

# The Correlation between Daily Lens Wear Duration and Dry Eye Syndrome

Rodiah Rahmawaty Lubis<sup>1\*</sup>, Monica Tumiar Hanna Gultom<sup>2</sup>

<sup>1</sup>Department of Ophthalmology, Medical Faculty of University of Sumatera Utara, Medan, Indonesia; <sup>2</sup>Medical Faculty of University of Sumatera Utara, Medan, Indonesia

## Abstract

**Citation:** Lubis RR, Gultom MTH. The Correlation between Daily Lens Wear Duration and Dry Eye Syndrome. Open Access Maced J Med Sci. 2018 May 20; 6(5):829-834. <https://doi.org/10.3889/oamjms.2018.215>

**Keywords:** Dry eye syndrome; Softlens; Daily lens wear duration

**\*Correspondence:** Rodiah Rahmawaty Lubis. Department of Ophthalmology, Medical Faculty of University of Sumatera Utara, Indonesia. E-mail: rahma.lubis@yahoo.com

**Received:** 24-Feb-2018; **Revised:** 23-Apr-2018; **Accepted:** 29-Apr-2018; **Online first:** 18-May-2018

**Copyright:** © 2018 Rodiah Rahmawaty Lubis, Monica Tumiar Hanna Gultom. This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

**Funding:** This research did not receive any financial support

**Competing Interests:** The authors have declared that no competing interests exist

**AIM:** To analyze the correlation between the daily lens wear duration and dry eye syndrome.

**SUBJECTS AND METHODS:** This study was an analytic cross sectional study using consecutive sampling conducted among the students in Economy and Business Faculty and Faculty of Humanities in University of Sumatera Utara aged between 17 to 23 that wore contact lens continuously for at least a year and 5 days a week. The symptoms were assessed using Contact Lens Dry Eye Questionnaire-8 (CLDEQ-8) and interview about their contact lens comfort; eye drops usage, contact lens washing habit, daily circumstances, places to buy contact lens and personal experience in wearing contact lens.

**RESULTS:** The questionnaire was completed by 53 students. All of them were female and wore softlens wearers. The mean duration of daily wear was  $8.19 \pm 2.20$  hours. The most common symptom experienced was dry eye and the least symptom experienced was removing lens. The most frequent symptom experienced was closing eyes and the least frequent symptom experienced was removing lenses. This study used Exact Test as analysis statistic method. The result was  $p > 0.05$  which means there is no correlation between daily lens wear duration and dry eye syndrome.

**CONCLUSION:** This study showed that dry eye syndrome was not correlated with daily lens wear duration, but affected by many factors such as contact lens, lens care solution, eye drops usage and environment.

## Introduction

Contact lens dry eye syndrome is recognized as a growing public health problem and one of the most frequent reasons for seeking ophthalmologist intervention [1] [2]. Previously conducted investigations estimate that the frequency of contact lens related dry eye is approximately 50% [1] [3]. Evidence from previous study has contributed to general consensus that contact lens discomfort is the main reason for discontinuation of wear and that the most common type of discomfort is dryness [3]. Due to changes associated with dry eyes these persons also often complain visual disturbance and blurred vision [1] [3]. Discomfort and desiccation symptoms are the primary reasons for contact lens intolerance, a reduction in the length of wearing time and eventual discontinuation [1] [3]. Dumbleton et al., study on

2013 also reported dropping out rate was 23% with the primary reasons for dropping out were discomfort (24%) and dryness (20%) [4]. A previous study conducted by Rumpakis showed more than one out of 6 contact lens wearers will discontinue lens wear [2].

In some previous studies, contact lens dry eye syndrome was associated with daily wear duration. Kaštelan found a weak correlation between daily wear duration and higher OSDI values and moderate negative correlation between daily wear duration and TBUT [3]. Pili et al., found a weak negative correlation between daily wear duration and TBUT [1]. Otherwise in Sapkota et al., study found no correlation between daily wear duration and degree of dry eye symptoms. These inconsistent results made us interested to do a research in Indonesia.

The diagnosis of dry eye is set on the basis of patients' self reports of symptoms and clinical examination [3]. The clinical examinations that are

usually used to examine dry eye are tear film break up time test (TFBUT) to examine tear film stability and Schirmer Test to evaluate tear production, corneal and conjunctival staining to assesst ocular surface damage [6]. Whereas patient's symptoms can be assessed using some questionnaire. CLDEQ-8 is a short form of CLDEQ questionnaire that was designed to describe dry eye among contact lens wearers in particular [7].

The aim of this study was to analyze the association between daily lens wear duration and dry eye syndrome using CLDEQ-8 as the instrument.

### Subjects and Methods

The study was conducted in Economy and Bussiness Faculty and Faculty of Humanities in University of Sumatera Utara that was selected based on majority of contact lens population amongst all the faculties. Before doing this study, we had already had ethical clearance from Health Research Ethical Committee of Medical Faculty of Sumatera Utara University/H. Adam Malik General Hospital. This study was an analytic cross sectional study and sampling methods used for this study was consecutive sampling The students included in this study were recruited through direct referrals. The eligible participants had to wear contact lens continuously for at least a year and 5 days a week [8]. Those who had eye surgery history, tear gland dysfunction, eye infection, low blink rate, hormone replacement therapy, radiotherapy and chemotherapy patient, students with HIV/AIDS or diabetes were excluded from the study to avoid bias [9]. Minimal sample for this study was 45 students.

The dry eye syndrome were assessed by Contact Lens Dry Eye Questionnaire-8 (CLDEQ-8) and there are some additional questions included daily and weekly contact lens wear time, years of contact lens wear and also frequency on disposing lens. Contact Lens Dry Eye Questionnaire-8 was chosen because it was a spesific questionnaire for contact lens wearer [7]. After given out the questionnaire, the students were interviewed about their contact lens comfort, eye drops usage, contact lens washing habit, daily circumstances, places to buy contact lens and personal experince in wearing contact lens. The Contact Lens Dry Eye Questionnaire-8 results would be calculated and matched with the baseline status score (Table 1):

**Table 1: Baseline status score**

Total Score	Eye's Condition
0-6	Excellent
7-9	Very Good
10-14	Good
15-17	Fair Good
>17	Poor/dry

### Results

A total of 53 students met the criterias to be participants. All of the students were female and no male student was found to wear contact lens. There was no RGP wearer. Most of student disposed their lenses every month with 30.2% and the least frequency in disposing lens is once in 5 months with 1.9% (mean 3.77 ± 2.39).

Wearing time is divided by two categories, they are daily wearing time and yearly wearing time. The daily wearing time ranged from 5 to 14 hours (mean 8.19 ± 2.20 hours) and the yearls of contact lens wear time ranged from 1 to 6 years (mean 3.38 ± 1.50 years).

The result of the students' answers showed that the most common symptom experienced by the students was dry eye and the least symptom experienced by the students was removing lens (Table 2).

**Table 2: Percentage of dry eye symptoms**

Symptoms	Percentage
Eye Discomfort	75.4%
Dry Eye	81.1%
Changable, Blurry Eye	66.0%
Closing Eyes	73.6%
Removing Lens	66.0%

The most frequent symptom experienced by the students was closing eyes and the least frequent symptom experienced by the students was removing lenses (Table 3).

**Table 3: The frequencies of dry eye symptoms**

Symptoms	Frequency				
	0	1	2	3	4
Eye Discomfort	13	14	23	3	0
Dry Eye	10	24	14	5	0
Changable, Blurry Eyes	21	16	3	3	0
Closing Eyes	14	14	18	7	0
Removing lens	18	15	12	8	0

Note:0=Never; 1=Rarely; 2=Sometimes; 3= Frequently; 4 = Constantly.

The questionnaires that were given to students were collected and scored. The students' scores range from 0 to 23. There were 2 students who had no score and there was 1 student whose score 23. The CLDEQ-8 scores were converted into eye's condition and most of the students had excellent eye (28.3%) and there were 7 students who had dry eyes (13.2%).

**Table 4: The students' total scores**

Total Score	Frequency
0-5	9
6-10	22
11-15	7
16-20	9
21-25	3

After given out the questionnaire, the students were interviewed about their contact lens comfort, eye drops usage, contact lens washing habit, daily

circumstances, places to buy contact lens and personal experience in wearing contact lens. The students usually wore their contact lenses mainly at campus. They studied at campus started 8 am to 5 pm. The classrooms didn't have air conditioner and when this study was held the weather was rainy everyday that made the air cool and moist. For the question places to buy contact lenses, the students answered that most of them bought the contact lens online, from the optic and from a nearby marketplace. When they were asked about the lens washing habit, they usually washed the lens twice a day. Before and after using the lens using multi purpose solution.

The students also brought artificial tears to use at campus. They usually used it every 3-4 hours. An interesting story came from a student, she said that she once had an eye irritation because of one lens care solution. After changing the brand she felt relieved. There was also a question about when they felt uncomfortable while wearing contact lens and most of them would start to feel uncomfortable when the lens was almost due to dispose.

**Table 5: The condition of students' eyes**

Eye's Condition	Frequency
Excellent	15
Very Good	13
Good	11
Fair Good	7
Dry Eye	7

In this study there were 7 students with dry eye. Three students experienced dry eye syndrome due to their lens. Their lens were uncomfortable to wear because the lens would be needed to replace soon, but due to economy reason they decided to bear with it until it was really the time to replace. Other than the contact lens replacing time, one of the students had an issue with the contact lens. The new contact lens weren't comfortable to wear, but she decided not to replace the lens because of economy reason too. She had never felt uncomfortable with the old lens. The others were used to this condition and felt uncomfortable wearing contact lens, but decided not to replace the contact lens with glasses because the glasses weren't practice to wear and the lens were functioned as a daily life style to improve confidence in appearance. The contact lens also helped them to improve appearance. So they decided to wear contact lens even though it wasn't comfortable.

**Table 6: Statistical analysis correlation between daily lens wear duration and dry eye syndrome using Fischer's exact test**

		Eyes' Condition				Total	P-Value
		Non Dry Eye		Dry Eye			
		N	%	N	%		
Daily Lens Wear Duration	≤ 8 hrs	32	69.6	4	57.1	36	0.667
	> 8 hrs	14	30.4	3	42.9	17	
Total		46	100	7	100	53	

This study showed no correlation between contact lens daily wear duration and dry eye syndrome ( $p > 0.05$ ).

## Discussion

The aim of this study was to analyze the correlation between daily lens wear duration and dry eye syndrome using CLDEQ-8 as the instrument. The result of this study is consistent with a study conducted in Nepal Eye Hospital between July 2007 and June 2012 that showed no correlation between daily lens wear duration and degree of symptoms in contact lens wearer even though many of contact lens wearers suffered from some symptoms. According to their study, dry eye syndrome that happened to their population was caused by dust and high pollution.<sup>5</sup> This cause was also present in Young et al., study in 2011 among UK soft contact lens wearers. According to their study pollution, dust and smoking were factors that significantly affect comfortable lens wear.<sup>10</sup> Chalmers and International Workshop on Contact Lens Discomfort 2013 also stated that environment factors induced dry eye [9] [11].

The other factor that affect dry eye in Sapkota et al., study was improper lens care system. The population of their study used MPS, but 14% used MPS that didn't contain appropriate disinfectant and 14.7% used unknown or solution without brand [5]. Lens care solution are intended for cleaning, disinfecting, removing protein deposit, rinsing and storing soft contact lens. To perform these functions, they have strong antibacterial properties, demonstrate compatibility with tear film and ocular tissue, are chemically and physically stable throughout the shelf-life and are physically compatible with wide range of lens materials. Multi Purpose Solution (MPS) component (buffers, surfactant, chelators) can help optimize the the physical properties of solution of solution to match those of tear film and maintain homeostasis which may improve its biocompatibility with the ocular surface [12]. A randomized study by Lipener compared two different regiments of MPS. The result was regiment 1 showed statistically significant clinical difference for both corneal and conjunctival staining and reported greater comfort and tolerability to the contact lens/solution combination [13]. A randomized study by Guillon et al., also showed significant improvement in contact lens wettability and surface cleanliness with a specific lens care solution [14]. Lens Care Solutions differently affected blink rate, subjective dry eye symptoms and visual discrimination speed. Those with wetting agents led to significant fewer eye blinks while affording better ocular comfort for contact lens wearers compared to that without. Lens Care Solutions with wetting agents also resulted in better visual

performance compared to wearing daily disposable contact lens. These presumably are because of the improved tear film quality [15]. One student told us about her experience in using lens care solution. She had eye irritation due to the use one brand lens care, but then she immediately changed to another brand lens care and her eyes were back to normal without any problems. The ability of lens care solution to clean protein deposit from the lens depends on the composition of lens care solution and contact lens material [16]. Choosing improper lens care solution can increase dry eye symptoms. Protein deposit on lens can also increase the foreign body sensation which is one of the dry eye symptoms [5]. Polymers age and over time gather more and more deposit. Replacing the lens as often as possible can reduce problems. Daily disposable lens are the highest standard of this concept [17].

Sapkota et al., study also stated that low compliance and improper lens fitting might also contribute to the high rate of dry eye symptoms [5]. Although some lens movement is necessary to allow postlens tear exchange, loose fitting hydrogel lenses are associated with more corneal staining and bulbar and limbal hyperemia and with poorer comfort. Base curve and diameter are surrogate measures for lens sag and increasing sag reduces movement and consequently improves comfort within the limits of acceptable fitting [18]. A previous study by Wong et al., found 40% of their subjects unable to obtain acceptable fit because of loose fit due to steeper cornea [19]. Asian eyes have greater lid tightness compared with non-Asians, which could easily affect the behaviour of the lens on the eye during blink cycle, thus impacting sensations of discomfort or dryness. Minimizing lens movement would minimize its mechanical stimulus to the cornea, conjunctiva and eyelids, although too tight a fit with virtually no lens movement could result in increased dryness symptoms due to poor tear exchange [20].

Young et al., study and Sullet et al., study also found that contact lens material can increase comfort in wearing contact lens [10] [21]. The use of high water content and ionic characteristic materials are associated with greater dehydration [22] [23]. Such dehydration changes could in turn lead to ramifications such as reduced oxygen transmissibility, greater lens adherence and reduced tear exchange [22]. High water content materials have been shown to be associated with significant tear film deposition than low water content materials [17] [21]. Differences in deposition patterns of materials may impact wearer comfort and dry eye symptoms by altering the lens surface wettability and potentially tear stability/evaporation characteristics. The more polar lipids from the tear film may be attracted to the additional water to polymers (as water is polar itself and hydrogen bonds are a stronger attractive force than electrostatics bonds that might be associated with lipids binding to polymer itself). The resultant

altered pre-lens tear film lipid layer and altered contact lens surface may lead to increased evaporation and/or reduced wettability, respectively [23].

Studies have revealed that continuous contact lens wear can produce a reduction in corneal sensitivity, with the extent of sensation loss related to the type of contact lens, the material it is made from, and the frequency and duration of wear. Sensitivity diminishes progressively with the length of wear to a maximum after the 12 hour wear period [24]. The decrease in dry eye symptoms with more years of lens wear for non-Asians may be explained by a decrease in corneal sensitivity with contact lens wear. An alternative interpretation is that perhaps cornea becomes desensitized with long term wear leading to reduce perception of dryness [25].

According to Chalmers and Young et al., study, the use of artificial tears can also help in decreasing symptoms [10] [11]. In general, artificial tears or contact lens rewetting drops moisturize the eyes surface by simply increasing the water content of the tear film or by preventing tear evaporation and protect the ocular surface by reducing frictions between eyelids and the cornea [26]. Contact lens wear decrease the tear meniscus height especially with high water content contact lens [27]. Using lens rewetting drops can increase tear meniscus volume and reducing symptoms of dryness [11] [27] [28] [29] [30]. A reduction in the prelens tear film lipid layer and an increase in tear film evaporation are attributed contact lens wear, resulting in the precipitation of dryness symptoms [29]. A previous study that compared a lipid based eye drops with nonlipid eye drops showed that lipid based eye drops improved subjective comfort scores, increased comfortable in wearing time and reduced signs of lid wiper epitheliopathy and corneal staining compared with the use of non-lipid-containing rewetting eye drops [30].

The last factor found in this study was environmental factor. When this study was hold, the weather was always rainy almost everyday for a month. The temperature was cool with high humidity. Some studies found a connection between contact lens dry eyes and low humidity and high temperature [9] [10] [11]. The classrom had no air conditioner that was associated with dry eye due to low humidity and airflow [9]. Visual display terminal work also associated with dry eye syndrome. A previous study in Japan showed that contact lens wearers and long term visual display terminal worker had worse tear meniscus height value than non contact lens wearers and short term video display terminal workers [31]. Contact lens wearers that work in front of computer were found to be more likely to develop ocular symptoms than non contact lens wearers [32]. This study doesn't have data about smoking, but exposure to smoke (smoker or passive smoker) tend to increase the symptoms score. This might be due to a fact that exposure to smoke increases the tear inflammatory cytokines, tear lipid peroxidations products and

decreases the mucosal defense resulting tear instability and damage the ocular surface epithelia [5].

In conclusion, this study shown that daily lens wear duration is not correlated with dry eye syndrome. Choosing the right lens material and fit for one's eye, frequent replacement of lens, using lens care solution and artificial tears and also protection from dust and smoke for comfortable lens wear can be achieved for longer comfortable duration.

There are some limitations of the study. This study only used questionnaire as an instrument to measure dry eye syndrome without clinical examination that may give better measurement of dry eye syndrome. Second, the population in this study was only 53. Bigger population may give more differ scores that may affect the result.

## References

- Pili K, Kaštelan S, Karabatic M, Kasun B, Čulig B. Dry Eye in Contact Lens Wearers as A Growing Public Health Problem. 2014; 26(3):528-532
- Rumpakis J. New Data on Contact Lens Dropouts: An International Perspective, 2010. accessed 26 April 2017, Available at: <https://www.reviewofoptometry.com/article/new-data-on-contact-lens-dropouts-an-international-perspective>
- Kaštelan S, Lukenda A, Salopek-Rabatić J, Pavan J, Gotovac M. Dry eye symptoms and signs in long-term contact lens wearers. Collegium antropologicum. 2013; 37(1):199-203. PMID:23837244
- Dumbleton K, Woods CA, Jones LW, Fonn D. The impact of contemporary contact lenses on contact lens discontinuation. Eye & contact lens. 2013; 39(1):93-9. <https://doi.org/10.1097/ICL.0b013e318271caf4> PMID:23266586
- Sapkota K, Martin R, Franco S, Lira M. Common Symptoms of Nepalese soft contact lens wearers: A Pilot Study. Journal of Optometry. 2015; 8:200-205. <https://doi.org/10.1016/j.optom.2015.01.004> PMID:25659748 PMID:PMC4502082
- Holland EJ, Mannis MJ. Ocular Surface Disease: Medical and Surgical Management. Springer, New York, 2002.
- Chalmers RL, Begley CG, Moody K, Hickson-Curran SB. Contact Lens Dry Eye Questionnaire-8 (CLDEQ-8) and Opinion of Contact Lens Performance. 2012; 89(10):1435-1442.
- Tran N, Graham AD, Lin MC. Ethnic Differences in Dry Eye Symptoms: Effects of Corneal Staining and Length of Contact Lens Wear. Contact Lens & Anterior Eye. 2013; 629:1-8. <https://doi.org/10.1016/j.clae.2013.06.001>
- Definition DE. Classification. The definition and classification of dry eye disease: Report of the definition and classification Subcommittee of the international dry eye workshop (2007). The Ocular Surface. 2007; 5(2):76.
- Young G, Chalmers RL, Napier L, Hunt C, Kern J. Characterizing contact lens-related dryness symptoms in a cross-section of UK soft lens wearers. Contact Lens and Anterior Eye. 2011; 34(2):64-70. <https://doi.org/10.1016/j.clae.2010.08.005> PMID:20832350
- Chalmers R. Overview of factors that affect comfort with modern soft contact lenses. Contact Lens and Anterior Eye. 2014; 37(2):65-76. <https://doi.org/10.1016/j.clae.2013.08.154> PMID:24035279
- Morgan PB, Bright FV, Burke SE, Chalmers RL, Dobson C, Fleiszig SM, Hutter JC, Papas E, Peterson RC, Stapleton F. 4. Contemporary research in contact lens care. Contact Lens and Anterior Eye. 2013; 36:S22-7. [https://doi.org/10.1016/S1367-0484\(13\)60006-5](https://doi.org/10.1016/S1367-0484(13)60006-5)
- Lipener C, Contact Lens Advisory in Scientific Studies (CLASS) group. A randomized clinical comparison of OPTI-FREE EXPRESS and ReNu MultiPLUS multipurpose lens care solutions. Advances in therapy. 2009; 26(4):435-46. <https://doi.org/10.1007/s12325-009-0023-8> PMID:19444658
- Guillon M, Maissa C, Wong S, Patel T, Garofalo R. Effect of lens care system on silicone hydrogel contact lens wettability. Contact Lens and Anterior Eye. 2015; 38(6):435-41. <https://doi.org/10.1016/j.clae.2015.06.007> PMID:26189942
- Yang SN, Tai YC, Sheedy JE, Kinoshita B, Lampa M, Kern JR. Comparative effect of lens care solutions on blink rate, ocular discomfort and visual performance. Ophthalmic and Physiological Optics. 2012; 32(5):412-20. <https://doi.org/10.1111/j.1475-1313.2012.00922.x> PMID:22775005
- Omali NB, Heynen M, Subbaraman LN, Papinski D, Lakkis C, Smith SL, Morgan Ahmed F. Impact of Lens Care Solutions on Protein Deposition on Soft Contact Lens. Optom Vis Sci. 2016; 93(8):963-72. <https://doi.org/10.1097/OPX.0000000000000928> PMID:27391539
- Beljan J, Beljan K, Beljan Z. Complications caused by contact lens wearing. Collegium antropologicum. 2013; 37(1):179-87. PMID:23837241
- Stapleton F, Tan J. Impact of contact lens material, design, and fitting on discomfort. Eye & contact lens. 2017; 43(1):32-9. <https://doi.org/10.1097/ICL.0000000000000318> PMID:28002225
- Optom MK, Optom TT, Optom MT. Clinical performance and factors affecting the physical fit of a soft toric frequent replacement contact lens. Clinical and Experimental Optometry. 2002; 85(6):350-7. <https://doi.org/10.1111/j.1444-0938.2002.tb02385.x>
- Optom MK, Optom TT, Optom MT. Clinical performance and factors affecting the physical fit of a soft toric frequent replacement contact lens. Clinical and Experimental Optometry. 2002; 85(6):350-7. <https://doi.org/10.1111/j.1444-0938.2002.tb02385.x>
- Sulley A, Young G, Hunt C. Factors in the success of new contact lens wearers. Contact Lens and Anterior Eye. 2017; 40(1):15-24. <https://doi.org/10.1016/j.clae.2016.10.002> PMID:27818113
- Ramamoorthy P, Sinnott LT, Nichols JJ. Contact lens material characteristics associated with hydrogel lens dehydration. Ophthalmic and Physiological Optics. 2010; 30(2):160-6. <https://doi.org/10.1111/j.1475-1313.2009.00705.x> PMID:20444120
- Ramamoorthy P, Sinnott LT, Nichols JJ. Treatment, material, care, and patient-factors in contact lens-related dry eye. Optometry and vision science: official publication of the American Academy of Optometry. 2008; 85(8):764. <https://doi.org/10.1097/OPX.0b013e318181a91f> PMID:18677240 PMID:PMC2628947
- Ntola A, Murphy PJ. The effect of contact lens wear on corneal sensation. Minerva Oftalmologica. 2002; 44:31-8.
- Tran N, Graham AD, Lin MC. Ethnic differences in dry eye symptoms: Effects of corneal staining and length of contact lens wear. Contact Lens and Anterior Eye. 2013; 36(6):281-8. <https://doi.org/10.1016/j.clae.2013.06.001> PMID:23850062
- Bayhan SA, Bayhan HA, Muhafiz E, Bekdemir Ş, Gürdal C. Effects of osmoprotective eye drops on tear osmolarity in contact lens wearers. Canadian Journal of Ophthalmology. 2015; 50(4):283-9. <https://doi.org/10.1016/j.ijco.2015.03.008> PMID:26257222
- Garcia-Lazáro S, Belda-Salmerón L, Ferrel-Blasco T, Cervi-o A, Montés-Micó R. Comparison of Two Artificial Tear Formulation For Dry Eye Through High-Resolution Optical Coherence Tomography. Clin Exp Optom. 2011; 94(6):549-556. <https://doi.org/10.1111/j.1444-0938.2011.00632.x> PMID:21929716
- Nagahara Y, Koh S, Maeda N, Nishida K, Watanabe H. Prominent Decrease of Tear Meniscus Height With Contact Lens

Wear and Efficacy of Eye Drop Instillation. *Eye & Contact Lens*. 2015; 41:318-322. <https://doi.org/10.1097/ICL.000000000000134> PMID:25839348

29. McDonald M, Schachet JL, Lievens CW, Kern JR. Systaine® Ultra Lubricant Eye Drops for Treatment of Contact Lens Related-Dryness. *Eye & Contact Lens*. 2014; 40:106-110. <https://doi.org/10.1097/ICL.000000000000018> PMID:24552755

30. Guthrie SE, Jones L, Blackie CA, Korb DR. A Comparative Study Between an Oil-in-Emulsion and Nonlipid Eye Drops Used for Rewetting Contact Lens. *Eye & Contact Lens*. 2015; 41:373-377. <https://doi.org/10.1097/ICL.000000000000138> PMID:26488155

31. Kojima T, Ibrahim OMA, Wakamatsu T, Tsuyama A, Ogawa J, Matsumoto Y, Dogru M, Tsubota K. The Impact of Contact Lens Wear and Visual Display Terminal Work on Ocular Surface and Tear Functions in Office Workers. *Am J Ophthalmol*. 2011; 152:933-940. <https://doi.org/10.1016/j.ajo.2011.05.025> PMID:21871600

32. McMonnies Charles W. Psychological and Other Mechanisms for End-of-Day Soft Lens Symptoms. *Optom Vis Sci*. 2013; 90:e175-e181. <https://doi.org/10.1097/OPX.0b013e318292624b> PMID:23604300