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Original Research Article

To Study the Association of Various Risk Factors with Meibomian Gland Dysfunction

Anuradha Manish Totey

Assistant Professor, Department of Ophthalmology, Dr. Rajendra Gode Medical College, Amravati

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Corresponding Author: Anuradha Manish Totey
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Abstract

Background: A change in the meibomian glands' activity that results in a decrease in the stability of the tear film is known as meibomian gland dysfunction (MGD). Meibomian gland dysfunction (MGD) is a long-term, diffuse abnormality of the meibomian glands that is characterized by changes in glandular secretion, either qualitatively or quantitatively, and/or terminal duct obstruction. This condition can affect the tear film and cause symptoms such as ocular surface disease, irritation of the eyes, and clinically noticeable inflammation. The superficial lipid layer of the tear film is stabilized by lipids released by the meibomian glands, which diminish surface tension. It also keeps the aqueous from evaporating. Evaporative dry eye disease (DED), alterations to the ocular surface, and blepharitis are caused by an increase in aqueous tear evaporation, tear osmolality, and an unstable tear film, which is caused by a decrease in tear film lipids brought on by the death of glands in MGD. It is unknown how risk factors for metabolic syndrome relate to meibomian gland disease (MGD), a subtype of dry eye. Dry eye disease has been linked to several factors.

Aim: The aim of the study is to Study the Association of Various Risk Factors with Meibomian Gland Dysfunction.

Material and Method: Patients gave their prior written approval for the Department of Ophthalmology to conduct an observational study. Patients with symptoms of dryness or irritation, blurred vision, excessive watering or sticky discharge, and/or early morning puffiness around the eyes who visited the outpatient department of ophthalmology, regardless of gender, were examined. After obtaining informed consent in their native tongue, fifty patients were added to the trial. A thorough slit-lamp biomicroscopic analysis was conducted, which included the Schirmer test, the tear film break-up time (TBUT) test, and an assessment of the expressibility and quality of the meibum. By putting a fluorescein strip in the inferior fornix after soaking it with a drop of normal saline, the tear film break-up time was evaluated. Anthropometric measurements, clinical results, medical history, serologies, and patient demographics were all examined. Based on clinical indicators recorded in the medical record, an MGD diagnosis was made.

Results: A total of fifty cases were taken into the study. Both of these were age and sex-matched. In the 18–40, 41–60, and 61–80 years age groups, it was found that 22.6%, 49.4%, and 28% cases respectively had MGD. The age range of 41 to 60 years old showed higher prevalence and severity of MGD, and it was discovered that females were much more affected than males. Within the age range of 41 to 60 years, a noteworthy correlation was noted between the severity of MGD and age. Compared to men, women had a stronger correlation with MGD. According to our research, extended computer use and digital screen exposure are strongly linked to MGD.

Conclusion: Meibomian gland disease was more common in women, people with diabetes, people with hypertension, people who used visual aids excessively, and people on oral hypoglycemic medicines, oral hypoglycemic agents, and oral contraceptive pills. Consequently, when a patient with MGD presents to an ophthalmologist, a comprehensive systemic workup is ideal. Finding, eliminating or changing the risk factors that aggravate MGD would assist reduce symptoms and enhance the quality of life for the patient.

Keywords: Meibomian Gland Dysfunction, Dry Eye, Dyslipidemia and Meibomian Gland

Introduction

Meibomian glands (MGs) are crucial to the condition and health of the surface of the eyes. Meibomian glands are named for the German physician Heinrich Meibom (1638–1700), who provided the first detailed description of them. [1] The tarsal plate of the upper and lower eyelids contains these altered sebaceous glands. The upper eyelid has roughly 25–40 glands, while the lower eyelid contains roughly 20–30 glands. The length of them is roughly 5.5 mm in the upper eyelid and 2 mm in the lower. They release lipids known as meibum, which makes up the tear film's outermost

layer. This meibum serves as a lubricant for the eyelids when blinking, lowers the amount of tears that evaporate, and could operate as a barrier to keep bacteria out of the tear film. [2,3]

Meibomian gland dysfunction (MGD) is a long-term, diffuse abnormality of the meibomian glands that is characterized by changes in glandular secretion, either qualitatively or quantitatively, and/or terminal duct obstruction. These changes can affect the tear film and cause symptoms such as ocular surface disease, irritation of the eyes, and clinically noticeable inflammation. [4] The superficial lipid layer of the tear film is stabilized by lipids released by the meibomian glands, which diminish surface tension. It also keeps the aqueous from evaporating. [5] Evaporative dry eye disease (DED), alterations to the ocular surface, and blepharitis are caused by the decrease in tear film lipids brought on by the glands' destruction in MGD. Additionally, this leads to increased aqueous tear evaporation, tear osmolality, and unstable tear film. [6] Between 39% and 50% of people have MGD, and the incidence rises with age. [7,8] There are two types of meibomian gland dysfunction: high delivery states (caused by hypersecretion) and low delivery states (caused by hyposecretion or duct blockage). Exogenous factors like topical eye drops or contact lens usage can alter both the low delivery and high delivery stages of MGD, as can endogenous factors like age, sex, and hormone imbalances. MGD that is obstructive is the most common type. [9] The pathophysiological factors responsible for the development of MGD include hyperkeratinization and increased meibum viscosity. Meibum is retained inside the ducts as a result of dilatation and ensuing acing atrophy. [5]

Because meibomian gland (MG) secretions are lipid-based, there may be a connection between them and abnormalities in systemic lipid levels. [10] The complex mixture of different polar and nonpolar lipids found in their secretions includes wax esters, diesters, triacylglycerides, free cholesterol, free fatty acids, and phospholipids in addition to cholesterol. [11] The incidence and prevalence of dry eye have sharply increased in the general population due to a multitude of changes in lifestyle, including food choices, work habits, and the widespread use of computers in all aspects of life.

The tear film lipid layer is altered in MGD by decreased meibum secretion, qualitative alterations (such as increased viscosity, loss of polar or amphiphilic lipids, changes in lipid structure), or both. These changes lead to tear film instability and increased evaporative water loss. [12,13,14] The MGD-related tear film instability causes tears to become hyperosmolar, which in turn causes ocular surface cell death and inflammation. These events all feed into and reinforce the DED vicious cycle. [14,15] Irritation, dryness, burning or stinging, and vision problems are some of the symptoms of DED that can negatively impact a patient's quality of life, function, daily activities, and productivity at work. [16,17,18] Reduced tear fluid (Schirmer I test), ocular surface damage (fluorescein staining), tear film instability (tear film breakup time), and conjunctival redness are among the symptoms of DED that are evaluated during clinical testing. [19]

The cholesterol esters detected in secretions of the meibomian glands of patients with MGD were not always present in normal controls. [20] The objective of the present study was to identify the risk factors associated with meibomian gland dysfunction and correlate them with the severity of MGD.

Material and Methods

Patients gave their prior written approval for the Department of Ophthalmology to conduct an observational study. Patients with symptoms of dryness or irritation, blurred vision, excessive watering or sticky discharge, and/or early morning puffiness around the eyes who visited the outpatient department of ophthalmology, regardless of gender, were examined. After obtaining informed consent in their native tongue, fifty patients were added to the trial.

Inclusion Criteria

- Patients who were aged 18 years and above
- Those who gave valid consent.

Exclusion Criteria

- Patients below the age of 18 years
- Patients not giving valid consent
- Recent ocular surgery
- Treatment with topical steroid 4 weeks before the study
- Changes in the drainage system of the lacrimal apparatus
- Ongoing glaucoma medications
- Patients suffering from keratoconjunctivitis of infectious type
- Patients who are onthe oral contraceptive pill
- Patients on antihypertensive medication
- Pregnant women
- Patient with rosacea, Sjogren's syndrome, cholestatic liver disease, and Parkinsonism.

Procedure for Test

The patient was evaluated using (a) a full ophthalmic examination, which included a lacrimal system assessment for any abnormalities, and (b) a meibomian gland assessment, which involved applying pressure to the middle third of both the upper and lower eyelids while looking through a slit lamp. The international workshop on MGD's criteria were used to diagnose MGD patients.[11] A thorough slit-lamp biomicroscopic analysis was conducted,

which included the Schirmer test, the tear film break-up time (TBUT) test, and an assessment of the expressibility and quality of the meibum. By putting a fluorescein strip in the inferior fornix after soaking it with a drop of normal saline, the tear film break-up time was evaluated. Topical anesthetic was not used during the Schirmer test. By using digital pressure on the lower tarsus, the meibum quality score (MQS) in eight glands located in the middle third of the lower eyelid was evaluated and subsequently categorized.

- Meibomian glands with clear fluid were graded as 0;
- cloudy fluid -as grade 1;
- cloudy meibum with debris- as grade 2;
- thick toothpaste-like meibum -as grade 3.

Accordingly, the meibum expressibility score was assessed from five glands of the central third of the lower eyelid. It was graded:

- Grade 0 -with all glands expressible,
- Grade 1 - with 3–4 glands,
- Grade 2 -with 1–2 glands
- Grade 3 -with no glands expressible.

Numerical staining: Scores refer to a summed score of staining of the exposed cornea and conjunctiva. Fluorescein stains were used. The Oxford scale has a range of 0–15.

Statistical Analysis

Chi-square test/unpaired t-test were used for qualitative variables. All data analysis was done with IBM SPSS Statistics.

Result: -

A total of fifty cases were taken into the study. Both of these were age and sex-matched. In the 18–40, 41–60, and 61–80 years age groups, it was found that 22.6%,49.4%, and 28% cases respectively had MGD. Prevalence and severity of MGD were more observed in the age group of 41-60 years, while it was found to be significantly more in females as compared to males.

Table 1: Age distribution of cases and stages of meibomian gland dysfunction

Age (in years)	No of patients	Stage I	Stage II	Stage III	Stage IV
18-40	15	3	4	6	2
41-60	23	5	7	6	5
>60	12	2	3	5	2

Within the age range of 41 to 60 years, a noteworthy correlation was noted between the severity of MGD and age. Compared to men, women had a stronger correlation with MGD. According to our research, extended computer use and digital screen exposure are strongly linked to MGD.

Table 2 shows the different types of disease associated with MGD

Diseases	Cases
DM	11
HTN	13
Hypercholesterolemia	8
DM with HTN	9
DM with Hypercholesterolemia	05
Hypercholesterolemia with HTN	04

Diabetes Mellitus (DM), Hypertension (HTN), and Hypercholesterolemia were significantly associated with MGD.

Table 3 shows the Systemic medications associated with MGD

Systemic medications	Cases
Anti-hypertensive	15
Oral hypoglycemic agents	19
Anti-allergics	11
OC Pills	05

MGD was substantially correlated with the use of oral hypoglycemic medications, anti-allergics, oral contraceptives, and anti-hypertensives.

Discussion

Meibomian gland dysfunction is a multifactorial ocular condition that is frequently seen. According to the International Workshop on Meibomian Gland Dysfunction, aqueous-deficient dry eye may be related to meibomian gland dysfunction, which is the most common cause of evaporative dry eye.

Evaporative dry eye disease (DED) is mostly caused by malfunction of the meibomian glands. Within the age range of 41 to 60 years, a noteworthy correlation was noted between the severity of MGD and age.

Compared to men, women had a stronger correlation with MGD. These results were similar to the observations by **Pult et al. 2012 [**21]. **Guliani et al. 2018 [**22] also reported similar findings. It could be due to the negative effect of estrogen on meibomian gland function. The use of VDTs (mobile, laptop, computer, and television) was found to be significantly correlated with MGD in our study. That was in line with a 2018 study that also established the link between prolonged computer use and evaporative dry eye syndrome. [22]

A study done by **Gulani et al.2018 [**23] also found a correlation between increasing age and higher stages of MGD. A study done by **Dao et al. 2010 [**24] also could not detect any significant correlation between MGD and elevated or low levels of HDL. Additionally, their research shows that dyslipidemia is common in MGD patients. It primarily correlates with TGs and cholesterol. They were unable to find a relationship between the level of MGD and LDL, though. The significant disparity in sample sizes between the two research provides an explanation for this. A study done by **Bhkhari et al.2013 [**25] concludes that the disease severity of MGD is more with a higher level of TGs and LDL, and a positive correlation was found for the female sex. Two factors account for this discrepancy: a significant variation in the number of patients engaged and a lower proportion of females in the older age group. Larger population studies are required to confirm the causality of this connection. The clinical characteristics of MGD may potentially be improved by treatment targeted at reversing hyperlipidemia. [26]

Diabetes and the metabolic syndrome have been connected to DED. Similarly, MGD has also been linked to hyperglycemia, a feature of the metabolic syndrome. [27] One cross-sectional study that provided evidence in favor of this theory found that individuals with metabolic syndrome had significantly higher mean tear osmolarity and ocular surface disease index questionnaire scores. Moreover, there was a strong link found between tear osmolarity, waist circumference, and fasting blood glucose, even if the tear film breaking time (TBUT) and Schirmer's test values were much lower. There were no associations discovered between triglycerides, HDL, and hypertension and tear osmolarity. [28]

The use of anti-allergics, anti-hypertensives, anti-depressants, and topical anti-glaucoma drugs was significantly associated with MGD in our study. Though another study performed by **Machalinska et.al. 2016 [**29] observed a significant association of MGD with the use of anti-allergic drugs but did not find any association with other drugs. **Dao et al.2010 [**24] found that patients with MGD had a lower incidence of hypertriglyceridemia than the general population. MGD was more common among women, diabetics, smokers, wearers of contact lenses, excessive users of visual display terminals, patients with rheumatoid arthritis, hypothyroidism, and those taking topical anti-glaucoma, anti-hypertensive, anti-depressant, and anti-allergic medications. There was a clear correlation found between elevated triglycerides, total cholesterol, LDL, and HDL with the severity of MGD. Finding and modifying the risk factors that aggravate MGD would assist reduce symptoms and enhance the patient's quality of life.

Conclusion:

Meibomian gland disease was more common in women, those with diabetes, hypertension, heavy users of visual aids, and those on oral hypoglycemic medicines, oral hypoglycemic agents, and oral contraceptive pills, according to our study. Consequently, when a patient with MGD presents to an ophthalmologist, a comprehensive systemic workup is ideal. Finding, eliminating or changing the risk factors that aggravate MGD would assist reduce symptoms and enhance the quality of life for the patient. In order to enhance the patient's overall health, it should be identified early and treated properly.

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