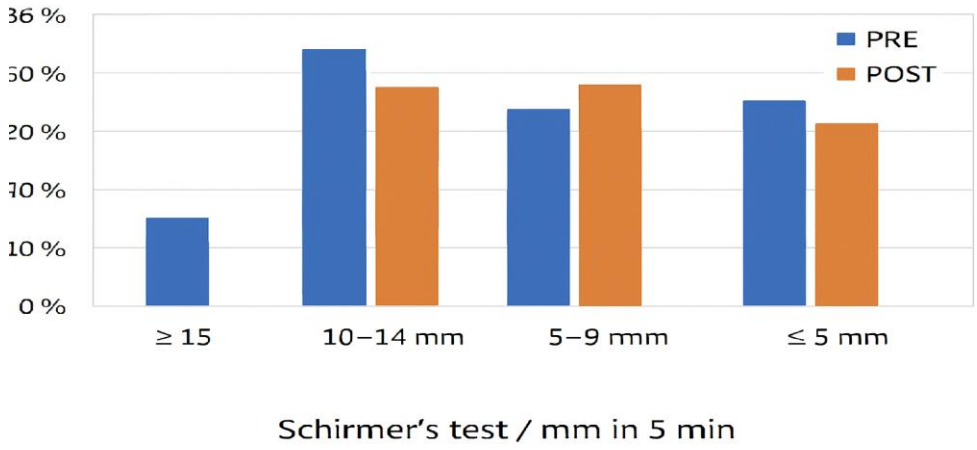

Figure 8: Pre-Post comparison of Schirmer's Test

Table 11: One-Sample Test

One-Sample Test						
	Test Value = 0.05					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TBUT in sec(pre)	36.648	149	.03	2.80333	2.6522	2.9545
Schirmers test/ mm in 5min(pre)	33.744	149	.04	2.68333	2.5262	2.8405
TBUT in sec(post)	35.875	149	.01	2.87000	2.7119	3.0281
Schirmers test/ mm in 5min(post)	36.596	149	.01	2.90333	2.7466	3.0601

The reason behind the one-sample t-test was the need to compare the mean values of TBUT (Tear Break-Up Time) and Schirmer's test results before and after treatment to a test value of 0.05. In the case of the pre-treatment TBUT, the average difference was 2.80 seconds (t = 36.65, df = 149, p = 0.03), and 95% range was 2.65 to 2.95 seconds. The pre- and post-treatment Schirmer test had a mean difference of 2.68 mm (t = 33.74, df = 149, p = 0.04) and a 95% interval of 2.53 seconds to 2.84 seconds. In the same way, the mean difference in Schirmer's test post-treatment was 2.90mm (t=36.60,df=149, p=0.01) with a 95 percent interval of 2.75 to 3.06mm. Such strong findings ($p < 0.05$) suggest that the values of TBUT and Schirmer test prior and after the treatment differ significantly as compared to the test value.

Table 12 Anova Test

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Types of anti-glaucoma medication(s)	Between Groups	22.129	3	7.376	3.204	.025
	Within Groups	336.165	146	2.302		
	Total	358.293	149			
Type of glaucoma	Between Groups	22.129	3	7.376	3.204	.025
	Within Groups	336.165	146	2.302		
	Total	358.293	149			
Eyes feeling gritty or sandy	Between Groups	6.745	3	2.248	2.305	.049
	Within Groups	142.429	146	.976		
	Total	149.173	149			
Eyes feeling sore or achy	Between Groups	7.080	3	2.360	2.799	.042
	Within Groups	123.113	146	.843		
	Total	130.193	149			
Blurred vision	Between Groups	6.745	3	2.248	2.305	.049
	Within Groups	142.429	146	.976		
	Total	149.173	149			

The ANOVA test indicated that there were significant group differences in terms of anti-glaucoma medications types and glaucoma types ($F(3,146) = 3.204$, $p = 0.025$). Moreover, there were also significant differences in the groups regarding such symptoms as the

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eyes feel gritty or sandy (F(3,146) = 2.305, p = 0.049), the eyes feel sore or achy (F(3,146) = 2.799, p = 0.042), blurred vision (F(3,146) = 2.305, p = 0.049). These findings show that the kind of medication, nature of glaucoma, and existence of such symptoms differ greatly in the groups under investigation.

Table 13 Correlation

Correlations				
		Types of anti-glaucoma medication(s)	TBUT in sec(post)	Schirmers test/ mm in 5min(post)
Types of anti-glaucoma medication(s)	Pearson Correlation	0.01	.11	.10
	Sig. (2-tailed)		.10	.02
	N	150	150	150
TBUT in sec(post)	Pearson Correlation	.01	0.1	.11
	Sig. (2-tailed)	.10		.000
	N	150	150	150
Schirmers test/ mm in 5min(post)	Pearson Correlation	.10	.04	0.1
	Sig. (2-tailed)	.02	.000	
	N	150	150	150
*. Correlation is significant at the 0.05 level (2-tailed).				
**. Correlation is significant at the 0.01 level (2-tailed).				

Correlation analysis involved relationships between the type of anti-glaucoma medications, post-treatment TBUT, and post-treatment Schirmer test. The connection between the types of medications used and TBUT was too weak and insignificant (r = 0.01, p = 0.10). However, a small but significant positive correlation was found between medication types and Schirmer's test results (r = 0.10, p = 0.02). TBUT and Schirmer's test showed a modest positive correlation (r = 0.11) that was highly significant (p < 0.001). Overall, these results suggest that while medication type has limited association with TBUT, it is slightly related to tear production as measured by Schirmer's test, and TBUT and Schirmer's test are positively correlated.

DISCUSSION

The majority of the 150 participants in the study were between the ages of 41 and 50 (38.0%) and had a balanced gender distribution (52.7% female). Both eyes showed changes in vision, and the majority of participants showed either 6/60 vision or the capacity to count fingers. A moderate to severe impairment in visual function was indicated by the mean visual acuity score of 0.34 ± 0.15 for the right eye and 0.32 ± 0.17 for the left. Most had glaucoma for more than three years, with open-angle glaucoma accounting for 46.0% of cases. The most often prescribed drugs were prostaglandin analogs (46.0%), followed by beta-blockers (24.7%). With a mean score of 1.11 for dry eye frequency, 0.35 for gritty sensation, 0.52 for hurting or achy eyes, and 1.49 for blurred vision, participants commonly reported ocular surface symptoms as dry eyes. In terms of the effects of the drug, 65% reported having side effects (mean = 0.65), 40% had switched treatments because of tear film disruption (mean = 0.40), and 70% said that the advantages of the medication outweighed the drawbacks (mean = 0.70).

The mean Tear Break-Up Time (TBUT) decreased from 2.80 ± 0.23 seconds before therapy to 2.87 ± 0.22 seconds after treatment. Schirmer's test results also improved, going from a pre-treatment mean of 2.68±0.20 mm to a post-treatment mean of 2.90±0.21 mm. These improvements were shown to be statistically significant ($p < 0.05$) using one-sample t-tests. Significant variations in glaucoma types, anti-glaucoma drugs, and ocular symptoms were found using ANOVA. Pearson correlation analysis has shown that treatment and ocular surface stability may be correlated (r = 0.11 and r = 0.10, respectively); TBUT and Schirmer compared to each other are (r = 0.10). The proportion of males and females in the present study was quite balanced, where 52.7 percent out of the participants were female and 47.3 percent were male, which compares with the study by Kopilaš and Kopilaš (2024), where the female percentage was significantly higher, standing at 62.2. This difference could be attributed to differences in the approaches to samples, or the local population, or health seeking behavior, since women tend to seek healthcare services more frequently. The majority of the study participants were middle-aged (29 50 years), and the highest proportion (38) comprised the age group between 41 and 50 years. In contrast, the Kopilaš and Kopilaš (2024) population was considerably older, with an average age of 70.4 years (SD = 11.52) with individuals ranging in age from 42 to 94. [34]

With 40.7% of right eyes and 43.3% of left eyes limited to 6/60 and almost one-third of patients confined to counting fingers, the visual acuity in the current investigation was noticeably inadequate. Wu et al. (2023), on the other hand, found that patients with early glaucoma had comparatively preserved visual acuity, with deterioration only becoming more noticeable in mid to severe stages.[35] The majority of subjects in this study had experienced glaucoma for more than three years, with 28.0% reporting more than five years and 30.0% reporting three to five years. In contrast, Parkkari et al. (2020) discovered that a greater percentage of patients had glaucoma for less than two years, 42.4% for two to three years, and just 19.5% for four years or more.[36]

Blurred vision and complaints of dry eyes were the most common ocular surface symptoms reported by the participants of the study, with a mean of 2.1 and 1.4, respectively, indicating moderate and severe discomfort on the OSDI scale. Similarly, Boso et al. (2020) have found that nearly all patients with glaucoma met diagnostic criteria of ocular surface disease, and most of them (73.7) had severe symptoms (OSDI > 33). Despite the fact that both studies prove that ocular surface problems are a big burden on glaucoma patients, Boso et al. evaluated the severity levels more precisely, as the current results represent the pattern of symptom frequency in

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a larger group. All these results are in favour of the fact that ocular surface disease is rather frequent in glaucoma and has a significant effect on patient-reported outcomes. [37]. Prostaglandin analogs (46.0%), and beta-blockers (24.7%), were the most often administered pharmaceuticals in the group of the current study. Less commonly (9.3, 7.3, 6.7 and 6.0 percent, respectively) were alpha agonists, miotics, carbonic anhydrase and fixed-combination drugs. Conversely, Sahlu and Giorgis (2021) have discovered that the beta-blocker timol (53%), pilocarpine (36%), timolol-dorzolamide blends (41%), and prostaglandins (12%), were most frequently used. This comparison shows that there is a strong difference in prescription practices: in Ethiopia, the cohort was more reliant on beta-blockers, and older preservatives such as pilocarpine, whereas in the present study, more people prefer to use prostaglandin analogs as the initial treatment. Such discrepancies are likely to indicate the differences in the availability of drugs, the clinical practice guidelines, and economic factors in healthcare facilities. [38].

The proportion of the patients with mild to severe symptoms escalated to 50.4 at 46 weeks and a slight improvement to 41.5 at 1012 weeks suggesting a definite increase in the number of patients with dry eye symptoms postoperative in the previous study based on the OSDI scores. The present research, however, evaluated TBUT to determine the tear film stability and found quite moderate changes. Those who had attained TBUT 10 seconds or above gained a little (8.3 to 10.7) and those who had attained TBUT 9 seconds or above decreased (26.7 to 20.0). The values of participants whose TBUT was very short (less than 2 seconds) did not increase, and the value of those whose TBUT was between 2 and 4 seconds was slightly increased. Collectively, these findings suggest that the present study demonstrated a minor objective change in tear film stability, which suggests that the subjective symptoms might not necessarily be linked with TBUT results, but the previous one indicated that the postoperative effects on ocular surface health were more pronounced and more symptomatic. The proportion of anti-glaucoma drugs that were most frequently prescribed in the present study was destroyed by the prostaglandin analogs (46%), then by beta-blockers (24.7%), and finally, by alpha agonists (9.3%). In contrast, the former large-scale study concluded that the most frequent initial medications included prostaglandin analogues (25.2), timol combos (26.2) and beta-blocking agents (37.8). The variation in prescription procedures, access to medication, and treatment suggestions across diverse groups of populations can explain the gap between studies. It is notable that our findings indicate that there is a clear preference towards the use of the prostaglandin analogs as the first-line therapy compared to the earlier one where timolol and its combination sets were widely used. This is in line with the recent findings that show that they are superior in safety and efficacy, particularly in the control of long-term intraocular pressure. The relatively lower usage rate of combination drugs (6.0) of our cohort compared to the previous study points to the potential differentiation in the severity of the disease at the onset or in prescribing habits of the doctors. [40].

CONCLUSION

This paper notes that over time usage of anti-glaucoma drugs, especially the prostaglandin analogues, can cause ocular surface alterations such as the unstable tear film and symptoms of dry eye. Despite the insignificance of the effects in relation to tear production and stability, the values of the TBUT and Schirmer test were statistically better after treatment. The results indicate that these drugs are useful in the regulation of the intraocular pressure, but they can cause eye pain. Thus, the routine observation of the health of ocular surface is critical in patients with glaucoma and the development of treatment regimes that are based on both the effectiveness of specific treatment and comfort in the patient is crucial to maximize the final results.

RECOMMENDATIONS

Future research should consider multi-center studies with larger and more diverse populations to enhance generalizability. Longitudinal studies are needed to better assess the causal effects of different anti-glaucoma medications on ocular surface health. Incorporating objective measures alongside patient-reported outcomes, and controlling for environmental and lifestyle factors, would provide a more comprehensive understanding. Clinically, regular monitoring of tear film stability and ocular surface health is recommended for glaucoma patients, particularly those on long-term anti-glaucoma therapy, to optimize treatment comfort and effectiveness.

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