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Clinical and Morphological Evaluation of Meibomian Glands in Dry Eye Disease

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ABSTRACT

Introduction

Studies on Meibomian gland morphology and association with dry eyes are not common in our scenario. The objective of this study was to know the clinical pattern and morphology of Meibomian glands and its association with dry eyes.

Methods

This was prospective observational study done in Cornea clinic of Nepal Eye Hospital, Kathmandu, Nepal for a period of one year (December 2022 through December 2023). All the patients aged ≥20 years who were diagnosed with Dry eye disease was included in the study. The study variables included age, sex, Ocular surface disease index (OSDI), Schirmer test, Tear break up time (TBUT), Lissamine staining, Meibomian gland loss, Meibomian secretion and dry eyes severity. Descriptive analysis of data was done using frequencies and percentage and correlation between parameters were done using Pearson's test.

Results

Out of fifty cases of dry eye diseases, there were 24 (48%) male and 26 (52%) female with mean age 46.47 years (SD ± 11.96). Most of the patients presented with grade 2 severity of dry eyes (44%, n=22) and the Meibomian gland loss was mainly grade 3 type (60%, n=30). There was a strong positive correlation ($r = 0.621$, $p < 0.01$) between Meibomian gland loss and OSDI Score, also strong positive correlation ($r= 0.584$, $p < .001$) Meibomian gland secretion and dry eye severity.

Conclusion

The severity of dry eye is positively correlated with Meibomian gland loss and the meibum quality.

Keywords

Dry eye disease; meibomian gland dysfunction; meibography

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INTRODUCTION

Dry eye disease is defined as a disease of tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. [1] The meta-analysis yields prevalence of dry eye ranging from 5% to 50% with symptom-based diagnosis and 75% with any positive ocular signs worldwide.[2]

Meibomian glands which are located in posterior lid margin are responsible to secret meibum which is responsible for slowing evaporation and smoothing of the tear film to provide an even optical surface.[3] Meibomian gland dysfunction causes a disruption in the tear film lipid layer which affects the rate of tear evaporation and leads to tear hyperosmolarity which leads to the dry eye disease. Dry eye disease and meibomian gland dysfunction are strongly associated with each other, such that many of their risk factors, signs, and symptoms overlap.[4] Recent literature reports the prevalence of Meibomian gland disease ranging from as low as 3.5% to 70% in clinical and population-based studies.[5] Dry eye disease and Meibomian gland dysfunction are common in Asian populations, with prevalence rates greater than 60%, compared to around 20% in Caucasian populations.[6]

Dry eye disease and Meibomian gland dysfunction are also common findings in Nepali population with 25% and 9% prevalence rate respectively.[7,8] In Nepal the morphology of Meibomian glands in dry eye disease has not been studied. The present study was undertaken to know the clinical pattern and morphology of Meibomian glands in dry eye disease and its correlation with severity of dry eyes.

METHODS

This was prospective observational study done in General OPD and Cornea clinic of Nepal Eye Hospital, Kathmandu, Nepal for a period of one year (December 2022 through December 2023). The ethical clearance was taken from institutional review board of National academy of medical sciences (Ref no: 978/2079/80). Non- probability convenience sampling was used for collection of cases.

All the patients aged ≥20 years who were diagnosed with Dry eye disease was included in the study. Patients with infectious keratoconjunctivitis, history of dyslipidemia or intake of lipid-lowering drugs, alterations of lacrimal drainage system, history of recent intraocular surgery and patients with use of topical steroids within four weeks before the study were excluded from the study.

After obtaining informed consent for the study, a specially designed proforma was used, which included demographic history and detailed slit lamp examination was performed. They were provided with an Ocular Surface Disease Index (OSDI) questionnaire, patients were subjected to Schirmer 1 test, Tear breakup Time (TBUT), Lissamine green staining, nature of Meibomian gland secretion was also analyzed and grading of dry eyes was done according to Dry eye workshop (DEWS) classification and Compression Of The Eyelid (COTE) grading system for Meibomian gland secretion.[6] Non-contact infrared meibography was performed using Topcon CA-800 Corneal Analyzer to know the area of loss of Meibomian glands. (Figure 1) All the data were recorded in excel sheet first and then transferred to SPSS 27 for analysis. Descriptive analysis of the data was done and expressed using frequencies, percentages, and means. Pearson test was done to see the correlation between two parameters.

RESULTS

Hundred eyes of fifty cases of dry eye disease were enrolled in the study period and as there was not much difference between two eyes mean values both eyes were evaluated. The mean age of the patients in this study was 46.47 years (SD ± 11.96), with 24 (48%) male and 26 (52%) female. The mean of OSDI, TBUT, Schirmer test and Lissamine staining were 30.64 (SD± 23.44), 7.6 sec (SD± 8.5),

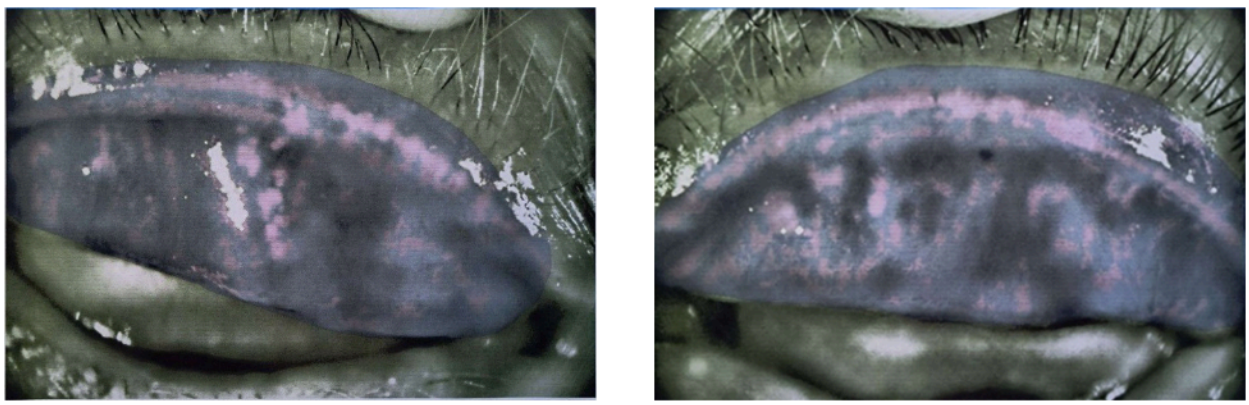

Figure 1. *Picture of right and left upper eyelids showing Meibomian gland loss in meibography*

Table 1. Pattern of dry eye severity and meibomian gland loss

Characteristics	Number (%)
Dry eye severity (Grade)	
I	4 (8)
II	22 (44)
III	18 (36)
IV	6 (12)
Meibomian gland loss	
I (< 25%)	6 (12)
II (26%- 50%)	11 (22)
III (51%- 75%)	30 (60)
IV (> 75%)	3 (6)

12.20mm (SD± 6.9) and 2.5 (SD± 2.0) respectively.

Most of the patients presented with grade 2 severity of dry eyes (44%, n=22) and grade of Meibomian gland loss was grade 3 type (60%, n=30) as shown in Table 1.

Twenty- two patients (44%) had slow egress of Meibomian gland secretion as shown in Table 2.

There was a strong positive correlation (r = 0.621, p < 0.01) between Meibomian gland loss and subjective dry eye symptoms (OSDI Score) which suggests that more the gland loss, severe is the Dry eye symptoms (Figure 2). Regarding the correlation between Meibomian gland secretion and dry eye severity also shows strong positive correlation (r= 0.584, p <0.001) (Figure 3).

The Lissamine Green staining score mean of both eyes were 28.0% cases had Grade 0, 41.0% had Grade 1, 24.0% had Grade II and 7.0% had Grade III done according to Oxford scale.

Table 2. Pattern of Meibomian gland secretion

Grade	Frequency (%)
I (easy egress of meibum)	9 (18)
II (slow egress of meibum)	22 (44)
III (thick toothpaste like meibum)	15 (30)
IV (complete blockage of tarsal gland)	4 (8)

DISCUSSION

In this study, the maximum percentage of participants belonged to the age group of 40-49 years which is comparable with the study published by Rabensteiner et al. where mean age was 55.4 ± 16.6 years.[9] Meibomian gland dysfunction (MGD) is a common eyelid disorder that has widespread prevalence with the incidence increasing with age which is also similar findings with our study. Among the total participants in our study, the highest number of Meibomian gland loss was grade 3 which contrast with the study by Nishant et al where 40% cases had grade 1 loss whereas only 5% had a score of 4.[10] Brooks and Gupta study showed that the mean Meiboscale score was 0.89 for subjects <35 years of age going for refractive surgery and 1.38 for those >35 years.[11] The difference may be due to the age difference in the participants. The current study showed a mean symptomatic OSDI score of 30.64± 23.44 which shows moderate dry eyes and the findings are similar to a study conducted by Yuanyuan Qi et al.[12] In our study we found positive correlation between the gland loss and symptomatic score which is comparable to the study by Kexuan Zhu et al. average score of OSDI of the dry eye group was 27.02 ± 14.35 and Meibomian gland dropout scores 3.21 ± 1.02 and had positive correlation.[13]This indicates as there is Meibomian gland loss there is more

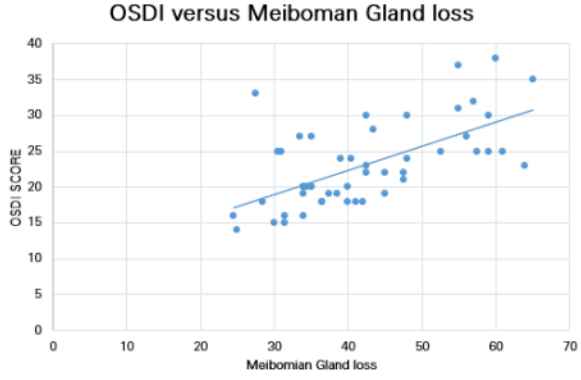

Figure 2. Correlation between OSDI and Meibomian gland loss

Figure 2. Correlation between Meibomian gland secretion and dry eye severity

symptoms of dry eyes which may be evaporative type. The Schirmer test value was 12.20±6.9 mm which is similarly to another study published by Adil et al where Schirmer I test among 538 patients was 14.4±10 mm.[14] In association of Meibomian gland morphology with symptoms and signs of dry eye disease in the Dry Eye Assessment and Management (DREAM) study published by Ebenezer et al. (2020), longer Schirmer test wetting lengths (0–5, >5–10, and >10 mm) were associated with increasing composite scores (22.02 (9.29), 23.80 (10.34), 24.96 (9.96), p = 0.03).[15] TBUT measures the tear film stability and is therefore more useful in detecting evaporative dry eye disorder while Schirmer's test measures tear production (volume) and so is actually detecting aqueous tear-deficient disorder. So to know the association of Meibomian gland in dry eye disorder TBUT is more reliable. The study published by Rabensteiner et al. in four hundred and ninety Meibomian gland dysfunction patients Tear Breakup Time was 11.3±6.1 sec whereas in our study the mean was 7.6 seconds.[16] In our study, maximum number of participants i.e. 44% had grade 2 nature of Meibomian secretion whereas only 8% participants had Grade 4 category Meibomian secretion in their eyes. This is in contrary to the study published by Yun et al. where the maximum number of patients i.e. 51.8% were in grade 4.[17] The study done by Shah et al mentioned that the prevalence of dry eye was 95% in patients with blocked Meibomian glands which is similar to our study which shows positive correlation between grade of mebium and severity of dry eyes.[18] The limitation of the study is it included only patients diagnosed case of dry eye so comparison of Meibomian gland morphology was not done with normal population and other limitation is many patients had used tear substitutes so it might have alter the result. Future studies should also include biochemical components of tears which will help to further evaluate the correlation with aqueous or evaporative dry eye disease.

CONCLUSION

The severity of dry eye is positively correlated with Meibomian gland loss and the meibum quality. So early clinical and morphological evaluation of Meibomian glands with meibography in dry eye disease plays important role.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

PS : concept of research and design of research, reviewing of manuscript; KS : Literature search,data collection, data interpretation , drafting of manuscript. Agreement to be accountable for all aspects of the work: PS , Dr KS

REFERENCES

1. Lemp MA, Foulks GN.The definition and classification of dry eye disease.Ocul Surf2007;5:75-92
2. Stapleton F, Alves M, Bunya VY, Jalbert I, Lekhanont K, Malet F, et al. TFOS DEWS II Epidemiology Report. The ocular surface. 2017;15(3):334–65. Epub 2017/07/25. pmid:28736337. http://dx.doi.org/10.1016/j.jtos.2017.05.003
3. Driver PJ, Lemp MA. Seborrhea and meibomian gland dysfunction. In: Krachmer JH, Mannis MJ, Holland EJ editor(s). Cornea. 2nd Edition. Philadelphia: Elsevier Mosby, 2005:485 91. https://doi.org/10.1016/b978-0-323-06387-6.00041-6
4. Chan TC, Chow SS, Wan KH, Yuen HK. Update on the association between dry eye disease and meibomian gland dysfunction. Hong Kong Medical Journal. 2019 Feb 1;25(1):38. https://doi.org/10.12809/hkmj187331
5. Jie Y, Xu L, Wu YY, Jonas JB. Prevalence of dry eye among adult Chinese in the Beijing Eye Study. Eye. 2009;23(3):688–93. https://doi.org/10.1038/sj.eye.6703101
6. Nichols KK, Foulks GN, Bron AJ, et al.: The international workshop on meibomian gland dysfunction: executive summary. Invest Ophthalmol Vis Sci. 2011, 52: 1922-9. https://doi.org/10.1167/iovs.10-6997a
7. Irfan KS, Agrawal A, Singh A, Mittal SK, Samanta R. Association of Lipid Profile with Severity of Meibomian Gland Dysfunction. Nepalese Journal of Ophthalmology. 2020 Oct 5;12(2):216-25.
8. Shrestha LJ, Kaiti R. A hospital based study of prevalence of dry eye in tertiary care hospital of Nepal. Kathmandu University Medical Journal. 2021 Mar 31;19(1):107-12. https://doi.org/10.3126/kumj.v19i1.49565
9. McCulley JP, Dougherty JM, Deneau DG. Classification of chronic blepharitis. Ophthalmology. 1982 Oct 1;89(10):1173-80. https://doi.org/10.1016/S0161-6420(82)34669-2
10. Nishant P, Ramawat A, Shrinkhal N, Gupta N, Mittal SK. Correlation of meiboscale symptom score and sign score for primary meibomian gland dysfunction in Indian eyes–A cross-sectional study. Indian Journal of Ophthalmology. 2022 Jun 1;70(6):1958-62. https://doi.org/10.4103/ijo.IJO_10_22
11. Brooks CC, Gupta PK. Meibomian gland morphology among patients presenting for refractive surgery evaluation. Clinical Ophthalmology. 2021 Jan 27:315-21.
12. Qi Y, Zhang C, Zhao S, Huang Y, Yang R. A novel noninvasive ocular surface analyzer for the assessment of dry eye with Meibomian gland dysfunction. Experimental and therapeutic medicine. 2017 Jun 1;13(6):2983-8. https://doi.org/10.3892/etm.2017.4364
13. Zhu K, Xie W, Ying J, Yao Y. Evaluation of tear film and meibomian gland function in dry eye patients using Keratograph 5M. Zhejiang da xue xue bao. Yi xue ban= Journal of Zhejiang University. Medical Sciences. 2016 May 1;45(4):422-8. https://doi.org/10.3785/j.issn.1008-9292.2016.07.14
14. Adil MY, Xiao J, Olafsson J, Chen X, Lagali NS, Ræder S, Utheim ØA, Dartt DA, Utheim TP. Meibomian gland morphology is a sensitive early indicator of meibomian gland dysfunction. American journal of ophthalmology. 2019 Apr 1;200:16-25.
15. Daniel E, Pistilli M, Ying GS, Bunya VY, Massaro-Giordano M, Asbell PA, Maguire MG. Association of meibomian gland morphology with symptoms and signs of dry eye disease in the Dry Eye Assessment

and Management (DREAM) study. The ocular surface. 2020 Oct 1;18(4):761-9. https://doi.org/10.1016/j.jtos.2020.07.014

16. Rabensteiner DF, Aminfar H, Boldin I, Schwantzer G, Horwath Winter J. The prevalence of meibomian gland dysfunction, tear film and ocular surface parameters in an Austrian dry eye clinic population. Acta ophthalmologica. 2018 Sep;96(6):e707-11. https://doi.org/10.1111/aos.13732
17. Yun ST, Woo DM, Chong CW, Liu Y, Francis KE, Shah SA, Agar A, Francis IC. Utilisation of a novel test to measure severity and treatment efficacy of posterior blepharitis. Journal of Ophthalmology. 2015;2015(1):617019. https://doi.org/10.1155%2F2015%2F617019
18. Shah S, Jani H. Prevalence and associated factors of dry eye: Our experience in patients above 40 years of age at a Tertiary Care Center. Oman J Ophthalmol 2015;8:151-6.