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Prevalence of Dry Eye in Patients with Pseudoexfoliation

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Abstract

Background: *Dry eye disease (DED) is a multifactorial condition of the ocular surface characterized by loss of homeostasis of the tear film, leading to symptoms such as irritation, visual disturbance, and potential damage to the ocular surface. Pseudoexfoliation syndrome has a notable impact on the ocular surface, leading to structural and functional changes.*

Aim: *To estimate the prevalence of dry eye disease in patients with pseudoexfoliation*

Methods: *The study included 350 patients with pseudoexfoliation attending ophthalmology OPD, complete evaluation of the patient is done. Specific tests to assess the dry eye is done using Schirmer's test, tear film break up time (TBUT), and ocular surface fluorescein staining. Prevalence of dry eye is estimated.*

Results: *11.14% of the study subjects were diagnosed with dry eye.*

Conclusion: *This study confirms a strong association between pseudoexfoliation syndrome and dry eye disease.*

Key words:
1. *DED- Dry Eye Disease*
2. *PXF/PEX -Pseudoexfoliation*
3. *TBUT – Tear Film Breakup Time*
4. *MGD – Meibomian Gland Dysfunction*
5. *MMP – matrix metalloproteinases*
6. *IL – Interleukin*
7. *TNF – Tumor Necrosis Factor*
8. *IFN – Interferon*
9. *LFU – Lacrimal functional Unit*
10. *CGRP – Calcitonin gene related peptide*
11. *ROS – Reactive Oxygen Species*
12. *OSDI – Ocular Surface Disease Index*
13. *MAPK – Mitogen Activated Protein Kinase*

INTRODUCTION:

Dry eye disease (DED) is a multifactorial condition of the ocular surface characterized by a loss of homeostasis of the tear film, leading to symptoms such as irritation, visual disturbance, and potential damage to the ocular surface. This condition involves tear film instability, increased osmolarity, and inflammation of the ocular surface [1]. Pseudoexfoliation (PXF) syndrome, on the other hand, is an agerelated systemic condition characterized by the production and deposition of extracellular fibrillary material in ocular and extraocular tissues. It is also associated with open-angle glaucoma and other ocular pathologies [2].

The prevalence of dry eye disease is increasing globally, particularly among older adults. Risk factors such as age, hormonal changes, and environmental factors have been well-documented. These same factors play a role in the development of pseudoexfoliation, making it essential to explore the interplay between the two conditions [3]. The burden of DED is significant due to its impact on vision-related quality of life, necessitating early detection and management, especially in high-risk populations such as those with pseudoexfoliation [4].

Pseudoexfoliation syndrome has a notable impact on the ocular surface, leading to structural and functional changes. The fibrillary deposits in many anterior segment structures disrupt tear film dynamics, contributing to tear film instability. Additionally, chronic ocular inflammation, a hallmark of PXF, exacerbates the symptoms and severity of dry eye disease in affected individuals [5]. Patients with PXF often present with increased tear film osmolarity and altered lipid layer quality, highlighting the link between pseudoexfoliation and dry eye [6]. Another critical factor linking PXF and DED is the disruption of the meibomian glands and lacrimal functional unit. Studies have shown that the deposition of pseudoexfoliative material in these structures interferes with their normal function, reducing tear production and tear film stability. This results in increased evaporation of the tear film, worsening dry eye symptoms [7].

Moreover, the oxidative stress and inflammation observed in PXF contribute to the progression of dry eye disease in these patients [8]. Gender differences have also been observed, with women showing a higher prevalence of dry eye, potentially due to hormonal influences that further compromise tear film stability [10]. Studies have suggested that the clinical presentation of DED in patients with PXF might differ from that in patients without PXF. The severity of symptoms, as well as the specific ocular surface changes, are often more pronounced in PXF patients. This makes it imperative to consider PXF as a critical factor in the assessment and management of dry eye disease [11]. The use of clinical tests such as tear break-up time (TBUT), Schirmer's test, and ocular surface staining are essential in evaluating dry eye in this population [12].. The current study aims to address the gap in literature regarding the prevalence of dry eye disease in patients with pseudoexfoliation. By correlating the demographic profile of these patients with the presence of dry eye, this research will contribute to a deeper understanding of the ocular surface changes associated with PXF and the need for specialized care in this population [15]. Early identification and intervention in these patients are crucial for preventing long-term complications and improving their quality of life [16].

METHODS AND MATERIALS

Study Design: This study was designed as a hospital-based cross-sectional study to investigate the prevalence of dry eye in patients with pseudoexfoliation. The cross-sectional nature of the study enabled a comprehensive collection of data at a single point in time, without any intervention by the researchers. This design allowed for an in-depth understanding of the ocular profiles of patients with pseudoexfoliation and the relationships between dry eye and pseudoexfoliation. By employing a descriptive and analytical approach, the study aimed to provide a detailed account of the prevalence of dry eye in patients with pseudoexfoliation. This design also facilitated the identification of patterns and correlations between ocular assessments, which could inform future clinical practices and research in this area. The study's design enabled a thorough examination of the relationship between pseudoexfoliation and dry eye, providing valuable insights into the ocular mechanisms underlying pseudoexfoliation.

Study Duration: The study was conducted over a period of 18-months, from September 2023 to march 2025.

INCLUSION CRITERIA:

1. Patients with pseudoexfoliation
2. Age 40-80 years.

EXCLUSION CRITERIA:

1. Patients with pseudoexfoliative glaucoma
2. Patients with previous ocular surgeries
3. Patients with long-standing use of antiglaucoma drugs such as timolol and other systemic medications, Linking to dry eye
4. Patients with adnexal abnormality, corneal pathologies and pterygium. patients with Diabetes, Sjogren's syndrome, thyroid disease, sarcoidosis, rheumatoid arthritis, and any autoimmune conditions associated with dry eye
5. Patients with lacrimal gland disorders

Data collection involved systematically recording clinical and ocular findings at a single point in time. For each participant, detailed demographic information and medical history were documented. Clinical assessments were conducted using standardized forms to capture data on ocular history, symptoms, and other relevant clinical findings. Ocular evaluations included assessments of dry eye parameters such as Schirmer's test, fluorescein staining, and tear film break-up time. All data were entered into Microsoft Excel for initial organization and subsequently analyzed using SPSS software. This comprehensive data collection process ensured that all relevant information was accurately captured, facilitating thorough analysis and reliable conclusions regarding the prevalence of dry eye in patients with pseudoexfoliation. Additionally, the study aimed to examine the relationships between dry eye parameters, pseudoexfoliation and ocular history.

Data Analysis Data analysis for the study was conducted using SPSS software, following systematic entry of all collected data into Microsoft Excel. Descriptive statistics were employed to summarize clinical characteristics of the patients with pseudoexfoliation, including measures of central tendency (mean, median) and variability (standard deviation). The primary analysis focused on examining the correlation between dry eye parameters (Schirmer's test, fluorescein staining, tear film break-up time) and pseudoexfoliation using Chi-square tests. This statistical method was chosen to assess the strength and direction of the relationship between dry eye and pseudoexfoliation. Additionally, the study examined correlations between clinical parameters and ocular

findings to identify potential predictors of outcomes. Results were expressed in terms of correlation coefficients, percentages, proportions, and significance levels, with a pvalue of <0.05.

RESULT AND ANALYSIS

Table 1. Schirmer's Test Results Distribution

Schirmer's Test Result (mm in 5 mins)	Frequency	Percentage (%)
Normal (>15 mm)	310	88.57%
Borderline (10–15 mm)	27	7.71%
Abnormal (<10 mm)	13	3.71%
Total	350	100.00%

The table presents the distribution of Schirmer's test results among the study participants. Out of 350 individuals, 310 (88.57%) had normal tear production (>15 mm), 27 (7.71%) had borderline values (10–15 mm), and 13 (3.71%) showed abnormal results (<10 mm).

Figure 1: Pie chart showing Schirmer's Test Results

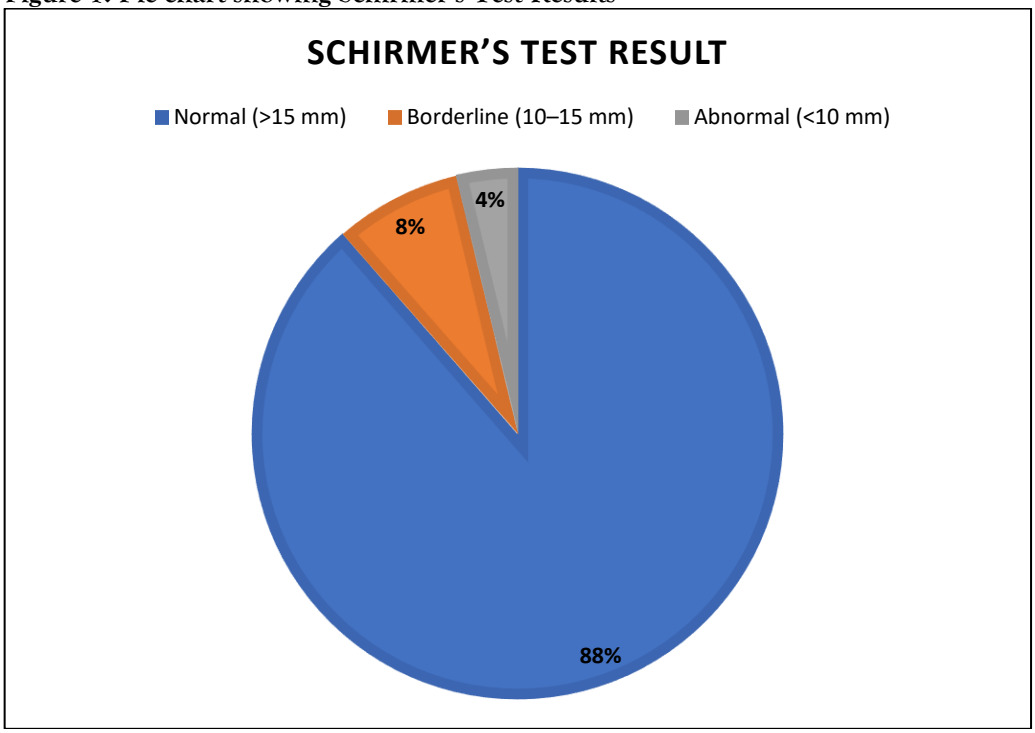

Table 2. Tear Film Break-Up Time (TBUT) Results Distribution

TBUT Category (seconds)	Frequency	Percentage (%)
Normal (15–45 s)	308	88.00%
Borderline (10–15 s)	30	8.57%
Abnormal (<10 s)	12	3.43%
Total	**350**	100.00%

The table shows the distribution of participants based on Tear Break-Up Time (TBUT) categories. Among the total of 350 participants, 308 (88.00%) had normal TBUT (15–45 seconds), 30 (8.57%) fell into the borderline range (10–15 seconds), and 12 (3.43%) had abnormal TBUT (<10 seconds).

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Figure 2: Pie chart showing TBUT category results

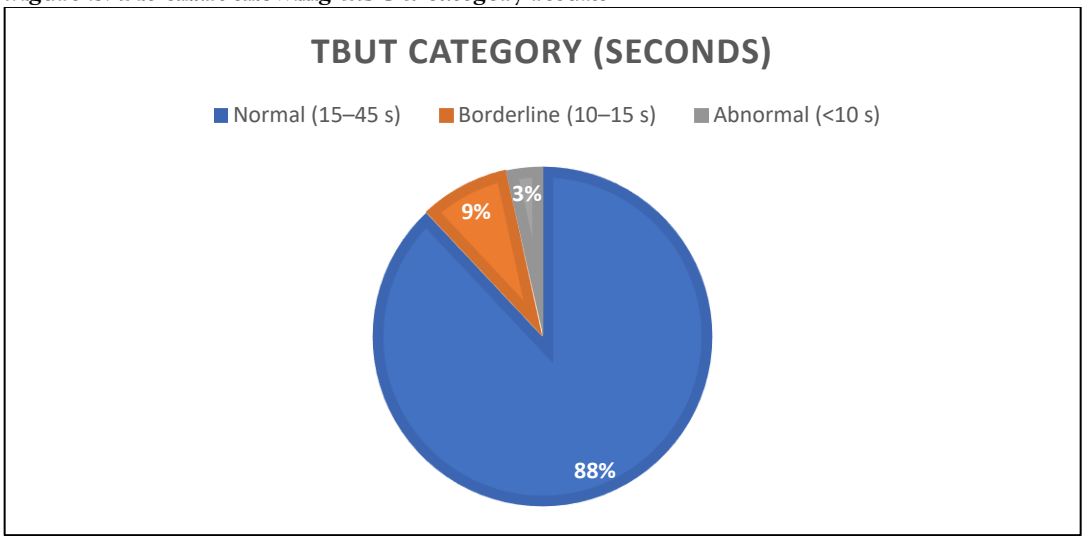

Table 3. Fluorescein Staining Score Distribution

Fluorescein Staining Score	Frequency	Percentage (%)
Score 0 (No staining)	303	86.57%
Score 1 (Mild)	28	8.00%
Score 2 (Moderate)	15	4.29%
Score 3 (Severe)	4	1.14%
Total	**350**	100.00%

The table presents the distribution of fluorescein staining scores among the participants. A majority of 303 individuals (86.57%) showed no staining (Score 0), while 28 (8.00%) had mild staining (Score 1). Moderate staining (Score 2) was observed in 15 participants (4.29%), and severe staining (Score 3) was seen in 4 participants (1.14%).

Figure 3: Pie chart showing Fluorescein Staining Score

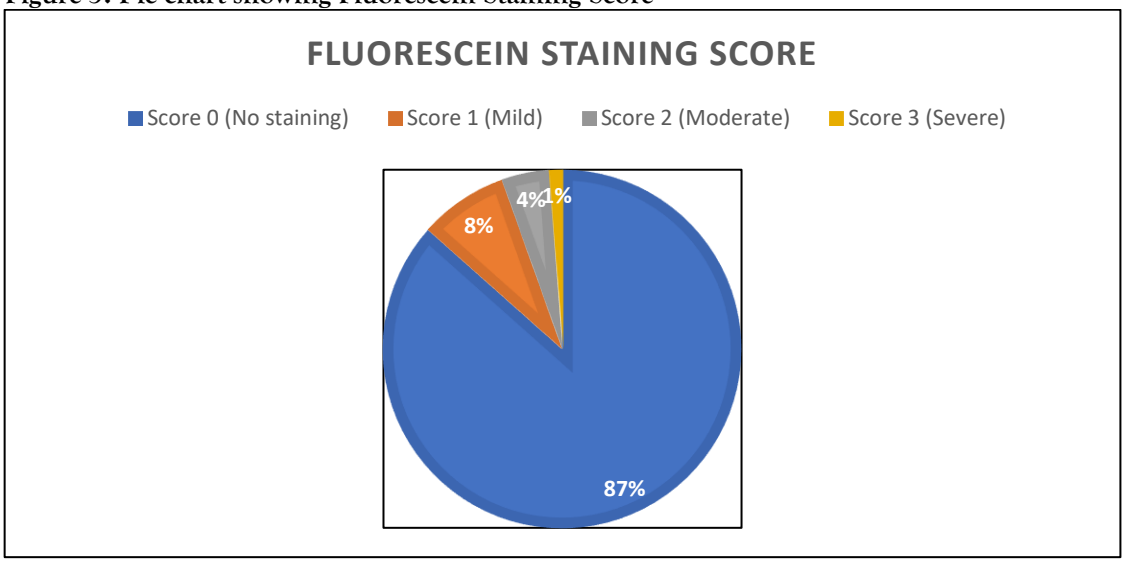

Table 4. Prevalence of Dry Eye Symptoms

Dry Eye Symptom	Frequency	Percentage (%)
Burning Sensation	22	6.29%

Foreign Body Sensation	20	5.71%
Grittiness	31	8.86%
Redness	17	4.86%
No Symptoms	260	74.29%

The table outlines the frequency and percentage of various symptoms reported by participants with dry eye. Grittiness was the most commonly reported symptom (31 cases, 8.86%), followed by burning sensation (22 cases, 6.29%) and foreign body sensation (20 cases, 5.71%). Redness was reported by 17 participants (4.86%). Notably, the majority of individuals (260 cases, 74.29%) reported no symptoms.

Figure 4: Bar chart showing Fluorescein Staining Score

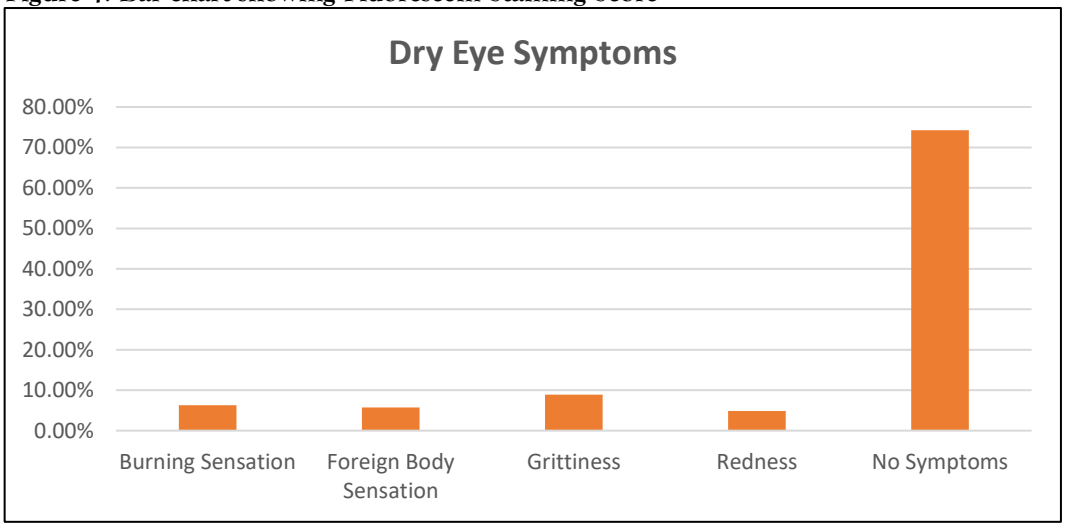

Table 5. Overall Dry Eye Diagnosis

Dry Eye Diagnosis	**Frequency**	**Percentage (%)**
Dry Eye Present	39	11.14%
Dry Eye Absent	311	88.86%
Total	**350**	100.00%

Using a combination of objective tests (Schirmer's, TBUT, and fluorescein staining), 11.14% of the study subjects were diagnosed with dry eye, while 88.86% were classified as not having dry eye.

Figure 5: Bar chart showing dry eye diagnosis

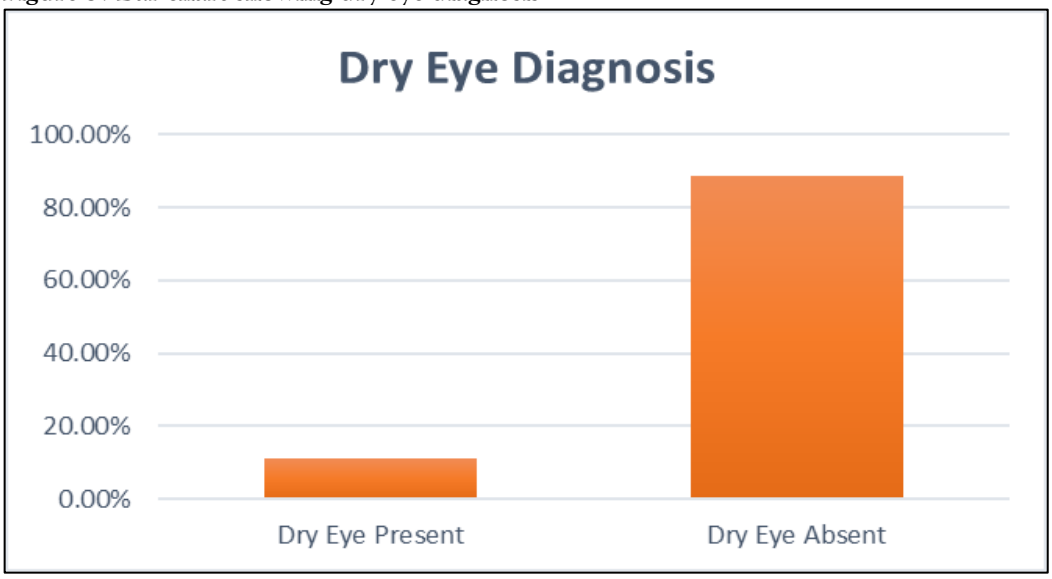

Table 6. Correlation between Schirmer's Test and Dry Eye Symptoms

Schirmer's Test Result	Dry Eye Present	Dry Eye Absent	Total
Abnormal (<10 mm)	10	3	13
Borderline (10–15 mm)	4	23	27
Normal (>15 mm)	25	285	310
Overall p-value	< 0.0001		

Among patients with abnormal Schirmer's test results (<10 mm), 10 had dry eye and 3 did not. In the borderline group (10–15 mm), 4 had dry eye and 23 did not. In the normal Schirmer's test range (>15 mm), 25 patients had dry eye while 285 did not. The association between Schirmer's test results and the presence of dry eye was statistically significant ($p < 0.0001$).

Figure 6: Bar chart showing Correlation between Schirmer's Test and Dry Eye Symptoms

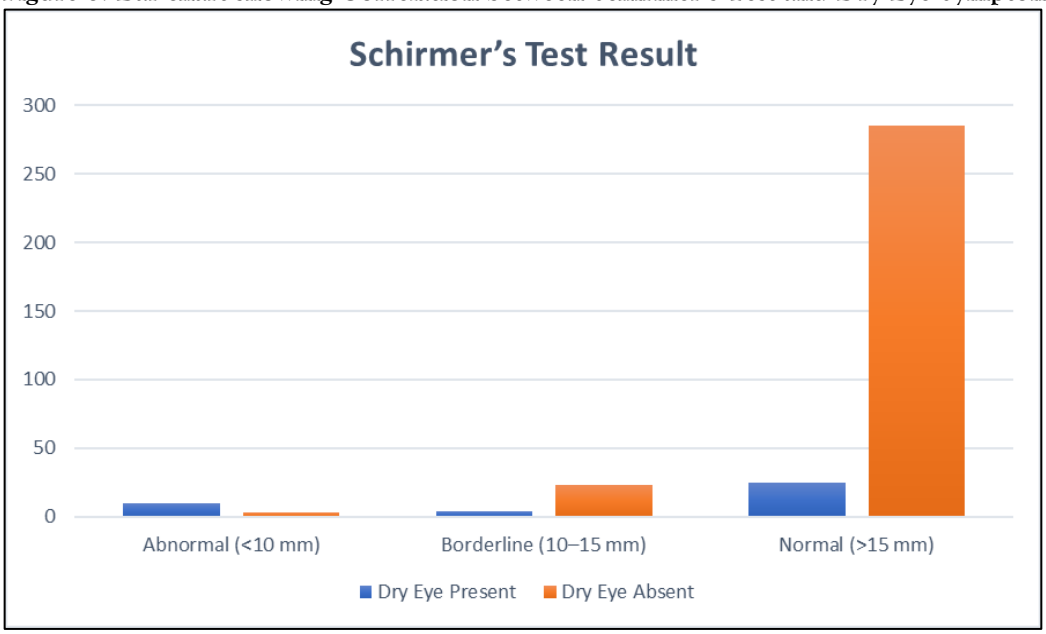

Table 7. Correlation between TBUT and Dry Eye Symptoms

TBUT Category	Dry Eye Present	Dry Eye Absent	Total
Abnormal (<10 s)	8	4	12
Borderline (10–15 s)	13	17	30
Normal (15–45 s)	18	290	308
Overall p-value	< 0.0001		

The table displays the distribution of dry eye cases based on TBUT (Tear Break-Up Time) categories. In the abnormal TBUT group (<10 seconds), 8 individuals had dry eye and 4 did not. In the borderline group (10–15 seconds), 13 had dry eye and 17 were free of it. Among those with normal TBUT (15–45 seconds), 18 had dry eye while 290 did not. The association between TBUT and dry eye status was found to be statistically significant ($p < 0.0001$).

Figure 7: Bar chart showing Correlation between TBUT and Dry Eye Symptoms

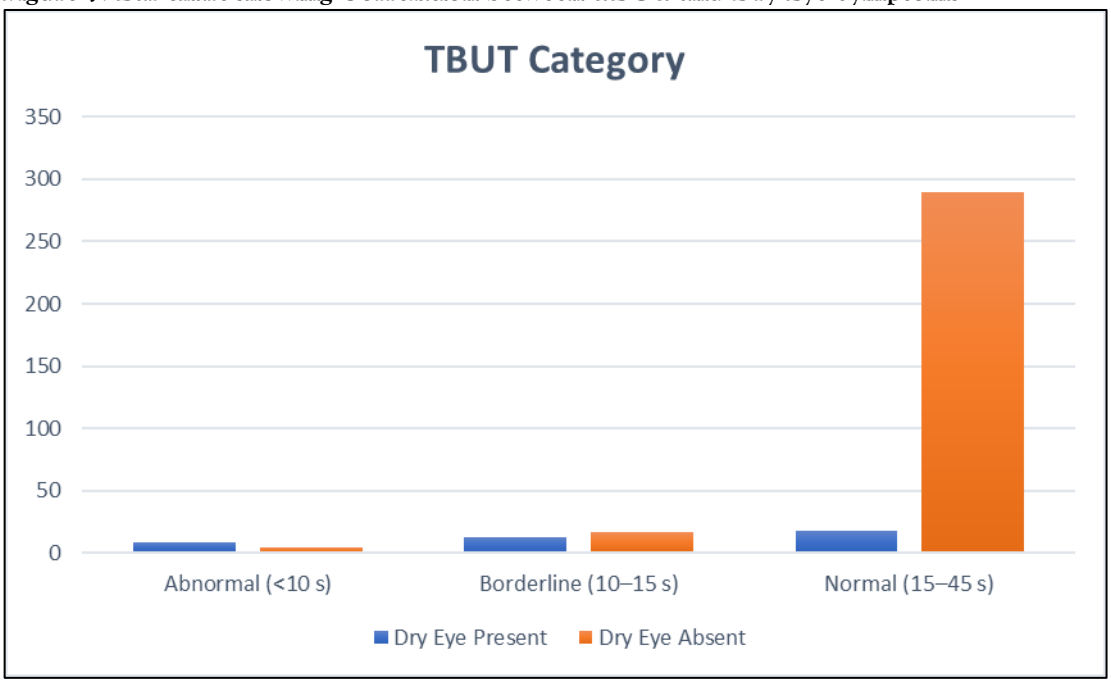

Table 8. Correlation between Fluorescein Staining Score and Dry Eye Severity

Fluorescein Score	Dry Eye Present	Dry Eye Absent	Total
Score 0	9	294	303
Score 1	17	11	28
Score 2	9	6	15
Score 3	4	0	4
Overall p-value	< 0.0001		

The table presents the distribution of dry eye cases according to fluorescein staining scores. Among those with a score of 0, 9 had dry eye and 294 did not. For score 1, 17 individuals had dry eye while 11 did not. In the score 2 group, 9 had dry eye and 6 did not. All 4 individuals with a score of 3 had dry eye, with none in the dry eye absent group. The association between fluorescein score and dry eye presence was statistically significant ($p < 0.0001$).

Figure 8: Bar chart showing Correlation between Fluorescein Staining Score and Dry Eye Symptoms

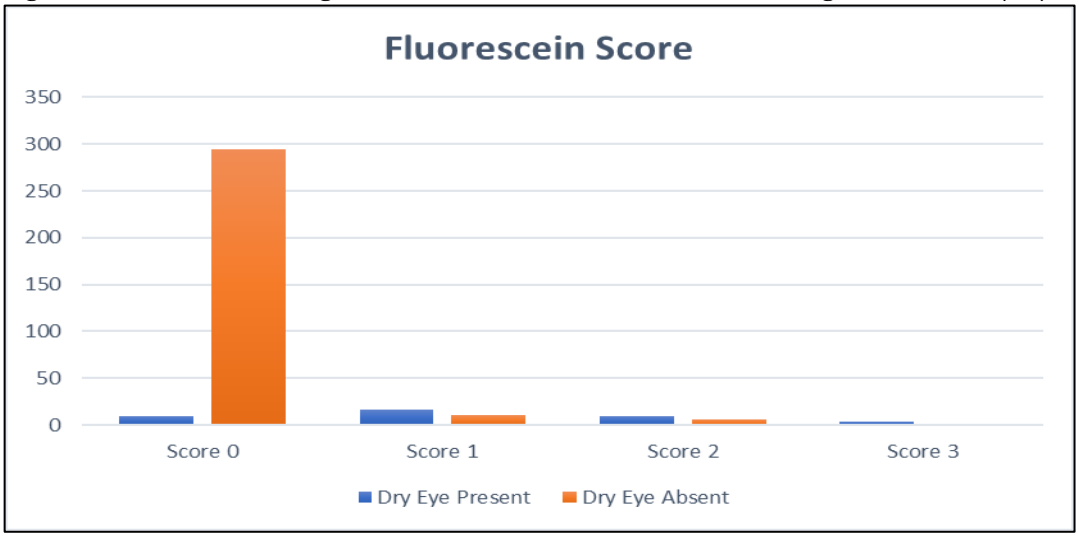

Table 9. Overall Statistical Analysis Summary

Parameter	Test Used	p-value	Significance
Schirmer's Test vs. Dry Eye	Chi-square	< 0.0001	Significant
TBUT vs. Dry Eye	Chi-square	< 0.0001	Significant
Fluorescein Staining vs. Dry Eye	Chi-square	< 0.0001	Significant
Age Group vs. Dry Eye Prevalence	Chi-square	0.47512	Not Significant
Gender vs. Dry Eye Prevalence	Chi-square	0.8063	Not Significant

The table summarizes the statistical analysis of various parameters in relation to dry eye presence. Schirmer's test, TBUT, and fluorescein staining all showed a statistically significant association with dry eye ($p < 0.0001$, Chi-square test). In contrast, age group ($p = 0.47512$) and gender ($p = 0.8063$) did not show significant associations with dry eye prevalence.

DISCUSSION

The study enrolled 350 patients with pseudo exfoliation syndrome (PXF) from Ophthalmology Out Patient Department (OPD) at a tertiary health care centre. The results demonstrate a significant association between pseudo exfoliation and dry eye, highlighting the importance of early detection and management of ocular surface dysfunction in these patients.

Prevalence of Dry Eye Symptoms Patient-reported symptoms of dry eye included burning, foreign body sensation, grittiness, and redness. In the study, 6.29% of patients reported a burning sensation, 5.71% felt a foreign body sensation, 8.86% experienced grittiness, and 4.86% reported redness. Notably, 74.29% of the patients did not report any dry eye symptoms. Many patients reported more than one symptom, reflecting the multifactorial nature of dry eye in pseudo exfoliation. The high prevalence of subjective symptoms, particularly grittiness, supports the clinical findings of tear film instability and ocular surface compromise. These symptom reports underscore the importance of combining subjective and objective measures when diagnosing dry eye.

Prevalence of Dry Eye in Pseudoexfoliation Syndrome: Three dry eye tests were performed in all patients with pseudoexfoliation to assess ocular surface changes. The study found that 11% of patients with pseudoexfoliation exhibited dry eye, as diagnosed combining Schirmer's test, tear break-up time (TBUT), and fluorescein staining. Gowthaman S et al. reported 6% prevalence of dry eye syndrome in pseudoexfoliation patients. A significant proportion of patients exhibited reduced tear production and stability in the present study. These findings suggest that pseudoexfoliation-related ocular surface changes may disrupt the normal functioning of the tear film, leading to increased tear evaporation and ocular discomfort. The presence of pseudoexfoliative material on the ocular surface may contribute to mechanical irritation, further exacerbating tear film instability.

Correlation Between Dry Eye and Objective Clinical Parameter, Schirmer' s test In our study, we employed Schirmer's test to assess tear production. This test evaluates the capacity of the eyes to produce the aqueous component of tears, a function that is often reduced in individuals diagnosed with PXF. The observed decline in tear production may be attributed to the deposition of PXF material and changes in the morphology of the tear-producing glands. In the present study, 88.57% of patients exhibited normal tear secretion, had 7.7% had borderline results, and 3.71% had abnormal tear secretion (15mm), 2.6% had 10-15 mm revealing borderline 58 findings and 1.4% had abnormal values between 5-10 mm. A study by Noori S et al. demonstrated abnormal tear secretion in 17.66 % of patients. Moreover, present study identified a strong correlation between dry eye prevalence and Schirmer's test with p value of 0.0001. Schirmer's test results showed that a substantial number of patients had decreased tear secretion, suggesting possible lacrimal gland dysfunction in pseudoexfoliation.

Tear Film Break-Up Time (TBUT) Tear film stability was assessed by the TBUT test. TBUT assesses the adequacy of the mucin layer of the tear film which is depleted in patients with PEX. In this study, 88% of patients had a normal TBUT (15–45 seconds), 8.57% fell into the borderline category (10–15 seconds), and 3.43% had abnormal TBUT (<10 seconds

Gowthaman S et al demonstated 2% of patients with abnormal TBUT. In the present study, 12% of patients exhibited tear film instability, a key feature of dry eye disease. TBUT values were significantly reduced, indicating tear film instability and increased evaporation, which are hallmarks of evaporative dry eye. Shorter TBUT values in PXF patients could be attributed to disrupted lipid layer function due to meibomian gland

dysfunction, increased ocular surface inflammation linked to pseudoexfoliative deposits or altered tear film composition, leading to faster tear evaporation.

Other studies by Noori S et al., Pujar C et al. and Reshma G et al observed a significantly decreased TBUT values (p value <0.05) between cases of PXF and age matched controls further reinforcing that the depletion of mucin layer might be attributed to the deposition of PEX material at the openings of the goblet cells contributing to dry eye symptoms.

Fluorescein Staining and Ocular Surface Damage The fluorescein staining score was used to grade ocular surface damage. The results showed that 86.57% of patients had no staining, 8% had mild staining, 4.29% had moderate staining, and 1.14% had severe staining. These findings indicate that while the majority of patients have a relatively intact ocular surface, significant proportion of the population displayed significant epithelial damage. This damage, as evidenced by moderate to severe staining, is a marker of ocular surface disease and correlates with dry eye severity. In contrast, only 0.7% of patients demonstrated positive staining in a study by Gowthaman S et al. This variation could be due to sample selection bias in which their study population included majority of patients with milder forms of disease. Furthermore, in our study, Fluorescein staining scores were significantly higher in patients with dry eye, indicating an increased degree of corneal and conjunctival epithelial damage. Corneal staining patterns observed in these patients suggest tear film instability leading to epithelial desiccation and increased susceptibility to mechanical irritation. The presence of pseudoexfoliation deposits on the ocular surface may play a role in epithelial damage by disrupting the smoothness of the tear film and causing localized tear film breakup. Additionally, pseudoexfoliation has been linked to increased oxidative stress and inflammation, both of which contribute to ocular surface disease.

CLINICAL IMPLICATIONS OF THE STUDY

This study highlights the significant prevalence of dry eye in patients with pseudo exfoliation syndrome (PXF) and its potential impact on ocular health and quality of life. The findings have several important clinical implications that can guide ophthalmologists in early diagnosis, management, and long-term care strategies. Importance of Early Screening and Diagnosis Routine Dry Eye Screening in PXF Patients: The study found significant associations between dry eye symptoms and diagnostic tests such as Schirmer's, TBUT, and fluorescein staining. Therefore, using a combination of these tests rather than relying on a single parameter enhances diagnostic accuracy. Impact on Visual Acuity and Quality of Life. PXF is already associated with an increased risk of glaucoma and cataracts. The presence of dry eye further exacerbates the risk of corneal damage, which can contribute to long-term visual deterioration. Need for Personalized Treatment Plans: Patients presenting with moderate to severe dry eye symptoms may require more aggressive treatment strategies, including tear supplements, anti-inflammatory therapies, and lifestyle modifications. Optimizing Treatment Strategies for PXF-Related Dry Eye Artificial Tear Supplementation: Given that 34.3% of patients were diagnosed with dry eye, the use of preservative-free artificial tears should be encouraged to improve tear film stability and reduce ocular discomfort. Lid Hygiene and Warm Compresses: Patients with significant symptoms should be advised to maintain good eyelid hygiene and use warm compresses to improve meibomian gland function, reducing evaporative dry eye.

Avoidance of Exacerbating Factors: Patients should be counseled on environmental factors that can worsen dry eye, such as prolonged screen exposure, air-conditioned environments, and smoking. Since PXF is a major risk factor for cataract and glaucoma surgeries, assessing dry eye preoperatively is crucial. Dry eye symptoms can affect postoperative healing, visual recovery, and patient satisfaction.

Patient Education and Awareness: Educating Patients on Dry Eye as a Chronic Condition: Many patients may not recognize the significance of dry eye symptoms and may delay seeking treatment. Providing education on symptom recognition and available management strategies can improve adherence to therapy. Regular Follow-Up for Long-Term Monitoring. Since dry eye is a progressive condition, periodic follow-ups should be scheduled to assess changes in symptoms, adjust treatment plans, and prevent further ocular surface damage.

CONCLUSION

This study confirms a significant association between pseudoexfoliation syndrome and dry eye disease, with significant tear film instability, reduced aqueous tear production and ocular surface damage. The findings emphasize the importance of early detection and management of dry eye in PXF patients to preserve ocular comfort and visual function. Regular ocular surface evaluations and individualized treatment strategies should be integrated into clinical practice to improve patient outcomes. Future research should focus on identifying optimal therapeutic approaches to mitigate ocular surface dysfunction in pseudoexfoliation patients.

BIBLIOGRAPHY

1. Okutucu M, Findik H, Aslan MG. Evaluation of dry eye and meibomian gland dysfunction with meibography in pseudoexfoliation syndrome. *Turk Klin J Ophthalmol.* 2020 Nov 1;29(4).
2. Warjri GB, Das AV, Senthil S. Clinical profile and demographic distribution of pseudoexfoliation syndrome: An electronic medical record-driven big data analytics from an eye care network in India. *Indian J Ophthalmol.* 2023 Jul 1;71(7):2746-55.
3. Shazly TA, Farrag AN, Kamel A, Al-Hussaini AK. Prevalence of pseudoexfoliation syndrome and pseudoexfoliation glaucoma in Upper Egypt. *BMC Ophthalmol.* 2011 Dec;11:1-6.
4. Pujar C, Hiremath S, Gadag VR. Correlations between tear function abnormalities and pseudoexfoliation: A comparative study. *Indian J Clin Exp Ophthalmol.* 2019 Jan;5:118-20.
5. Dermenoudi M, Matsou A, Keskini C, Anastasopoulos E. Ocular surface disease signs and symptoms in patients with pseudoexfoliative glaucoma: A case-control study. *Vision.* 2022 Feb 8;6(1):11.
6. Rumelaitienė U, Žaliūnienė D, Špečkauskas M, Tamošiūnas A, Radišauskas R, Peto T, Larsen MB, Bernotienė G. Pseudoexfoliation syndrome association with aging and ocular changes in cornea, lens, retina.
7. Kozobolis VP, Detorakis ET, Tsilimbaris MK, Vlachonikolis IG, Tsambarlakis IC, Pallikaris IG. Correlation between age-related macular degeneration and pseudoexfoliation syndrome in the population of Crete (Greece). *Arch Ophthalmol.* 1999 May 1;117(5):664-9
8. Rao A, Padhy D, Sahay P, Pradhan A, Sarangi S, Das G, Raj N. Clinical spectrum of pseudoexfoliation syndrome—An electronic records audit. *PLoS One.* 2017 Oct 27;12(10):e0185373.
9. Rashmi G, Chaitra MC. Tear film abnormalities in patients with pseudoexfoliation syndrome. *Pan-Am J Ophthalmol.* 2023 Dec 1;5(1):53.
10. Eroglu FC, Sekeroglu MA, Ceran TH, Simsek M, Hondur G. Evaluation of lacrimal drainage system in pseudoexfoliation syndrome. *Eye.* 2022 Nov;36(11):2094-8.
11. Bikbov MM, Kazakbaeva GM, Rakhimova EM, Rusakova IA, Fakhretdinova AA, Tuliakova AM, Panda-Jonas S, Gilmanshin TR, Zainullin RM, Bolshakova NI, Safiullina KR. The prevalence of dry eye in a very old population. *Acta Ophthalmol.* 2022 May;100(3):262-8.
12. Kaliaperumal S, Govindaraj I, Rao V. Abnormalities of tear function in patients with pseudoexfoliation. *Int J Clin Exp Physiol.* 2014 Jan 1;1(1):34-.
13. Kushwah S, Thamodharan S, Manjula TR, Raju K. Evaluation of tear function and ocular surface changes in patients with pseudoexfoliation. *Indian J Clin Exp Ophthalmol.* 2023;9(3):354-8.
14. Yüksel N, Tuğan BY. Pseudoexfoliation glaucoma: Clinical presentation and therapeutic options. *Turk J Ophthalmol.* 2023 Aug 19;53(4):247.
15. Erdoğan H, Arıcı DS, Toker Mİ, Arıcı MK, Fariz G, Topalkara A. Conjunctival impression cytology in pseudoexfoliative glaucoma and pseudoexfoliation syndrome. *Clin Exp Ophthalmol.* 2006 Mar;34(2):108-13.
16. Yilmaz YC, Hayat SC, Ipek SC. Corneal clarity and tomographic patterns in pseudoexfoliation syndrome: A severity-based investigation. *Eye Contact Lens.* 2024 Nov 1;50(11):482-8.
17. Pflugfelder SC, de Paiva CS. The pathophysiology of dry eye disease: what we know and future directions for research. *Ophthalmology.* 2017 Nov 1;124(11):S4-13.
18. Hicks PM, Siedlecki A, Haaland B, Owen LA, Au E, Feehan M, Murtaugh MA, Sieminski S, Reynolds A, Lillvis J, DeAngelis MM. A global genetic epidemiological review of pseudoexfoliation syndrome. *Explor Med.* 2021 Dec 31;2(6):527-43.
19. Taube AB, Konzer A, Alm A, Bergquist J. Proteomic analysis of the aqueous humour in eyes with pseudoexfoliation syndrome. *Br J Ophthalmol.* 2019 Aug 1;103(8):1190-4.
20. Mikalauskiene L, Grzybowski A, Zemaitiene R. Ocular surface changes associated with ophthalmic surgery. *J Clin Med.* 2021 Apr 12;10(8):1642.
21. Lemp MA, Foulks GN. The definition and classification of dry eye disease. *Ocul Surf.* 2007 Apr;5(2):75-92.
22. Sorkhabi R, Ghorbanihaghjo A, Ahoor M. Oxidative stress in pseudoexfoliation syndrome.
23. Tekin K, Sekeroglu MA, Kiziltoprak H, Yetkin E, Doguizi S, Yilmazbas P. Static and dynamic pupillary characteristics in clinically unilateral pseudoexfoliation syndrome. *J Glaucoma.* 2018 Jun 1;27(6):552-7.

LIST OF ABBREVIATIONS

1. DED- Dry Eye Disease
2. PXF/PEX -Pseudoexfoliation
3. TBUT – Tear Film Breakup Time
4. MGD – Meibomian Gland Dysfunction
5. MMP – matrix metalloproteinases
6. IL – Interleukin
7. TNF – Tumor Necrosis Factor
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