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Impact of contact lens wear on ocular surface and Meibomian glands

Kontakt lens kullanımının oküler yüzey ve Meibomian bezleri üzerine etkileri

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Abstract

Aim: To determine the impact of contact lens (CL) wear on the ocular surface and Meibomian glands (MG).

Materials and Methods: 24 silicone hydrogel CL wearers for a minimum of 5 years (Group 1) and 26 healthy volunteers (Group 2) were included in this retrospective study. Best corrected visual acuity, Oxford scoring, tear film break-up time (T-BUT), Schirmer 1 test, Ocular Surface Disease Index (OSDI) scoring and MG evaluation by infrared captures of optic coherence tomography (OCT) were performed. Loss of the MG was scored blindly by a single researcher.

Results: The mean age was 30.00±6.22 in Group 1 and 28.70±4.95 in Group 2 (p=0.300). Male/female ratio was 4/20 in Group 1 and 9/17 in Group 2. The average duration of CL wear was 10.70±2.70 years. The mean T-BUT in Group 1 and 2 were 17.70±76.74 and 24.76±8.06 sec, respectively (p=0.002). The mean Schirmer 1 test in Group 1 and 2 were 29.04±7.67 and 25.50±8.48 mm, respectively (p=0.129). The mean Oxford scale staining in Group 1 and 2 were 0.58±0.94 and 0.15±0.41, respectively (p=0.040). The mean OSDI scores in Group 1 and 2 were 29.36±19.25 and 23.63±21.99, respectively (p=0.334). The average upper, lower eyelid, and total meiboscores in Group 1 and 2 were 0.95±0.87, 0.66±0.73, 1.60±1.40 and 0.67±0.59, 0.67±0.70 and 1.34±1.17, respectively. No statistical significance was detected in any of these scores.

Conclusion: CL wear has a variety of effects on ocular surface. MG has a significant influence on ocular surface. Meiboscoring is an effective and practical way for evaluation of the MG.

Keywords: Contact lens wear, infrared imaging, Meibomian gland, meibography, optic coherence tomography

Öz

Amaç: *Yumuşak kontakt lens (KL) kullanımının oküler yüzey ve Meibomian bezleri üzerine etkisini araştırmak*

Gereç ve Yöntem: *Beş yılı aşkın süredir silikon hidrojel KL kullanım öyküsü bulunan 24 olgu (Grup 1) ve 26 sağlıklı gönüllünün (Grup 2) en iyi düzeltilmiş görme keskinlikleri, Schirmer 1 testi, gözyaşı kırılma zamanı, oküler yüzey boyanması (Oxford skalası), OSDI skoru ve Meibomian bez özelliklerini içeren kayıtları retrospektif olarak değerlendirildi. Üst ve alt kapakların OCT meibografileri (Spectralis HRA+OCT; Heidelberg Engineering, Heidelberg, Germany) çekilerek bez kaybı açısından tek bir araştırmacı tarafından kör olarak değerlendirildi.*

Bulgular: *Ortalama yaş Grup 1'de 30,00±6,22, Grup 2'de ise 28,70±4,95 idi (p=0,300). Erkek/kadın oranı Grup 1'de 4/20, Grup 2'de 9/17 idi. KL kullanım süresi 10,70±2,70 yıldı. Ortalama gözyaşı kırılma zamanı Grup 1'de 17,70±76,74, Grup 2'de 24,76±8,06 saniyeydi (p=0,002). Ortalama Schirmer 1 değeri Grup 1'de 29,04±7,67, Grup 2'de 25,50±8,48 mm idi (p=0,129). Oxford skalası puanı Grup 1'de 0,58±0,94, Grup 2'de 0,15±0,41 olup fark istatistiksel olarak anlamlıydı (p=0,040). OSDI skoru açısından gruplar arası istatistiksel anlamlı fark bulunmamaktaydı (Grup 1: 29,36±19,25, Grup 2: 23,63±21,99, p=0,334). Üst, alt kapak ve toplam Meibomian bez skoru ortalaması Grup 1'de sırasıyla 0,95 ±0,87, 0,66±0,73 ve 1,60±1,40, Grup 2'de sırasıyla 0,67±0,59, 0,67±0,70 ve 1,34±1,17 idi ve aralarındaki fark istatistiksel olarak anlamlı değildi.*

Sonuç: *Uzun süreli KL kullanımının, oküler yüzeye birçok farklı etkisi mevcuttur. Meibomian bezler, oküler yüzeye önemli etkileri bulunan yapıladır. Meibobian bez skorlaması, Meibomian bez değerlendirmesi için etkili ve pratik bir yöntemdir.*

Anahtar Sözcükler: *Kontakt lens kullanımı, infrared görüntüleme, Meibomian bez, meibografi, optik koherens tomografi.*

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Introduction

Meibomian glands (MG) are specialized sebaceous glands, which are localized at the tarsal plates of the eyelids. These glands are responsible for lipid secretion, which plays a significant role to build the surface tension and stability of the tear film and prevents evaporation (1-3). Meibomian gland dysfunction (MGD) is a chronic disease, which results with ocular irritation and ocular surface disorders (4). Meibography is a relatively new technique for evaluating MGD. Infrared imaging of MG and scoring systems for MG loss are the leading research subjects on MGD issue recently (5-7).

Contact lens wearing has various undesired effects on the ocular surface, such as allergic conjunctivitis, infections and dry eye. Dry eye –one of the most common of these complications– is mainly suggested being related to abnormally functioning MG (8-10,13).

Herein, it is aimed to determine the effects of contact lens wear on the ocular surface and MG.

Materials and Methods

In this cross-sectional observational study 24 contact lens wearers (Group 1) and 26 healthy volunteers (Group 2) were evaluated. Inclusion criteria for contact lens wearers were minimum 5 years history of silicone-hydrogel type contact lens wearing. Exclusion criteria for both groups were ocular or systemic chronic disease history, any intra- or extra-ocular surgery history, smoking, and pregnancy or lactation period for female cases. Both eyes of each subject were evaluated for the study, and the mean values of both eyes were assessed for data analysis. All cases underwent a detailed ophthalmological examination and the following tests were performed: corneal and conjunctival fluorescein staining and Oxford scoring, tear film break-up time (T-BUT), Schirmer 1, Ocular Surface Disease Index (OSDI) score assessment, and evaluation of the MG after everting both upper and lower eyelids to reveal infrared captures using the Optic Coherence Tomography (OCT) device (Spectralis HRA+OCT; Heidelberg Engineering, Heidelberg, Germany). All patients were questioned for daily eyelid hygiene. Partial or complete loss of the MG was scored for each eyelid as grade 0 (no loss of MG), grade 1 (the area characterized by gland dropout was <1/3 of the total MG), grade 2 (the area characterized by gland dropout was 1/3-2/3 of the total MG) and grade 3 (the area characterized by gland dropout was >2/3 of the total MG) (Figure-1). Meiboscore assessment was performed blinded by the same researcher (AY). The meiboscores for the upper and lower eyelids were summed for each eye. This study was adhered to the tenets of the Declaration of Helsinki. The Statistical Package for the Social Sciences version 11.5.0 was used for statistical analysis. The Mann-Whitney U test is used to compare differences between two groups.

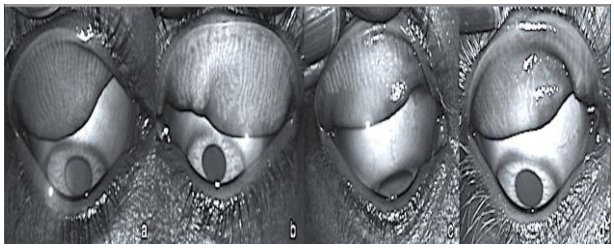

Figure-1. The infrared captures from Meibography, grade 0 (no loss of Meibomian glands) **(a)**, grade 1 (the area characterized by gland dropout was <1/3 of the total Meibomian glands) **(b)**, grade 2 (the area characterized by gland dropout was 1/3-2/3 of the total Meibomian glands) **(c)** and grade 3 (the area characterized by gland dropout was >1/3 of the total Meibomian glands) **(d)**.

Results

The mean age was 30.0±6.2 (range, 22-42) in Group 1 and 28.7±4.9 (range, 22-38) in Group 2 (p=0.300). Male to female ratio was 4/20 in Group 1 and 9/17 in Group 2 (p=0.080). The average duration of contact lens wear was 10.7±2.7 years (range, 5-16 years). Two cases (8.33%) in Group 1 and one case (3.84%) in Group 2 were performing daily eyelid hygiene. The mean T-BUT in Group 1 and 2 were 17.70±76.74 (range, 8-30) and 24.76±8.06 (range, 8-30) seconds, respectively (p=0.002) (Table-1). The mean Schirmer 1 test results in Group 1 and 2 were 29.04±7.67 (range, 1-35) and 25.50±8.48 (range, 11-35) mm, respectively (p=0.129).

The mean superficial punctate staining according to Oxford scale in Group 1 and 2 were 0.58±0.94 (range, 0-4) and 0.15±0.41 (range, 0-1.5), respectively (p=0.040). The mean OSDI scores in Group 1 and 2 were 29.36±19.25 (range, 0-70.83) and 23.63±21.99 (range, 0-70.45), respectively (p=0.334). The average upper eyelid, lower eyelid, and total (upper eyelid plus lower eyelid) meiboscores in Group 1 were 0.95 ±0.87 (range, 0-3), 0.66 ±0.73 (range, 0-3) and 1.60±1.40 (range, 0-6), respectively. The average upper eyelid, lower eyelid, and total (upper eyelid plus lower eyelid) meiboscores in Group 2 were 0.67 ± 0.59 (range, 0-2), 0.67 ±0.70 (range, 0-3.5) and (1.34±1.17) (range, 0-4), respectively. Although a noteworthy increase in upper eyelid meiboscore compared to the lower eyelid was noted in contact lens wearer group, the statistical difference could not reach the significance point (p=0.068). No other significant differences were found in the remaining meiboscores of the groups (Table-1).

Discussion

Contact lens use induces a variety of ocular complications, such as allergic conjunctivitis, infections and dry eye. One of the most important complications of prolonged contact lens wear is dry eye (11-12). The prevalence of dry eye and related findings were reported up to 50% in the literature (4).

MG plays an important role in structuring the lipid layer of the tear film (13). MGD consequently causes dry eye, mainly of evaporative type. There are several ways to evaluate MG function; slit lamp biomicroscopy for MG appearance, T-BUT measurement, analyzing meibum expressed from the glands (4).

Table-1. The results of the Corneal And Conjunctival Fluorescein Staining And Oxford Scoring, Tear Film Break-Up Time (T-BUT), Schirmer 1, Ocular Surface Disease Index (OSDI) Score Assessment, and Evaluation of the Meibomian Glands in Group 1 and 2.

	Group 1	Group 2	P value
T-BUT (sec)	17.70 ± 6.74	24.76 ± 8.06	0.002
Schirmer test (mm)	29.04 ± 7.67	25.50 ± 8.48	0.129
Oxford scale score	0.58 ± 0.94	0.15 ± 0.41	0.040
OSDI score	29.36 ± 19.25	23.63 ± 21.99	0.334
Total eyelid meiboscore	1.60 ± 1.40	1.34 ± 1.17	0.483
Upper eyelid meiboscore	0.95 ± 0.87	0.67 ± 0.59	0.218
Lower eyelid meiboscore	0.66 ± 0.73	0.67 ± 0.70	0.843

Meibography is a relatively objective and new technique for evaluating the MG, which images the MG and also advances with the developments in medical imaging. It can be performed in various ways by using contact or noncontact infrared cameras, confocal microscopy, ultrasound and OCT devices (14).

Currently, it is not clear which device is the most suitable one for this purpose. Besides, grading MGS is still a controversial issue. Most of the researchers defined their own grading systems and scoring the drop out of the gland percentage is the most common system (5,6,15-20). However, some of the researchers also evaluate the morphology of the glands (6,21-26).

There are only a few studies that investigate the relation of these two parameters, contact lens wear and MG. In most of the published literature, MG evaluation with conventional methods in gas permeable or hydrogel contact lens users was performed (13,25-26). In 2009, Arita et al (13), reported a significant MG loss in rigid gas permeable and hydrogel contact lens wearers with one-year history of lens use. They also reported that meiboscore difference that is demonstrated with their own developed infrared Meibography camera was prominent between upper and lower eyelids of contact lens wearer group. Herein, silicone hydrogel contact lens wearers – at least for 5 years - were included and MG imaging was performed with the infrared acquisition feature of the OCT device, which is widely present in most of the ophthalmology clinics. Contact lens wear is a probable reason of alterations in MG, which may result with MGD (13,27). We found a slight meiboscore difference between upper and lower eyelids in silicone hydrogel contact lens wearer group was detected, however the statistical difference did not reach the significance point.

In the present study, an increased Oxford scoring and decreased T-BUT in contact lens wearer group compared to the control group were found. The differences were statistically significant which is consistent with the literature – confirming the negative effects of contact lens wear on the ocular surface (8,13).

Conclusion

In conclusion, contact lens wear has a variety of effects on ocular surface. Meiboscoring of MG is an effective and practical way for the evaluation. There still is need for more detailed and associated randomized controlled prospective studies with larger populations to understand the issue in a better way.

References

1. Knop N, Knop E. Meibomian glands. Part I. Anatomy, embryology and histology of the Meibomian glands. Ophthalmologe 2009;106(10):872-83.
2. Nagyova B, Tiffany JM. Components responsible for the surface tension of human tears. Curr Eye Res 1999;19(1):4-11.
3. Craig JP, Tomlinson A. Importance of the lipid layer in human tear film stability and evaporation. Optom Vis Sci 1997;74(1):8-13.
4. Nelson JD, Shimazaki J, Benitez-del-Castillo JM, et al. The international workshop on meibomian gland dysfunction: Report of the definition and classification subcommittee. Invest Ophthalmol Vis Sci 2011;52(4):1930-7.
5. Arita R, Itoh K, Inoue K, Amano S. Noncontact infrared meibography to document age-related changes of the meibomian glands in a normal population. Ophthalmology 2008;115(5):911-5.
6. Pult H, Riede-Pult BH. Non-contact meibography: Keep it simple but effective. Cont Lens Anterior Eye 2012;35(2):77-80.
7. Srinivasan S, Sorbara L, Jones L, Sickenberger W. Imaging the structure of the meibomian glands. Contact Lens Spectrum 2011;7(1):52-3
8. Nichols JJ, Sinnott LT. Tear film, contact lens, and patient- related factors associated with contact lens-related dry eye. Invest Ophthalmol Vis Sci 2006;47(4):1319-28.
9. Pisella PJ, Malet F, Lejeune S, et al. Ocular surface changes induced by contact lens wear. Cornea 2001;20(8):820-5.
10. Hatfield RO, Jordan DR, Bennett ES, Henry VA, Marohn JW, Morgan BW. Initial comfort and surface wettability: A comparison between different contact lens materials. J Am Optom Assoc 1993;64(4):271-3.

11. Nichols JJ, Mitchell GL, Nichols KK, Chalmers R, Begley C. The performance of the contact lens dry eye questionnaire as a screening survey for contact lens-related dry eye. Cornea 2002;21(5):469-75.
12. Begley CG, Caffery B, Nichols KK, Chalmers R. Responses of contact lens wearers to a dry eye survey. Optom Vis Sci 2000;77(1):40-6.
13. 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(3):379-84.
14. Ngo W, Srinivasan S, Jones L. Historical overview of imaging the meibomian glands. Journal of Optometry 2013;6(1):1-8.
15. Nichols JJ, Berntsen DA, Mitchell GL, Nichols KK. An assessment of grading scales for meibography images. Cornea 2005;24(4):382-8.
16. Shimazaki J, Goto E, Ono M, Shimmura S, Tsubota K. Meibomian gland dysfunction in patients with Sjögren syndrome. Ophthalmology 1998;105(8):1485-8.
17. Goto E, Monden Y, Takano Y, et al. Treatment of noninflamed obstructive meibomian gland dysfunction by an infrared warm compression device. Br J Ophthalmol 2002;86(11):1403-7.
18. McCann LC, Tomlinson A, Pearce EI, Diaper C. Tear and meibomian gland function in blepharitis and normals. Eye Contact Lens 2009;35(4):203-8.
19. McCulley JP, Shine WE, Aronowicz J, Oral D, Vargas J. Presumed hyposecretory/hyperevaporative KCS: Tear characteristics. Trans Am Ophthalmol Soc 2003;101(3):141-52.
20. Aronowicz JD, Shine WE, Oral D, Vargas JM, McCulley JP. Short term oral minocycline treatment of meibomianitis. Br J Ophthalmol 2006;90(7):856-60.
21. Jester JV, Rife L, Nii D, Luttrull JK, Wilson L, Smith RE. In vivo biomicroscopy and photography of meibomian glands in a rabbit model of meibomian gland dysfunction. Invest Ophthalmol Vis Sci 1982;22(5):660-7.
22. Den S, Shimizu K, Ikeda T, Tsubota K, Shimmura S, Shimazaki J. Association between meibomian gland changes and aging, sex, or tear function. Cornea 2006;25(6):651-5.
23. Arita R, Itoh K, Inoue K, Amano S. Noncontact infrared meibography to document age-related changes of the meibomian glands in a normal population. Ophthalmology 2008;115(5):911-5.
24. Srinivasan S, Menzies K, Sorbara L, Jones L. Infra-red imaging of meibomian gland structure using a novel keratograph. OptomVis Sci 2012;89(5):788-94.
25. Henriquez AS, Korb DR. Meibomian glands and contact lens wear. Br J Ophthalmol 1981;65(2):108-11.
26. Ong BL. Relation between contact lens wear and meibomian gland dysfunction. Optom Vis Sci 1996;73(3):208-10.
27. Efron N, Jones L, Bron AJ, et al. The TFOS International Workshop on Contact Lens Discomfort: Report of the contact lens interactions with the ocular surface and adnexa subcommittee. Invest Ophthalmol Vis Sci 2013;54(11):98-122.