International Journal of Advances in Medicine
Nithisha TM et al. Int J Adv Med. 2023 Oct;10(10):711-715
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20232917

Original Research Article

A cross sectional study to assess the severity of meibomian gland dysfunction and its association with dyslipidemia

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Received: 26 July 2023
Revised: 02 September 2023
Accepted: 03 September 2023

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ABSTRACT

Background: Studies have linked increased cholesterol esters in meibomian secretions to patients with meibomian gland dysfunction. Dyslipidemia has been linked to the development of MGD. This study of serum lipid profile in established cases of MGD.
Methods: A cross sectional study was conducted in department of ophthalmology at Rajarajeswari medical college and hospital Kambipura, Bengaluru from January 2021 to June 2022. 75 study participants with clinical diagnosis of MGD were included.
Results: The mean age of the study participants was found to be 55.97±14.019. Mild MGD grade was found in 32% and 26.7% of the study participants in the right eye and left eye respectively. Moderate MGD grade was 38.7% and 42.7% of the study participants in the right and left eye respectively. 4% each of the study participants had very severe MGD grade in the right and left eye respectively. Marx line grading of 1 was found in 40% and 46.7% of the study participants in the right eye and left eye respectively. Marx line grading of 2 was found in 54.7% and 36% of the study participants in the right and left eye respectively. Marx line grading of 3 was 5.3% and 17.3% of the study participants in right left eye respectively. severity of MGD grading of the study participants increases, the Lipid profile values also increases. The association was statistically significant between the MGD grading and lipid profile.
Conclusions: MGD patients exhibit a higher degree of total cholesterol, LDL, lower degree of HDL in their serum lipid profiles than normal reference levels and the severity of MGD increases, the values of lipid profile increase. Elevated serum cholesterol was associated with MGD.

Keywords: Dry eye, Dyslipidemia, Meibomian glands, Meibomian gland dysfunction, Meibomian gland loss

INTRODUCTION

Dry eye disease (DED) is one of the most common ocular surface diseases which can significantly affect the quality of life of affected patients. The two main categories of dry eye disease are evaporative dry eye and aqueous deficient dry eye.[1] Evaporative dry eye is related to conditions that affect the eyelids such as meibomian gland dysfunction (MGD), poor blinking effort, and lid disorders. It is also seen in conditions that affect the ocular surface, such as prolonged contact lens wear, frequent use of topical drug preservatives, and immune-related ocular surface disorders (e.g., atopic keratoconjunctivitis). Aqueous deficient dry eye is primarily due to conditions affecting lacrimal gland function such as Sjögren's syndrome, lacrimal gland duct obstruction or deficiencies, and adverse effects of systemic drugs. Epidemiological evidence suggests that Dry eye disease is mainly evaporative in nature and is often associated with meibomian gland dysfunction.[2-4] Meibomian glands are found in the upper and lower eyelids where they secrete lipids (meibum) onto the ocular surface forming the

outermost layer of the tear film. These lipids spread easily promoting tear film stability and protecting against evaporation. Meibomian gland dysfunction is defined as 'a chronic diffuse abnormality of the meibomian glands commonly characterized by terminal duct obstruction and/or qualitative/quantitative changes in the glandular secretion. It may result in alteration of the tear film, symptoms of eye irritation, clinically apparent inflammation and ocular surface disease.[5]

The reported prevalence of Dry eye disease ranges from 5% to 50% whereas the reported prevalence of meibomian gland dysfunction varies more widely from 3.5% to nearly 70%.[6,7] Meibomian gland dysfunction appears to be more prevalent in Asian populations. Meibomian gland dysfunction has been reported to contribute to 60% of all cases of Dry eye disease; an additional 20% of cases of Dry eye disease are caused by aqueous deficiency.[8] Most patients with meibomian gland dysfunction are largely or entirely asymptomatic. In cases of symptomatic meibomian gland dysfunction, patients report a variety of symptoms, including foreign body sensation, dryness, itching, and/or photosensitivity.[9] These manifestations may be linked to chronic inflammation or mechanical friction between the ocular surface and meibum that has accumulated in the gland orifices.[10] Clinical diagnosis of meibomian gland dysfunction is made based on the examination of altered anatomical features such as meibomian gland dropout, altered meibum excretion, and changes to lid morphology, with plugging or pouting of the gland orifice. Gentle gland expression with digital pressure to the central lower lid can evaluate terminal duct obstruction and meibum quality. The severity of disease can be evaluated using international workshop on meibomian gland Dysfunction and can be used to guide management of meibomian gland dysfunction. The strong correlation between the ML score and the meibomian gland scores indicates that the ML score can be used as a simple and rapid screening score for meibomian gland function. Emerging studies have linked increased cholesterol esters in meibomian secretions to patients with meibomian gland dysfunction (MGD).[11] Meibum with higher cholesterol composition has a higher melting point which is postulated to result in more viscous secretions that may then obstruct meibomian glands or alter the quality of posterior eyelid excreta.[12]

Furthermore, patients with moderate to severe meibomian gland dysfunction seem to have a higher prevalence of abnormal serum cholesterol levels versus the general public. Dyslipidemia has been linked to the development of meibomian gland dysfunction, but direct evidence supporting this relationship is lacking.[13-15]

This study is undertaken to study the serum lipid profile in established cases of meibomian gland dysfunction. This observation will highlight the significance of monitoring the serum lipid profile as a potential correlate of meibomian gland dysfunction.

METHODS

A cross sectional study was conducted in department of ophthalmology at Rajarajeswari medical college and hospital Kambipura, Bengaluru from January 2021 to June 2022.

Inclusion criteria

Patient consenting for study, presenting with symptoms of meibomian gland dysfunction, age 20 years and above and of both genders were included.

Exclusion criteria

Exclusion criteria were; patients with a known history of hypercholesterolemia, primary or secondary Sjogren's syndrome, diabetes mellitus, pregnancy, active keratoconjunctivitis, inflammatory or allergic ocular surface diseases unrelated to meibomian gland dysfunction, corneal arcus, ocular surgery in the past 9 months, lacrimal drainage system dysfunction, chronic treatment with lipid lowering drugs, omega 3 fatty acids, beta blockers or other systemic drugs affecting tearing, as well as the use of topical ophthalmic medications (including corticosteroids) in the 4 weeks before the study.

Total 75 cases with clinical diagnosis of meibomian gland dysfunction were enrolled for the study. Ethical committee clearance was obtained from the institutional review board. A pre tested, semi structured questionnaire was used to collect information on socio demographic variables and history of presenting illness by interview method. Participants were divided into 4 groups based on meibomian gland dysfunction. The clinical diagnosis of MGD was based on descriptions of glandular obstruction and meibium quality. The evaluation of gland obstruction was obtained by firm digital pressure over the central 3rd of upper and lower eyelid, while observing the ease of excretion under slit lamp biomicroscopy. Marx line was assessed under slit lamp after staining with lissamine green dye or fluorescein dye. For each patient the grade of MGD, serum lipid profile and Marx line were evaluated.

Statistical analysis

The data was collected and compiled in MS Excel. Descriptive statistics has been used to present the data. To analyse the data SPSS (Version 26.0) was used. Significance level was fixed as 5% α=0.05. Qualitative variables are expressed as frequency and percentages and Quantitative variables are expressed as Mean and Standard Deviation. To compare the proportion between groups, Chi-square test was applied.

RESULTS

Mild MGD grade was found in 32% and 26.7% of the study participants in the right eye and left eye respectively. Moderate MGD grade was found in 38.7% and 42.7% of

the study participants in the right and left eye respectively. 4% each of the study participants had very severe MGD grade in the right and left eye respectively.

Table 1: Gender of the study participants.

Gender	N	%
Male	40	53.3
Female	35	46.7

Table 2: Ocular examination findings of study participants.

Ocular examination findings	Right eye		Left eye	
	Mean	SD	Mean	SD
MGS	5.08	4.333	4.95	4.116
DEWS	7.33	7.098	7.56	6.974
TBUT	8.71	2.832	8.56	2.858
SCH 1	10.69	1.823	10.89	1.169
SCH 2	5.83	1.647	6.36	1.467

Marx line grading of 2 was found in 54.7% and 36% of the study participants in the right and left eye respectively. Marx line grading of 3 was found in 5.3% and 17.3% of the study participants in the right and left eye respectively.

Table 3: MGD grading of the study participants.

MGD grade	Right eye		Left eye	
	N	%	N	%
Mild MGD	24	32.0	20	26.7
Moderate MGD	29	38.7	32	42.7
Severe MGD	19	25.3	20	26.7
Very severe	3	4.0	3	4.0

The mean S. Cholesterol of the study participants was found to be 201.59±13.23. The mean LDL of the study participants was found to be 126.33±9.83. The mean HDL of the study participants was found to be 47.83±6.51. The mean VLDL of the study participants was found to be 24.39±7.83. The mean TG of the study participants was found to be 134.87±12.66.

Table 4: Marx line grading of the study participants.

Marx line grading	Right eye		Left eye	
	N	%	N	%
Part of the ML touches the MOs	30	40.0	35	46.7
ML runs through all of the Mos	41	54.7	27	36.0
ML runs on the eyelid-margin side of the Mos	4	5.3	13	17.3

Marx line grading of 1 was found in 40% and 46.7% of the study participants in the right eye and left eye respectively. Marx line grading of 2 was found in 54.7% and 36% of the study participants in the right and left eye respectively. Marx line grading of 3 was found in 5.3% and 17.3% of the study participants in the right and left eye respectively. In the present study, Marx line grading of 1 was found in 40% and 46.7% of the study participants in the right eye and left eye respectively.

As seen from the Table 3, as the severity of MGD grading in the right eye increases, the Lipid profile values also increases in the present study. The association was found to be statistically significant between the MGD grading of the study participants in the right eye and the lipid profile parameters.

As seen from the Table 4, as the severity of MGD grading in the left eye increases, the Lipid profile values also increases in the present study. The association was found to be statistically significant between the MGD grading of the study participants in the left eye and the lipid profile parameters.

DISCUSSION

In the present study, 53.3% of the study participants were found to be males with females contributing to 46.7% of the study participants. In a study done by Nishant et al.54.7% of the study participants were found to be males, which is comparable with the findings of the present study.[1] According to Den et al a higher incidence of meibomian gland atrophy among men older than 70 years was observed, whereas no significant changes were observed in subjects under 70 years of age regardless of sex.[2] In the present study, Mild MGD grade was found in 32% and 26.7% of the study participants in the right eye and left eye respectively. Moderate MGD grade was found in 38.7% and 42.7% of the study participants in the right and left eye respectively. 4% each of the study participants had very severe MGD grade in the right and left eye respectively. In a study done by Guliani B et al, maximum number of patients belonged to stage 2, whereas stage 4 had the least number of patients. This is comparable with the results obtained from the present study. In the present study, Marx line grading of 1 was found in 40% and 46.7% of the study participants in the right eye and left eye respectively. Marx line grading of 2 was found in 54.7% and 36% of the study participants in the right and left eye respectively. Marx line grading of 3 was found in 5.3% and 17.3% of the study participants in the right and left eye respectively.[3] In the present study, the mean S. Cholesterol of the study participants was found to be 201.59±13.23. The mean LDL of the study participants was found to be 126.33±9.83. The mean HDL of the study participants was found to be 47.83±6.51. The mean VLDL of the study participants was found to be 24.39±7.83. The mean TG of the study participants was found to be 134.87±12.66.[4]

In the present study, it was observed that as the severity of MGD increases, the lipid profile values also increases in the present study. The association was found to be statistically significant between the MGD grading of the study participants and the lipid profile parameters. In a

study done by Guliani et al. Patients with higher stages of MGD more often had serum TGs >150 mg/dl, total cholesterol >200 mg/dl, an LDL >130 mg/dl, and serum HDL >40 mg/dl, and they found an association between increasing stage of MGD and lipid profile. These findings are consistent with the findings of the present study.[5]

Table 5: Lipid profile of the study participants.

Lipid profile	Minimum	Maximum	Mean	SD
S. Cholesterol	166	242	201.59	13.230
LDL	110	152	126.33	9.833
HDL	26	60	47.83	6.517
VLDL	13	46	24.39	7.836
TG	117	172	134.87	12.660

Table 6: Association of lipid profile with MGD grade of right eye.

MGD grade right eye		S. Cholestrol	LDL	HDL	VLDL	TG
Mild MGD	Mean	196.92	121.58	51.38	20.50	129.79
	SD	12.072	7.395	3.965	3.978	6.541
Moderate MGD	Mean	199.38	124.55	48.28	24.17	131.28
	SD	8.554	7.917	4.284	7.354	10.593
Severe MGD	Mean	209.79	133.47	43.58	28.47	145.58
	SD	17.274	10.788	8.909	9.137	13.789
Very severe MGD	Mean	208.33	136.33	42.00	31.67	142.33
	SD	7.095	8.505	6.557	12.702	22.053
P value		0.006	0.000	0.000	0.002	0.000

Table 7: Association of lipid profile with MGD grade of left eye.

MGD grade-left eye		S. Cholesterol	LDL	HDL	VLDL	TG
Mild MGD	Mean	197.00	122.15	50.95	20.45	130.30
	SD	13.163	7.242	4.347	3.886	6.062
Moderate MGD	Mean	198.03	122.69	49.19	23.38	130.38
	SD	8.353	7.403	4.344	7.197	9.863
Severe MGD	Mean	211.85	135.70	43.15	29.85	146.25
	SD	14.769	8.652	8.468	8.628	13.615
P value		0.000	0.000	0.000	0.001	0.000

In a study done by Braich et al patients with MGD have significantly higher mean values for triglycerides, total cholesterol, LDL, and HDL. The greatest variation was observed in LDL and total cholesterol levels, where the absolute differences in mean values were 34.4 and 46.5 mg/dl, respectively. This is comparable with the findings of the present study.[6]

The differences observed in this study lend credibility to the theory that higher levels of serum cholesterol values are related to meibomian gland dysfunction. Given the high prevalence of dyslipidemia among patients with MGD it appears that many patients were unaware that they had abnormal lipid values.[7]

CONCLUSION

It is of utmost importance to recognize that MGD is a complex condition, making it difficult to diagnose patients. Our results suggest that MGD patients exhibit a higher degree of total cholesterol, LDL, and lower degree of HDL in their serum lipid profiles than normal reference levels and that as the severity of MGD increases, the values of lipid profile parameters also increase. MGD may become a sign of undiagnosed dyslipidemia and the ophthalmologist may have a role in the early diagnosis of an important risk factor for cardiovascular disease. Eye care practitioners may play a key role in the detection of dyslipidemia, a known risk factor for cardiovascular disease. As such, identification of MGD during ophthalmic exams may warrant screening for dyslipidemia. This may be particularly important in areas where screening and preventative medicine is underutilized. If future studies can demonstrate a causal relationship showing dyslipidemia causes MGD, clinicians may consider lipid-lowering drugs for the treatment of MGD. Our findings suggest that ophthalmologists may be instrumental in the early detection of dyslipidemia in the general population. The ability to screen for lipid abnormalities by physical examination at the slit lamp is exciting. Further prospective studies should be conducted

to justify early screening of patients with meibomian gland dysfunction for dyslipidemia.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Craig JP, Nichols KK, Akpek EK, Caffery B, Dua HS, Joo CK, et al. Tfos dews ii definition and classification report. Ocular Surface. 2017;15(3):276-83.
2. Dua HS. The definition and classification of dry eye disease: report of the definition and classification subcommittee of the international dry eye workshop. Ocular Surface. 2007;5(2):75-92.
3. Schaumberg DA, Nichols JJ, Papas EB, Tong L, Uchino M, Nichols KK. The international workshop on meibomian gland dysfunction: report of the subcommittee on the epidemiology of, and associated risk factors for, MGD. Invest Ophthalmol Vis Sci. 2011;52(4):1994.
4. Uchino M. The epidemiology of dry eye disease: report of the epidemiology subcommittee of the international dry eye workshop. Ocular Surface. 2007;5(2):93-107.
5. Tomlinson A, Bron AJ, Korb DR, Amano S, Paugh JR, Pearce EI, et al. The international workshop on meibomian gland dysfunction: report of the diagnosis subcommittee. Invest Ophthalmol Vis Sci. 2011;52(4): 2006.
6. Stapleton F, Alves M, Bunya VY, Jalbert I, Lekhanont K, Malet F, et al. TFOS dews II epidemiology report. Ocular Surface. 2017;15(3):334-65.
7. McCarty C. The epidemiology of dry eye in Melbourne, Australia, Historical image. Ophthalmology. 1998;105(6):1114-9.
8. 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.
9. Hykin PG, Bron AJ. Age-related morphological changes in lid margin and meibomian gland anatomy. Cornea. 1992;11(4):334-42.
10. Yamaguchi M, Kutsuna M, Uno T, Zheng X, Kodama T, Ohashi Y. Marx line: fluorescein staining line on the inner lid as indicator of meibomian gland function. AM J Ophthalmol. 2006;141(4):669.
11. Shine WE, McCulley JP. The role of cholesterol in chronic blepharitis. Invest Ophthalmol Vis Sci. 1991; 32(8):2272-80.
12. Shine WE, McCulley JP. Polar lipids in human meibomian gland secretions. Curr Eye Res. 2003; 26(2):89-94.
13. Dao AH, Spindle JD, Harp BA, Jacob A, Chuang AZ, Yee RW. Association of dyslipidemia in moderate to severe meibomian gland dysfunction. Am J Ophthalmol. 2010;150(3):371375.
14. Pinna A, Blasetti F, Zinellu A, Carru C, Solinas G. Meibomian gland dysfunction and hypercholesterol-emia. Ophthalmology. 2013;120(12): 2385-9.

Cite this article as: Nithisha TM, Thomas LM, Joshi IS, Tejaswini P. A cross sectional study to assess the severity of meibomian gland dysfunction and its association with dyslipidemia. Int J Adv Med 2023;10:711-5.