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CORRELATION BETWEEN PRIMARY CHRONIC DACRYOCYSTITIS AND MEIBOMIAN GLAND DYSFUNCTION: A CLINICAL STUDY

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ABSTRACT

Background: Primary chronic dacryocystitis (PCD) is a long-standing inflammatory condition of the lacrimal sac that often presents with chronic tearing and discharge. Meibomian gland dysfunction (MGD), a leading cause of evaporative dry eye disease, may share inflammatory pathways with PCD due to their anatomical proximity. Despite this, the relationship between these two conditions remains underexplored. The aim is to evaluate the correlation between primary chronic dacryocystitis and meibomian gland dysfunction and to assess the impact of dacryocystorhinostomy (DCR) on MGD and tear film stability.

Materials and Methods: A prospective, interventional, observational study was conducted involving 90 participants divided into two groups: Group A (45 patients with unilateral PCD) and Group B (45 age- and gender-matched healthy controls). Comprehensive ophthalmic evaluation included tear film breakup time (TBUT), Schirmer's test, fluorescein staining, and assessment of meibomian gland expressibility and secretion quality. Patients in Group A underwent DCR, and postoperative assessments were performed at 1 and 3 months. Statistical analysis was done using SPSS version 26.0, with $p < 0.05$ considered statistically significant.

Results: MGD was significantly more prevalent in the PCD group (68.89%) compared to controls (26.67%) ($p < 0.001$). Poor gland expressibility and abnormal secretion quality were also significantly higher in Group A (62.22% and 66.67%, respectively) than in controls (22.22% and 24.44%) ($p < 0.001$). TBUT and Schirmer's test values were lower in PCD patients at baseline ($p < 0.001$). Following DCR, MGD prevalence decreased to 37.78%, TBUT improved to 8.63 ± 1.95 seconds, and poor gland expressibility reduced to 26.67% by 3 months, all showing statistically significant changes ($p < 0.01$).

Conclusion: There is a strong correlation between primary chronic dacryocystitis and meibomian gland dysfunction, with PCD contributing to worsened tear film quality and MGD severity. Dacryocystorhinostomy significantly improves both MGD and tear film parameters, underlining the need for integrated management of ocular surface health in patients with PCD.

Keywords: Dacryocystitis, Meibomian Gland Dysfunction, Tear Film, Dacryocystorhinostomy, Ocular Surface.

INTRODUCTION

The ocular surface is a complex, highly integrated system comprising the cornea, conjunctiva, tear film, eyelids, and associated glands. Among these, the tear film plays a pivotal role in maintaining optical clarity, surface hydration, and protection against microbial invasion. The tear film consists of three layers—lipid, aqueous, and mucin—each serving a distinct purpose in stabilizing and lubricating the ocular surface. The outermost lipid layer, secreted predominantly by the meibomian glands, is critical for retarding tear evaporation and ensuring tear film stability.[1] Disruption in the function of any component of this

system, particularly the meibomian glands, can lead to tear film instability and manifest clinically as dry eye symptoms.

Meibomian gland dysfunction (MGD) is a highly prevalent ocular surface disorder characterized by chronic, diffuse abnormalities of the meibomian glands, resulting in altered lipid secretion and glandular obstruction. These changes compromise the quality and quantity of the tear film lipid layer, increasing tear evaporation and promoting inflammation.[2] MGD is now recognized as one of the leading causes of evaporative dry eye disease worldwide.[3] It presents with a spectrum of clinical symptoms, including ocular discomfort, dryness, burning, foreign body sensation, and intermittent blurring of vision. Several morphological and functional alterations in meibomian glands, such as gland dropout, acinar atrophy, ductal dilation, and increased viscosity of meibum, are associated with its pathogenesis.[4]

Primary chronic dacryocystitis (PCD) is a distinct condition marked by persistent inflammation and obstruction of the nasolacrimal drainage system, particularly at the level of the lacrimal sac. It commonly presents with chronic tearing (epiphora), mucoid discharge, and recurrent conjunctivitis. Though the pathogenesis of PCD is largely attributed to obstruction-related stasis and secondary bacterial infections, recent research has suggested that its influence may extend beyond the lacrimal drainage system to impact adjacent ocular structures. The proximity of the lacrimal sac to the eyelids and ocular surface has led investigators to explore its potential role in exacerbating or triggering ocular surface diseases, including MGD.[5]

Chronic inflammation resulting from PCD may affect the periocular environment, including the meibomian glands. It is hypothesized that the stagnation of infected secretions within the lacrimal sac may propagate local inflammatory mediators, which in turn could influence eyelid margin health and meibomian gland function. While the association between PCD and tear film abnormalities has been acknowledged, the specific link between PCD and MGD remains inadequately explored in the literature. Few studies have systematically evaluated the morphological and functional status of meibomian glands in patients with PCD using modern diagnostic modalities.[6]

In clinical settings, it is often observed that patients with chronic dacryocystitis also exhibit signs of lid margin irregularity, meibomian orifice plugging, and tear film instability—all hallmark signs of MGD. However, the coexistence of these conditions is frequently overlooked, with clinical management often limited to addressing the lacrimal obstruction alone. As MGD itself contributes significantly to symptoms such as dryness, irritation, and foreign body sensation, untreated MGD in the presence of PCD may perpetuate ocular discomfort even after surgical relief of obstruction. Hence, a deeper understanding of the interrelationship between these two conditions could have significant implications for comprehensive patient care.

The therapeutic approach for PCD typically involves dacryocystorhinostomy (DCR), a surgical procedure aimed at bypassing the obstructed nasolacrimal duct to restore physiological tear drainage. While DCR effectively addresses epiphora and infection, its impact on meibomian gland status and overall ocular surface health has not been thoroughly studied. It remains unclear whether the resolution of chronic dacryocystitis following DCR contributes to the recovery or improvement of concurrent MGD signs and symptoms. Investigating this relationship could help clarify whether MGD is merely a coincidental finding or a secondary manifestation driven by the chronic inflammatory environment associated with PCD.[7]

The current understanding of MGD has advanced significantly, particularly with the advent of noninvasive imaging modalities such as infrared meibography, in vivo confocal microscopy, and tear film interferometry. These tools provide valuable insights into the structural integrity and functional capacity of the meibomian glands without causing patient discomfort. The integration of these techniques into clinical research has enabled more objective evaluation of gland dropout, orifice status, and secretion quality, facilitating early diagnosis and tailored management strategies.[8] In the context of PCD, using such diagnostic modalities could uncover subtle changes in meibomian gland morphology that may otherwise remain undetected through routine slit-lamp examination.

Understanding the association between PCD and MGD also holds relevance for improving surgical outcomes and patient satisfaction. Postoperative persistence of dry eye symptoms or lid margin disease may compromise the perceived success of DCR, even if anatomical patency is achieved. Identifying and treating underlying or coexisting MGD could enhance both symptomatic relief and ocular surface rehabilitation. In patients presenting with epiphora, a comprehensive ocular surface examination including evaluation of the lid margins and meibomian gland function should therefore be considered standard practice. Incorporating this dual approach may shift the management paradigm from an isolated focus on nasolacrimal patency to a more holistic strategy that addresses all contributing factors to ocular surface disease.[9]

MATERIALS AND METHODS

This was a prospective, interventional, observational study conducted at a tertiary care hospital. A total of 90 patients were enrolled in the study after obtaining institutional ethical clearance and informed consent from all participants. The study population was divided into two groups:

- **Group A:** 45 patients diagnosed with unilateral primary chronic dacryocystitis (PCD).

- **Group B:** 45 age- and gender-matched healthy controls with no history of lacrimal or meibomian gland disorders.

Inclusion Criteria

- Adults aged 18 years and above.
- Patients with clinically confirmed unilateral PCD, characterized by chronic epiphora and positive regurgitation on pressure over the lacrimal sac.
- Healthy controls with no ocular surface disease or lacrimal pathology.

Exclusion Criteria:

- History of previous ocular surgery or trauma.
- Contact lens wearers.
- Patients on chronic topical or systemic medications affecting the ocular surface.
- Presence of eyelid abnormalities (e.g., entropion, ectropion).
- Secondary causes of nasolacrimal duct obstruction.

Clinical Evaluation and Intervention

All participants underwent a comprehensive ophthalmic evaluation that included best-corrected visual acuity (BCVA), slit-lamp examination, tear film breakup time (TBUT), Schirmer's test, lid margin examination, meibomian gland expressibility and quality scoring, and ocular surface staining with fluorescein dye. Meibomian gland dysfunction (MGD) was assessed and graded based on the criteria established by the International Workshop on Meibomian Gland Dysfunction, incorporating both gland expressibility and secretion quality.

Patients in Group A, who were diagnosed with primary chronic dacryocystitis, underwent dacryocystorhinostomy (DCR) following baseline assessments. Postoperative evaluations focusing on tear film stability and MGD status were conducted at 1 month and again at 3 months after the surgical intervention.

Statistical Analysis: Data were analyzed using SPSS software version 26.0. Continuous variables were expressed as mean ± standard deviation. Categorical variables were compared using the Chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

Demographic Characteristics: As shown in [Table 1], the mean age of participants in Group A (PCD) was 53.20 ± 10.15 years, while that in Group B (Control) was 51.78 ± 9.65 years. The age difference between the two groups was not statistically significant ($p = 0.442$), indicating appropriate age matching. Similarly, the gender distribution between the groups was comparable, with 40.00% males and 60.00% females in the PCD group, and 44.44% males and 55.56% females in the control group ($p = 0.664$). These findings confirm that the demographic characteristics were balanced, minimizing bias related to age or gender.

Prevalence of Meibomian Gland Dysfunction (MGD): [Table 2] demonstrates a significantly higher prevalence of MGD among patients with PCD compared to healthy controls. In Group A, 31 out of 45 patients (68.89%) exhibited MGD, whereas only 12 out of 45 controls (26.67%) were affected. The difference was highly significant ($p < 0.001$). This suggests a strong association between primary chronic dacryocystitis and the presence of meibomian gland dysfunction, implying a potential link between chronic lacrimal sac inflammation and meibomian gland pathology.

Meibomian Gland Expressibility and Secretion Quality: As illustrated in [Table 3], patients in Group A showed significantly poorer meibomian gland expressibility and abnormal secretion quality compared to controls. Poor expressibility was observed in 62.22% of PCD patients versus 22.22% in the control group ($p < 0.001$). Abnormal secretion quality was found in 66.67% of PCD patients, compared to 24.44% in controls ($p < 0.001$). These findings highlight that PCD not only increases the prevalence of MGD but also worsens its severity, potentially contributing to tear film instability.

Tear Film Stability Parameters: [Table 4] compares tear film parameters between the two groups at baseline. The mean tear film breakup time (TBUT) was significantly lower in the PCD group (5.42 ± 1.80 seconds) compared to the control group (9.36 ± 2.10 seconds), with a p-value of <0.001. Similarly, Schirmer's test scores were lower in the PCD group (7.98 ± 2.42 mm) than in controls (12.54 ± 3.18 mm), again with a highly significant p-value (<0.001). These results indicate compromised tear production and stability in patients with PCD, likely due to associated MGD and chronic inflammation.

Postoperative Improvement After DCR in Group A: [Table 5] tracks changes in MGD and tear film parameters in the PCD group following dacryocystorhinostomy (DCR) surgery. At baseline, 68.89% of patients had MGD, which reduced to 53.33% at 1 month and further to 37.78% at 3 months postoperatively. This reduction was statistically significant ($p = 0.002$), suggesting that surgical resolution of dacryocystitis leads to improvement in meibomian gland health.

Likewise, TBUT improved significantly from a baseline of 5.42 ± 1.80 seconds to 7.24 ± 2.10 seconds at 1 month and 8.63 ± 1.95 seconds at 3 months ($p < 0.001$). The proportion of patients with poor gland expressibility also dropped from 62.22% at baseline to 42.22% at 1 month and 26.67% at 3 months post-DCR ($p = 0.001$). These improvements indicate a positive impact of DCR on tear film stability and MGD, likely due to resolution of inflammatory mediators and restoration of normal tear drainage.

Table 1: Demographic Characteristics of the Study Population

Variable	Group A (PCD, n=45)	Group B (Control, n=45)	p-value
Mean Age (years)	53.20 ± 10.15	51.78 ± 9.65	0.442
Gender (Male: Female)	18:27 (40.00% : 60.00%)	20:25 (44.44% : 55.56%)	0.664

Table 2: Prevalence of Meibomian Gland Dysfunction (MGD) at Baseline

MGD Presence	Group A (PCD)	Group B (Control)	p-value
Present (n, %)	31 (68.89%)	12 (26.67%)	<0.001
Absent (n, %)	14 (31.11%)	33 (73.33%)	

Table 3: Meibomian Gland Expressibility and Secretion Quality at Baseline

Parameter	Group A (PCD)	Group B (Control)	p-value
Poor Expressibility (n, %)	28 (62.22%)	10 (22.22%)	<0.001
Abnormal Secretion Quality (%)	30 (66.67%)	11 (24.44%)	<0.001

Table 4: Tear Film Stability Parameters at Baseline

Parameter	Group A (PCD)	Group B (Control)	p-value
Mean TBUT (seconds)	5.42 ± 1.80	9.36 ± 2.10	<0.001
Schirmer's Test (mm)	7.98 ± 2.42	12.54 ± 3.18	<0.001

Table 5: Postoperative Improvement in MGD and TBUT in Group A (PCD)

Parameter	Preoperative	1 Month Post-DCR	3 Months Post-DCR	p-value (Pre vs 3M)
MGD Present (n, %)	31 (68.89%)	24 (53.33%)	17 (37.78%)	0.002
Mean TBUT (seconds)	5.42 ± 1.80	7.24 ± 2.10	8.63 ± 1.95	<0.001
Poor Expressibility (n, %)	28 (62.22%)	19 (42.22%)	12 (26.67%)	0.001

DISCUSSION

In the present study, the mean age of participants in both groups was comparable (Group A: 53.20 ± 10.15 years; Group B: 51.78 ± 9.65 years), with no statistically significant difference ($p = 0.442$). Gender distribution was also balanced. These findings are consistent with Shimazaki et al. (1995),[10] who described meibomian gland dysfunction (MGD) as more prevalent with increasing age but did not report significant gender differences when groups were age-matched. By matching these demographic parameters, our study ensured that variations in meibomian gland parameters and tear film quality could be attributed primarily to the presence of primary chronic dacryocystitis (PCD), rather than to confounding factors.

The prevalence of MGD in patients with PCD in our study was 68.89%, which was significantly higher than 26.67% observed in healthy controls ($p < 0.001$). This is in close agreement with the findings of Knop et al. (2009),[11] who reported that MGD is often secondary to chronic inflammation of periocular structures. Additionally, Arita et al,[12] (2015) reported a prevalence of MGD around 65–70% in patients with tear film instability and ocular surface disease, which aligns closely with our Group A results. Our findings further extend this evidence by specifically associating MGD with PCD, a condition not often studied in this context.

The severity of MGD was also found to be higher in the PCD group. Poor meibomian gland expressibility was noted in 62.22% of PCD patients compared to 22.22% of controls, and abnormal secretion quality was observed in 66.67% versus 24.44%, respectively ($p < 0.001$). These results are consistent with Hao et al. (2016),[13] who found that poor expressibility and secretion quality were key diagnostic markers of advanced MGD. Similarly, Pult and Nichols (2012),[14] emphasized that gland expressibility and secretion quality are crucial for evaluating functional status, with high abnormality rates correlating to clinical severity.

Tear film stability, measured by TBUT and Schirmer's test, was also significantly compromised in PCD patients. The mean TBUT in our study was 5.42 ± 1.80 seconds in the PCD group, compared to 9.36 ± 2.10 seconds in controls ($p < 0.001$), while Schirmer's test values were 7.98 ± 2.42 mm versus 12.54 ± 3.18 mm, respectively ($p < 0.001$). These findings are strongly corroborated by Khurana et al. (1987),[15] who reported that chronic dacryocystitis patients had markedly reduced tear stability and quantity due to chronic inflammation and secondary ocular surface changes. While Korb and Blackie (2015),[16] suggested that many "dry eye" diagnoses are actually misidentified MGD, our findings show that in PCD, both evaporative (MGD-related) and aqueous-deficient mechanisms may coexist.

A unique contribution of this study lies in the postoperative follow-up of MGD parameters after dacryocystorhinostomy (DCR). The prevalence of MGD decreased from 68.89% preoperatively to 37.78% at 3 months post-DCR, with a significant p-value of 0.002. Mean TBUT improved from 5.42 ± 1.80 seconds to 8.63 ± 1.95 seconds ($p < 0.001$), and the percentage of patients with poor expressibility reduced from 62.22% to 26.67% ($p = 0.001$). These postoperative improvements reflect the hypothesis proposed by Sung et al,[17] (2017) and Kamal et al. (2016),[18] who suggested that anatomical normalization of the lacrimal drainage system not only restores tear flow but may also reduce periocular

inflammation, thereby improving meibomian gland function.

Comparatively, Sun et al,[19] (2005) noted that persistent infection in chronic dacryocystitis could contribute to a pro-inflammatory ocular surface, possibly perpetuating MGD even in the absence of classical dry eye disease. Our findings provide clinical support to this theory, demonstrating that addressing the underlying cause (PCD) through DCR has a measurable and statistically significant effect on MGD improvement. Few prior studies have quantified this postoperative change in MGD as precisely as we have.

Taken together, our results suggest that PCD is both a comorbid factor and potential aggravator of MGD, and that DCR not only resolves nasolacrimal obstruction but contributes meaningfully to ocular surface rehabilitation. This aligns with the findings of Singh et al. (2017),[20] who emphasized the value of functional imaging of the proximal lacrimal system in evaluating tear film-related disorders. The improvement of TBUT and expressibility over time in our cohort confirms the dynamic interplay between ocular surface health and lacrimal system integrity.

CONCLUSION

This study demonstrates a significant association between primary chronic dacryocystitis (PCD) and meibomian gland dysfunction (MGD), with PCD patients showing higher prevalence and severity of MGD compared to healthy controls. Tear film stability was also markedly compromised in the PCD group. Following dacryocystorhinostomy (DCR), substantial improvement was observed in both MGD parameters and tear film quality. These findings highlight the importance of evaluating and managing MGD in patients with PCD to enhance overall ocular surface health.

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