

Assessing public awareness of daily eyelid hygiene habits in Saudi Arabia: An online survey study

Manal A. Alhamazani¹, Maram S. Alnabri¹, Meshael N. Alreshidi², Hamad M. Alsulaiman³, Diego Strianese^{3,4}, Rawan N. Althaqib³

Access this article online
Quick Response Code:

Website: www.saudijophthalmol.org
DOI: 10.4103/sjopt.sjopt_25_20

Abstract:

PURPOSE: Incidences of ocular conditions, including meibomian gland dysfunction (MGD), blepharitis, and dry eye have been increasing globally. Eyelid hygiene is key to maintaining ocular surface health and improving ocular symptoms. This study investigated the awareness of eyelid hygiene among the Saudi population.

METHODS: This cross-sectional survey was conducted between April 2020 and May 2020 across all regions of Saudi Arabia through the distribution of an electronic self-administered questionnaire among the Saudi population.

RESULTS: A total of 1102 responses were received (women, 76.3%; men, 23.7%). Only 33.2% respondents reported consciously washing their eyelids, while 70.1% had never heard about MGD; however, most of the respondents (93.2%) had heard about dry eye. Based on the questionnaire results, the Saudi population had suboptimal (18.4%) level of awareness of eyelid hygiene. At least one ocular symptom was reported by 98.1% of the respondents.

CONCLUSION: The level of awareness of eyelid hygiene in Saudi Arabia was found to be suboptimal, particularly among patients with MGD and dry eyes. Poor knowledge about the benefits of daily eyelid hygiene was the primary barrier to its practice. We recommend that ophthalmologists raise awareness of good eyelid hygiene among patients with MGD and eye dryness. Despite the current findings, further studies and evidence are required before recommending daily eyelid hygiene practices in the general population, including those without clinical symptoms of MGD or eye dryness.

Keywords:

Awareness, dry eye, eyelid hygiene, meibomian gland dysfunction, ocular surface disease, Saudi Arabia

INTRODUCTION

Ocular surface diseases (OSDs) are considered to be a public health problem.^[1] These diseases affect the cornea, conjunctiva, eyelids, or lacrimal glands.^[2] Meibomian gland dysfunction (MGD), blepharitis, and dry eye are common conditions,^[1] and increased incidences have been reported worldwide.^[3-9] In 2008, one study of 420 Saudi ophthalmology patients reported an MGD prevalence of 77.6%.^[10] Another study reported a 93.2% prevalence of dry eyes among a cohort of 234 healthy participants with no eye-related issues.^[11]

Despite the considerable prevalence of OSD, cases are frequently misdiagnosed or

undertreated due to a lack of knowledge of symptoms and inappropriate examination.^[2] OSD can have a significant impact on eyesight and the quality of life, and in severe cases, it can result in blindness.^[2] Meibomian glands play a vital role in keeping the ocular surface healthy by secreting lipid components, namely meibum, which provides a protective layer to maintain tear film stability and defense against infectious agents.^[12] MGD 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 the alteration of the tear film, symptoms of eye irritation, clinically apparent inflammation, and ocular surface disease.”^[13] MGD is a major cause of dry eye syndrome^[3] and is an important

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Alhamazani MA, Alnabri MS, Alreshidi MN, Alsulaiman HM, Strianese D, Althaqib RN. Assessing public awareness of daily eyelid hygiene habits in Saudi Arabia: An online survey study. *Saudi J Ophthalmol* 2021;35:304-9.

¹Department of Ophthalmology, College of Medicine, University of Hail, Saudi Arabia,

²Department of Radiology, National Guard Health Affairs, Riyadh, Saudi Arabia. ³Division of Oculoplastic and Orbit, King Khaled Eye Specialist Hospital, Riyadh, Saudi Arabia,

⁴Department of Neurosciences, Reproductive Sciences and Dentistry, Orbit Unit, University of Naples “Federico II”, Naples, Italy

Address for correspondence:

Dr. Rawan N. Althaqib,
Department of Ophthalmology,
Division of Oculoplastic
and Orbit, King Khaled Eye
Specialist Hospital,
P.O. Box 245, Riyadh 13327,
Saudi Arabia.
E-mail: althaqib.r@gmail.com

Submitted: 09-Oct-2020

Revised: 19-Jun-2021

Accepted: 11-Jul-2021

Published: 20-Oct-2021

feature of posterior blepharitis.^[14] Dry eye has been defined as “a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability, with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.”^[15] Blepharitis is an inflammatory condition of the eyelid margin that persists for a long time. Although there is some overlap between the types of blepharitis, it can be classified into anterior and posterior classifications based on the anatomic location.^[16] The skin of the eyelids, the base of the eyelashes, and the eyelash follicles are affected by anterior blepharitis, while the meibomian glands are affected by posterior blepharitis.^[17] Burning sensation, irritation, tears, photophobia, blurred vision, red eyes, and eyelids sticking together in the morning are all common symptoms of blepharitis.^[16] Previous studies have reported that the aging process,^[18] changes in sex hormones,^[19] Sjogren’s syndrome, seborrheic dermatitis, acne rosacea, atopy, psoriasis, conjunctivitis and anterior blepharitis,^[20] contact lens wear,^[21] use of retinoids for acne treatment,^[22] use of cosmetic eye products,^[23] and overuse of smartphones^[24] are found to be associated with MGD and dry eye.

Eyelid hygiene remains the key to maintaining eyelid health and improving ocular symptoms.^[1,25] However, studies on the awareness of eyelid hygiene habits among general populations worldwide, particularly in Saudi Arabia, are insufficient. Therefore, in the present study, we aimed to assess the public awareness of eyelid hygiene in Saudi Arabia.

METHODS

This cross-sectional study was conducted between April 2020 and May 2020 to assess the awareness of eyelid hygiene in Saudi Arabia. A web-based survey questionnaire was randomly distributed among the general Saudi population, using popular social media platforms such as Twitter (Twitter, Inc., US), Snapchat (Snap, Inc., US), Instagram (Facebook, Inc., US), and WhatsApp (Facebook, Inc., US). The questionnaire was adapted from a similar study conducted in a Japanese population.^[26] After translating it into Arabic, the questionnaire was revised. The necessary modifications and additional questions comprising the regions, level of education, time spent on screens, use of eyelash products (such as wipes, eyelash shampoo, or oils), and use of cosmetic products (eye makeup, contact lens, and retinoid) were reviewed by an ophthalmologist to confirm its validity, particularly in the oculoplastic and orbit sections.

Ethical approval to conduct this study was obtained from the ethics committee. Agreement to complete the anonymized online questionnaire was considered as consent for participation in the study.

Data collection

The questionnaire was divided into six sections. The first section was used to collect the demographic characteristics (i.e., sex, age, region, and level of education). The second section

contained items that evaluated the daily habits of personal hygiene, time spent on screens, and use of eyelash products. The third section assessed the knowledge of eyelid hygiene. The fourth section assessed the participant’s recognition of the term, OSD. The fifth section enquired regarding ocular symptoms and eye care status. The last section focused on the use of eye cosmetic products.

Statistical analysis

We estimated the study sample size needed to be enrolled from the total Saudi population of 35 million using the Raosoft sample size calculator (Raosoft Inc., Seattle, USA); a sample size of 385 participants was determined as the appropriate sample size with a confidence interval of 95%. The sample size was increased to 1102 to compensate for the incomplete data. All the statistical analyses were carried out using SPSS (version 25; IBM, Armonk, NY, USA). Results are expressed as frequencies and percentages. The associations between categorical variables were assessed using the Chi-square test, and *P* values less than 0.05 were considered statistically significant.

RESULTS

Of the 1102 responses received, 8.3%, 12.9%, 24.6%, 23.3%, and 30.9% of the participants were from the Southern, Eastern, Northern, Western, and central regions, respectively. Sample demographics are presented in Table 1.

Respondents who reported that they washed their face using facial washing products and brushed their teeth daily showed better eyelid cleaning practices than those who did not. Of the respondents who reported washing their face daily, 54.4% also washed their eyelids regularly compared to only 25% of the respondents who did not wash their face daily ($P = 0.001$, Chi-squared test). In those who brushed their teeth daily, 35.5% performed regular cleaning of their eyelids compared to only 24% of those who did not brush their teeth daily ($P = 0.001$, Chi-squared test) [Figure 1].

In total, 22.1%, 7.3%, 5.8%, 30.0%, 32.7%, and 24.2% of the respondents reported the use of eyelash products, medicated eyelash cleaning products, baby shampoo, eyelash lengthening products, eyelash volumizing products, and oils, respectively. Table 2 shows the time spent each day focusing on screens (computer, smartphone, and TV). The majority of the respondents (42.7%) spent about 6–12 h each day viewing

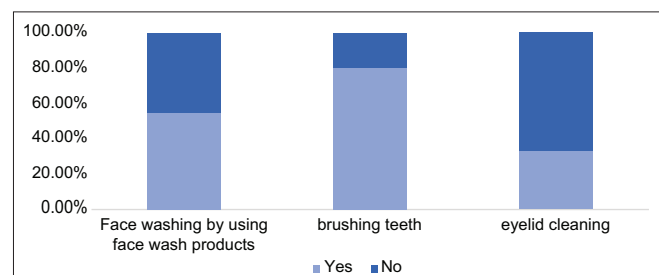


Figure 1: Habits of facial, eyelid, and dental hygiene

screens, while only (4.4%) spent about <2 h viewing screens. Figure 2 shows the rates of knowledge of dry eye disease and MGD. Considering the sources of this information, 10% of the respondents received knowledge from an ophthalmologist, 6.8% from social media, 3.7% from friends and relatives, and 1.4% through voluntary campaigns.

The prevalence of ocular symptoms was high. More than half of the respondents reported having some ocular symptom, including dry eye sensation (94.3%), foreign body sensation (73.4%), burning sensation in the eye (87.8%), sticky eyelashes upon awakening (42.1%), eyelid margin redness (57.4%), scaly eyelashes (33.6%), and chalazion (21.5%). Figure 3 represents the eye care status in response to these symptoms by the participants.

A total of 72.7% of the female respondents reported the use of eye makeup, and 39.5%, 25.5%, and 6.4% of them reported that they washed off their makeup immediately after the event, before going to sleep, and on the next day after they woke up, respectively. In addition, 14.9% of respondents reported the use of Vitamin A derivatives around their eyes to reduce wrinkles and to treat acne.

Table 1: Demographic data

Variables	Percentage
Sex	
Male	23.7
Female	76.3
Age (years)	
Below 20	20.1
21-30	50.4
31-40	13.3
41-50	9.0
51-60	6.2
Above 60	1.0
Level of education	
Below high school	3.5
High school	27.9
University	63.8
Masters and above	4.8

Table 2: Time spent each day focusing on screens (computer, smartphone, and television)

Variables (h)	Percentage
<2	4.4
Between 2-6	35.8
Between 6-12	42.7
More than 12	17.1

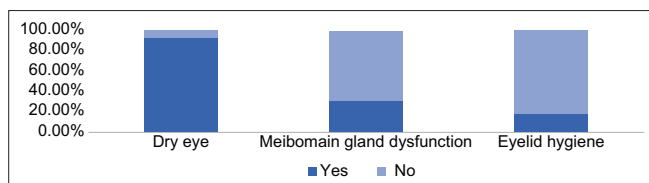


Figure 2: Knowledge of dry eye disease, meibomian gland dysfunction, and eyelid hygiene

DISCUSSION

Although eyelid hygiene and care are important to prevent OSD and ocular symptoms, there is scarce data on its prevalence or awareness in the general population in Saudi Arabia. To the best of our knowledge, this is the first study that measured the extent of awareness of eyelid hygiene habits in the general Saudi population. In terms of daily personal hygiene, we found that the number of respondents who reported consciously cleaning their eyelids daily was low (33.2%). The poor practice of eyelid washing in observed in this study was consistent with that reported by Motoko *et al.* in the Japanese population; the respondents that study were not aware why eyelid hygiene is important, and only (23%) participants reported consciously cleaning their eyelids daily.^[26] In contrast, the proportion of the respondents who reported brushing their teeth every day was high (80%). This indicates that the general population are aware of the importance of dental hygiene for oral health. Although eyelid margin care plays an important role in the treatment of MGD, ameliorates the ocular symptoms, and improves tear film stability,^[25,27] our study found that the level of awareness of eyelid hygiene was low (18.4%). We found that the respondents who did not clean their eyelids daily (66.8%) had not heard of the concept of lid hygiene (58%). The eyelid margin should be included in the daily facial. Our study found that the level of awareness of eyelid hygiene was low (18.4%). We found that the respondents who did not clean their eyelids daily (66.8%) had not heard of the concept of lid hygiene (58%). The eyelid margins are considered as part of the daily facial cleanliness routine according to the Center for Disease Control (CDC); however, it is frequently missed due to its location, which makes it difficult to reach.^[28] Therefore, upon creating awareness of the impact of eyelid hygiene on ocular surface health among MGD patients, they may become more motivated to perform eyelid cleaning while washing their faces.

In the present study, we found that 70.1% of the respondents had never heard of MGD, while the majority (93.2%) had heard about dry eye. According to Chhadva *et al.*, any disruption to the meibomian gland has an influence on the quality and quantity of meibum secretions, resulting in increased tear

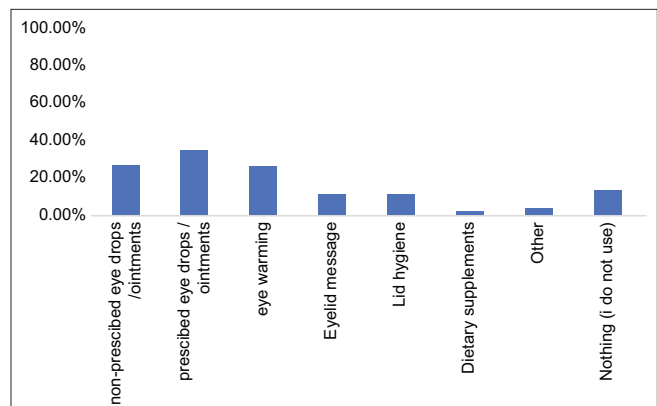


Figure 3: Eyecare status

evaporation, tear hyperosmolarity, increased ocular surface staining, increased inflammation, symptomatic irritation of the eyelid and globes, and decreased visual acuity.^[12] In this study, the prevalence of ocular symptoms was high. More than half of the respondents reported irritation, which was the chief complaint in patients with dry eye (94.3%). Poor knowledge regarding the beneficial effect of daily eyelid hygiene was the barrier to this practice, particularly in patients with MGD and dryness. Accordingly, patient education remains an essential component of therapy.^[28]

Several studies have shown that MGD could be symptomatic or asymptomatic.^[29,30] In a 2017 study on consecutive patients in an outpatient optometry clinic, Asiedu *et al.* found a high frequency of nonobvious obstructive MGD (24.6%) compared to obvious MGD (0.9%); thus, resulting in a challenging diagnosis.^[30] However, there is insufficient evidence in this study, and in the current literature, regarding the benefits of eyelid hygiene in a normal population without clinical signs or symptoms of MGD and dryness. To promote the practice of eyelid hygiene on a daily basis in the normal population, further studies and evidence are warranted. Moreover, Bitton *et al.* reported that there is insufficient research evaluating the efficiency of various eyelid cleaning frequencies and durations;^[28] the current frequency recommendations may range from once to twice a day.^[31,32]

Nowadays, the use of technology and eye cosmetics has become part of everyday life. In our study, 70.6% of the respondents reported using make up (mascara, kohl, and eyeliner applied on the inside/outside of the eyelid) daily and 92% of these respondents were females. Moreover, 42.7% of the respondents spent time each day focusing on screens (computer, smartphone, TV) for between 6 h and 12 h. There is a significant correlation between the time spent each day focusing on screens and eye-related symptoms ($P < 0.05$). Blinking helps to regenerate tear film, which is important for protecting and hydrating eyes, and working for long periods of time diminishes the blink rate.^[24]

Female participants reported using eye cosmetics, contact lenses, retinoid (A) derivative cream around their eyes as an antiaging product to reduce wrinkles or for oral acne treatments. Motoko *et al.* stated that most of the female respondents in their study who used eye cosmetics were unaware about the risk of ocular surface disorders such as blepharitis and MGD.^[26] Our research revealed that there is a significant correlation between the use of eye makeup and eye symptoms ($P < 0.05$). Respondents who reported the use of eyelash lengthening products and eyelash volumizing products and oils had more ocular symptoms than those who reported the use of medicinal eyelash cleaning products and baby shampoo. In 2011, Ng *et al.* reported that the ocular discomfort perception was greater when cosmetics were used ($P < 0.001$), while the Cosmetics users' OSD Index scores were identical to those of nonusers ($P = 0.083$).^[33]

Increased debris in the surface tear film lipid layer, meibomian gland blockage, and meibum contamination have all been linked

to cosmetic product migration beyond the eyelid margins.^[34-36] Conjunctival pigmentation results from diffuse pigmentation of the tarsal conjunctiva and conjunctival fornices leading to discrete, punctate deposits.^[37-39] Kohl, which is popular as an eyeliner in the Middle East, Asia, and Africa, contains high concentrations of lead resulting in lead toxicity and abnormal pigmentation of the conjunctiva and lacrimal sac.^[40-41] Retinoid acids are also known for their influence on human meibomian gland epithelial cells causing inhibited cell proliferation, induced cell death, and, differentiation, keratinization, inflammation, reduced and abnormal secretions, as well as tear film instability and hyperosmolarity, dry eye symptoms, and blepharitis.^[20,42] Our results were consistent with these findings, with 14.9% of those who used retinoid A and reported dry eye sensation, foreign body sensation, burning sensation, and noticeable redness on the eyelids. The use of contact lenses is associated with reduced meibomian gland morphology and function^[12] resulting from mechanical trauma and accumulation of epithelial cells on gland orifices.^[43,44] Among our respondents, 39.4% reported daily use of contact lenses.

Previous studies have highlighted the importance of eyelid hygiene for the maintenance of ocular surface health in patients with MGD. A prospective study on patients with MGD-associated dry eye demonstrated that patients who received artificial tears and lid warming combined with lid margin cleaning with a deep cleaning device showed significantly better improvements in dry eye symptoms compared to control patients who received only artificial tears and lid warming.^[45] Patients diagnosed with blepharitis and chalazion are instructed to maintain eyelid hygiene to treat their chronic condition.^[46,47] The risk of OSD following eye surgery can be reduced using conservative means preoperatively.^[48] One of the side effects of using antiglaucoma medication in patients with glaucoma is OSD signs and symptoms. Boso *et al.* encouraged ocular surface practices without the need to discontinue glaucoma medication.^[49] Therefore, we recommend that ophthalmologists educate to their patients, especially those with MGD and dryness, about the importance of establishing good eyelid hygiene habits.

Limitations

Eyelid hygiene is a topic that requires more than a cross sectional study. Future prospective studies and experimental studies with big sample size are needed. The distribution across various age groups, sexes, and regions could have been influenced by the nature of the online questionnaire.

CONCLUSION

The level of awareness of eyelid hygiene in Saudi Arabia was found to be suboptimal generally and specifically in patients with MGD and eye dryness. Poor knowledge regarding the beneficial effects of daily eyelid hygiene in this group of patients was the barrier to its implementation. We recommend increasing the awareness through ophthalmologists of good eye hygiene practices among patients with MGD and dryness.

However, there is insufficient evidence in the current literature about the benefits of eyelid hygiene in a normal population without clinical signs or symptoms of MGD and dryness. Further studies and evidence are needed before we active promotion of the daily practice of eyelid hygiene for the normal population.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Benitez-Del-Castillo JM. How to promote and preserve eyelid health. *Clin Ophthalmol* 2012;6:1689-98.
- Khanna RC. Ocular surface disorders. *Community Eye Health* 2017;30:S1-2.
- Shimazaki J, Sakata M, Tsubota K. Ocular surface changes and discomfort in patients with meibomian gland dysfunction. *Arch Ophthalmol* 1995;113:1266-70.
- Li Y, Lu J, Zhou Q, Wang C, Zeng Q, Chen T, *et al.* Analysis of clinical and regional distribution characteristics of obstructive meibomian gland dysfunction in China: A multicenter study. *Curr Eye Res* 2020;45:1373-9.
- Costa VP, Marcon IM, Galvão Filho RP, Malta RF. The prevalence of ocular surface complaints in Brazilian patients with glaucoma or ocular hypertension. *Arq Bras Oftalmol* 2013;76:221-5.
- Garza-Leta M, Valencia-Garza M, Martncia-Leal B, Villarreal-Peam P, Marcos-Abdala HG, Cortla-Guajardo AL, *et al.* Prevalence of ocular surface disease symptoms and risk factors in group of university students in Monterrey, Mexico. *J Ophthalmic Inflamm Infect* 2016;6:44.
- Mostafa E. Prevalence of dry eye disease in southern Egypt: A hospital-based outpatient clinic study. *J Egypt Ophthalmol Soc* 2016;109:32.
- Chan CC, Crowston JG, Tan R, Marin M, Charles S. Burden of ocular surface disease in patients with glaucoma from Australia. *Asia Pac J Ophthalmol (Phila)* 2013;2:79-87.
- Vehof J, Kozareva D, Hysi PG, Hammond CJ. Prevalence and risk factors of dry eye disease in a British female cohort. *Br J Ophthalmol* 2014;98:1712-7.
- Bukhari AA. Prevalence of obstruction meibomian gland disease among ophthalmology patients. *J King Abdulaziz Univ Med Sci* 2009;16:69-76.
- Bukhari A, Ajlan R, Alsaggaf H. Prevalence of dry eye in the normal population in Jeddah, Saudi Arabia. *Orbit* 2009;28:392-7.
- Chhadva P, Goldhardt R, Galor A. Meibomian gland disease: The role of gland dysfunction in dry eye disease. *Ophthalmology* 2017;124:S20-6.
- Nelson JD, Shimazaki J, Benitez-del-Castillo JM, Craig JP, McCulley JP, Den S, *et al.* The international workshop on meibomian gland dysfunction: Report of the definition and classification subcommittee. *Invest Ophthalmol Vis Sci* 2011;52:1930-7.
- Mathers WD, Shields WJ, Sachdev MS, Petroll WM, Jester JV. Meibomian gland dysfunction in chronic blepharitis. *Cornea* 1991;10:277-85.
- The definition and classification of dry eye disease: Report of the Definition and Classification Subcommittee of the International Dry Eye WorkShop (2007). *Ocul Surf* 2007;5:75-92.
- Bernardes TF, Bonfioli AA. Blepharitis. *Semin Ophthalmol* 2010;25:79-83.
- McCulley JP, Dougherty JM, Deneau DG. Classification of chronic blepharitis. *Ophthalmology* 1982;89:1173-80.
- Chader GJ, Taylor A. Preface: The aging eye: Normal changes, age-related diseases, and sight-saving approaches. *Invest Ophthalmol Vis Sci* 2013;54:F1-4.
- Mantelli F, Moretti C, Macchi I, Massaro-Giordano G, Cozzupoli GM, Lambiasi A, *et al.* Effects of sex hormones on ocular surface epithelia: Lessons learned from polycystic ovary syndrome. *J Cell Physiol* 2016;231:971-5.
- Knop E, Knop N, Millar T, Obata H, Sullivan DA. The international workshop on meibomian gland dysfunction: Report of the subcommittee on anatomy, physiology, and pathophysiology of the meibomian gland. *Invest Ophthalmol Vis Sci* 2011;52:1938-78.
- Arita R, Itoh K, Inoue K, Kuchiba A, Yamaguchi T, Amano S. Contact lens wear is associated with decrease of meibomian glands. *Ophthalmology* 2009;116:379-84.
- Bergler-Czop B, Bilewicz-Stebel M, Staewicz-S A, Bilewicz-Wyrozumska T. Side effects of retinoid therapy on the quality of vision. *Acta Pharm* 2016;66:471-8.
- Ng A, Evans K, North R, Purslow C. The effects of cosmetic eye pencil application on the tear film and ocular surface. *Invest Ophthalmol Vis Sci* 2013;54:952.
- Sadagopan AP, Manivel R, Marimuthu A, Nagaraj H, Ratnam K, Kumar T, *et al.* Prevalence of smart phone users at risk for developing cell phone vision syndrome among college students. *J Psychol Psychother* 2017;7:299.
- Tanabe H, Kaido M, Kawashima M, Ishida R, Ayaki M, Tsubota K. Effect of eyelid hygiene detergent on obstructive meibomian gland dysfunction. *J Oleo Sci* 2019;68:67-78.
- Motoko Kawashima K. Daily habits to maintain ocular surface health: Internet survey on eyelid cleaning. *Qual Prim Care* 2016;24:187-90.
- Romero JM, Biser SA, Perry HD, Levinson DH, Doshi SJ, Terraciano A, *et al.* Conservative treatment of meibomian gland dysfunction. *Eye Contact Lens* 2004;30:14-9.
- Bitton E, Ngo W, Dupont P. Eyelid hygiene products: A scoping review. *Cont Lens Anterior Eye* 2019;42:591-7.
- Amano S, Inoue K. Estimation of prevalence of meibomian gland dysfunction in Japan. *Cornea* 2017;36:684-8.
- Asiedu K, Kyei S, Dzasimatu SK, Morny EK. Meibomian gland dysfunction in a youthful clinical sample in Ghana. *Optom Vis Sci* 2018;95:349-53.
- Rhee D, Pyfer M. Blepharitis/Meibomitis. In: Rhee D, Pyfer M, editors. *The Wills Eye Manual: Office and Emergency Room Diagnosis and Treatment of Eye Disease*. Philadelphia: Lippincott Williams and Wilkins; 1999. p. 141-2.
- A.Ao. Ophthalmology, Blepharitis Preferred Practice Pattern-Management; 2018. Available from: [https://www.aaojournal.org/article/S0161-6420\(18\)32645-9/pdf](https://www.aaojournal.org/article/S0161-6420(18)32645-9/pdf). [Last accessed on 2019 Jun 26].
- Ng A, Evans K, North R, Purslow C. Eye cosmetic usage and associated ocular comfort. *Ophthalmic Physiol Opt* 2012;32:501-7.
- Goto T, Zheng X, Gibbon L, Ohashi Y. Cosmetic product migration onto the ocular surface: Exacerbation of migration after eyedrop instillation. *Cornea* 2010;29:400-3.
- Ng A, Evans K, North RV, Purslow C. Migration of cosmetic products into the tear film. *Eye Contact Lens* 2015;41:304-9.
- Hunter M, Bhola R, Yappert MC, Borchman D, Gerlach D. Pilot study of the influence of eyeliner cosmetics on the molecular structure of human meibum. *Ophthalmic Res* 2015;53:131-5.
- Platia EV, Michels RG, Green WR. Eye-cosmetic-induced conjunctival pigmentation. *Ann Ophthalmol* 1978;10:501-4.
- Donaldson DD. Mascara pigmentation of the conjunctiva. *Arch Ophthalmol* 1969;81:124-5.
- Sugar HS, Kobernick S. Subconjunctival pigmentation; associated with the use of eye cosmetics containing carbon-black. *Am J Ophthalmol* 1966;62:146-9.
- Al-Ashban RM, Aslam M, Shah AH. Kohl (surma): A toxic traditional eye cosmetic study in Saudi Arabia. *Public Health* 2004;118:292-8.
- Hidayat AA, Weatherhead RG, Al-Rajhi A, Johnson FB. Conjunctival and lacrimal sac pigmentation by kohl (eyeliner) *Br J Ophthalmol* 1997;81:418.
- Ding J, Kam WR, Dieckow J, Sullivan DA. The influence of 13-cis retinoic acid on human meibomian gland epithelial cells. *Invest Ophthalmol Vis Sci* 2013;54:4341-50.
- Ong BL, Larke JR. Meibomian gland dysfunction: Some clinical, biochemical and physical observations. *Ophthalmic Physiol Opt* 1990;10:144-8.
- Larke, JR. *The Eye in Contact Lens Wear*. London: Butterworth; 1985. p. 5-6. 47. Henriquez AS, Korb DR. Meibomian glands and contact lens

- wear. *Br J Ophthalmol* 1981;65:108-11.
45. Xie WJ, Jiang LJ, Zhang X, Xu YS, Yao YF. Eyelid margin cleaning using Deep Cleaning Device for the treatment of meibomian gland dysfunction-associated dry eye: A preliminary investigation. *J Zhejiang Univ Sci B* 2019;20:679-86.
46. Perry HD, Serniuk RA. Conservative treatment of chalazia. *Ophthalmology* 1980;87:218-21.
47. Arr. 2 M, Samudio M, Faridi N, Cibils D, Laspina F, Sanabria R, *et al.* Comparative study of the efficacy of different treatment options in patients with chronic blepharitis. *Arch Soc Esp Oftalmol* 2015;90:112-8.
48. Song P, Sun Z, Ren S, Yang K, Deng G, Zeng Q, *et al.* Preoperative management of MGD alleviates the aggravation of MGD and dry eye induced by cataract surgery: A prospective, randomized clinical trial. *Biomed Res Int* 2019;2019:2737968.
49. Mylla Boso AL, Gasperi E, Fernandes L, Costa VP, Alves M. Impact of ocular surface disease treatment in patients with glaucoma. *Clin Ophthalmol* 2020;14:103-11.