

# Awareness of Contact Lens Care among College Students in Saudi Arabia

Ashjan Yousef Bamahfouz<sup>1,2</sup>, Hanaa Nafady-Hego<sup>3,4</sup>, Serene Jouhargy<sup>5</sup>, Mohammed Abdul Qadir<sup>6</sup>, Weam Nabeel Jameel Qutub<sup>7</sup>, Khaled Mohammed Bahubaishi<sup>8</sup>, Abdullah Atiah Al-ghamdi<sup>9</sup>

<sup>1</sup>Assistant Professor, Department of Ophthalmology, College of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia, <sup>2</sup>Consultant, King Abdullah Medical City, Makkah, Saudi Arabia, <sup>3</sup>Lecturer, Department of Microbiology and Immunology, Faculty of Medicine, Assiut University, Assiut, Egypt, <sup>4</sup>Assistant Professor, Department of Hematology and Immunology, College of Medicine, Makkah, Saudi Arabia, <sup>5</sup>Chief, Department of Ophthalmology, King Abdullah Medical Complex, Jeddah, Saudi Arabia, <sup>6</sup>Assistant Consultant, Department of Ophthalmology, King Abdullah Medical City, Makkah, Saudi Arabia, <sup>7</sup>Resident, Department of Ophthalmology, King Abdullah Medical City, Makkah, Saudi Arabia, <sup>8</sup>Intern, College of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia, <sup>9</sup>Assistant Professor, Department of Ophthalmology, Umm Al-Qura University, Makkah, Saudi Arabia

## Abstract

**Introduction:** Although there are continuous breakthroughs in the contact lens (CL) industry, to provide safe CLs and to meet the continuous demand, CL-induced ocular complications induced by CL wear, especially corneal ulcer (CU) is still troublesome.

**Purpose:** To evaluate the adherence to the guidelines of CL care practice among the students of Umm Al-Qura University in Makkah, Saudi Arabia.

**Materials and Methods:** A cross-sectional structured questionnaire survey of 31 elements was conducted electronically on 4462 college students from the preparatory year, in the Umm Al-Qura University to evaluate the general knowledge and practice of CL wear, care and its possible complications.

**Results:** A total of 543 (50.1%) students, out of 1074, wore CL. 335 (63.3%) female students used CL for cosmetic reasons which were significantly high ( $P < 0.001$ ). 148 (29.8%) students wore CLs for more than 3 years. Among these CL wearers, 66 (13.3%) students wore CLs for more than 8 h daily, 33.1% wore daily disposable CL, 7.9% wore weekly disposable CL, and 55% wore monthly disposable CL. 58 (11.6%) students slept with the CL. 73 (14.6%) and 34 (6.8%) students wore CL during shower and swimming, respectively. 33 (6.6%) students did not wash their hands before handling CL. 349 (70.4%) students did not rub their CL with fingers before soaking in the solution. 100 (20.1%) did not rinse their CL. About 253 (52.2%) students had ocular complaints. 260 (79.7%) students had some allergic reaction, dry eyes in 132 (40.2%) were advised to quit CL wear by doctors, corneal abrasions in 58 (17.4%), and CUs in 26 (8%). 53 (16.3%) students used CL for more than 3 years ( $P = 0.043$ ), frequent daily use of CL ( $P = 0.019$ ), sleeping with CL ( $P < 0.0001$ ), and water activity as a shower ( $P = 0.002$ ) or swimming ( $P = 0.016$ ) were associated with CU.

**Conclusion:** More than half of our students experienced eye complications due to improper care of CL. Increasing awareness is crucial to avoid identified risk factors for CU.

**Key words:** Contact lens disinfectant solutions, Contact lenses, Corneal ulcer, Keratitis

## INTRODUCTION

Although there are continuous breakthroughs in the contact lens (CL) industry, to provide safe CLs and to meet

the continuous demand, CL-induced ocular complications induced by CL wear, especially corneal ulcer (CU) is still troublesome.<sup>1-5</sup> The at-risk population being young adults, who are the main CL wearers, several studies were conducted among them to evaluate the risk factors for ocular complications. Many risk factors were identified, including, sleeping while wearing CLs.<sup>6-11</sup> The risk of microbial keratitis increased by about five-fold among subject who wear their CLs during sleep.<sup>7</sup> In yet another study, CL wearers who developed CUs were found to wear CLs overnight.<sup>11</sup> Swimming with CL was reported in more than one-third of CL wearers who suffered with CU.<sup>11,12</sup>

Access this article online



www.ijss-sn.com

Month of Submission : 02-2016  
 Month of Peer Review : 03-2016  
 Month of Acceptance : 04-2016  
 Month of Publishing : 04-2016

**Corresponding Author:** Irshad A Subhan, King Abdullah Medical City, Makkah, Saudi Arabia. Tel.: +966543027674. E-mail: drias227@gmail.com

Poor hygiene practices, and failure to follow the instruction of use, are major risk factors for corneal inflammation among CL users.<sup>11</sup> Many earlier reports showed that *Pseudomonas aeruginosa* and *Staphylococcus aureus* have been the most common frequently isolated organisms.<sup>4,6,11,13-15</sup> Therefore, it is utmost important to increase awareness of prospective CL users on proper lens care, especially the use of well-fitting daily-disposable lenses<sup>13,16</sup> and regular after care.

## MATERIALS AND METHODS

A cross-sectional structured questionnaire survey of 31 elements was conducted electronically on 4462 college students from the preparatory year, in the Umm Al-Qura University to evaluate the general knowledge and practice of CL wear, care and its possible complications. Any college student who has ever worn CL for whatever reason and for any period was enrolled in this study. The electronic structured questionnaire was distributed among the students from February 2015 to April 2015. All the questions were prepared in English and answers were also given in English by all the students. The questionnaire consisted of single-response questions and one multiple-response question. The following data were collected: Gender, age, use of CL, use of spectacles, type of CL, water activity, hygiene practice, and complication of CL use.

The nature of the study was explained to all the students at the beginning of the questionnaire. The study followed the tenets of the Declaration of Helsinki and was approved by the Umm Al-Qura University Ethics Committee.

### Statistical Analysis

Statistical analyzes were performed using the Statistical Package for the Social Science (SPSS: An IBM Company, Version 16.0, IBM Corporation, Armonk, NY, USA). Data

are presented as mean  $\pm$  standard deviations, median, range, or percentage where appropriate. One-way ANOVA test followed by *post-hoc* tests (Bonferroni test) or independent *t*-test for quantitative data or chi-square test for qualitative data were used to compare differences between subjects of study where appropriate.  $P < 0.05$  was regarded as significant.

## RESULTS

### General Characteristics of Subjects

About 4462 college students from the preparatory year, Umm Al-Qura University were invited to participate in this study. The response rate was 24.1% (1074/4462). Out of 1074, college students who responded to the questionnaire, 543 (50.1%) students had previous or current CL use, 393 (72.4%) students were currently wearing CL, and the remaining 150 (27.6%) had stopped wearing CL for variable reasons (Figure 1).

The reasons reported by students who stopped CL wearing were; loss of interest after cosmetic purpose use in 32 (26.4%), experiencing complications in 12 (9.9%), failure to keep up with the instructions in 7 (5.79%), discomfort in one (0.8%), no special reason in 38 (31.4%), and 31 (25.6%) did not mention any reason (Figure 2).

### Demographic Characteristics of the Study Group

The characteristics of the study group were listed in Table 1.

Of the total surveyed male students, 677 (63.7%) were 19-year-old. Out of which 349 and 328 were CL wearers and non-wearers, respectively. A total of 691 (65.1%) students were females, the majority of them were CL wearer ( $P < 0.001$ ). CL preference versus glasses significantly differs between CL wearer and non-wearer CL as 326 (60.7%) students of CL wearer were found to prefer CL ( $P < 0.0001$ ). 237 (43.6%) students of CL wearer had

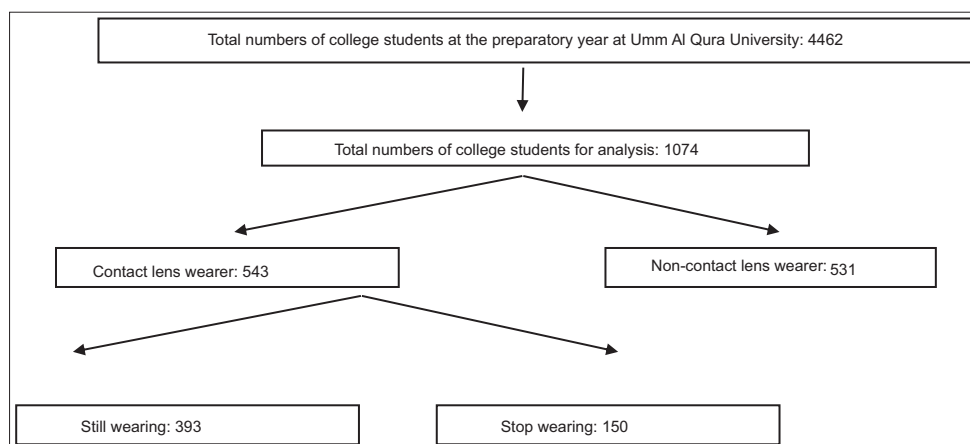


Figure 1: Characteristics of the study group

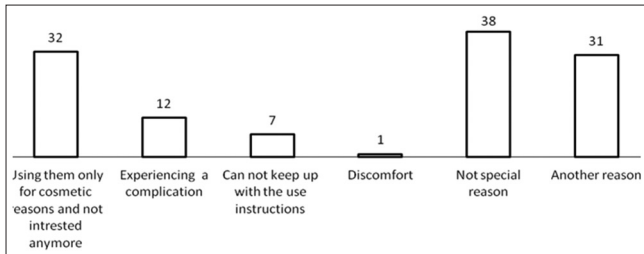
spectacles compared to 138 (26%) students of the non-CL wearer ( $P < 0.0001$ ).

**Characteristics of CL Wearer**

The characteristics of CL wearer are listed in Table 2. The reasons for using CLs varied among students, it was found that 335 (63.3%) of the respondents used them for cosmetic reasons, and 194 (36.7%) students used them to correct vision. Moreover, types of CL varied among users. 7 (1.4%) students wore rigid gas permeable lenses. 491 (98.6%) students wore soft CLs, 69 (13.9%) students wore daily disposables, 39 (7.2%) students wore weekly disposables, 36 (7.8%) students wore monthly disposable, and 353 (71%) students wore conventional lenses.

Of the participants, 358 (70.2%) students had worn CLs for <3 years, and 148 (29.8%) students had worn CLs for more than 3 years. Thus, the minority of participants in this study was experienced wearers. For the daily wearing time, 66 (13.3%) students wore CLs for more than 8 h daily; furthermore, 58 (11.6%) students reported that they slept with their CLs.

Students also reported concomitant water activities and lens wear. 73 (14.6%) of CL wearer recalled that they had been taken shower, while wearing their CLs and 34 (6.8%) of participants reported they engaged in swimming activity while wearing their CLs.



**Figure 2: Reasons for stopping contact lens wearing**

**Table 1: Demographic characteristic of the study groups**

Characteristics	Contact lens wearer (n=543)	Non-contact lens wearer (n=531)	P value
Gender (male/female)	78/464	293/227	<0.0001
Age/years			0.24
18 or below	92	93	
19	349	328	
20	60	75	
21	18	15	
22	9	4	
23 or older	13	6	
Had a pair of glasses	237	138	<0.0001
Preference to wear CLs/glasses	326/211	120/348	<0.0001

CL: Contact lens

**Table 2: Characteristic of the CL wearer (n=543)**

Indication and types of CL	
Reason for CLs	
Vision correction/cosmetic or fashion reason	194/335
Type of used CLs	
Soft/hard	491/7
Type of used CLs	
Disposable/extended wear	173/325
CLs wear modality (%)	
Duration of CLs use	
<6 months	110 (22.2)
6 months-1 year	35 (7.1)
1-2 years	103 (20.8)
2-3 years	100 (20.2)
More than 3 years	148 (29.8)
Frequency of CLs use	
Daily	69 (13.9)
Weekly	39 (7.2)
Monthly	36 (7.8)
Only on special occasions or other events (cosmetically)	353 (71)
The daily wearing time/hours	
<6 h	142 (28)
6-8 h	287 (58)
12-24 h	52 (10.5)
1-2 days	5 (1)
More than 2 days	9 (1.8)
Frequency of sleeping with CLs	
Every day	10 (2)
1-2 days a week	13 (2.6)
1-2 days a month	8 (1.6)
Less than once per month	27 (5.4)
Never	440 (88.4)
Water activities and CLs wear (%)	
Frequency of taking a shower with CLs	
Every day	20 (4)
1-2 days a week	12 (2.4)
1-2 days a month	10 (2)
Less than once per month	31 (6.2)
Never	424 (85.3)
Frequency of swimming with CLs	
Every day	7 (1.4)
1-2 days a week	2 (0.4)
1-2 days a month	4 (0.8)
Less than once per month	21 (4.2)
Never	464 (99.2)
CLs and lens case hygiene practices (%)	
Frequency of share of CLs	
Every day	14 (2.8)
1-2 days a week	9 (1.8)
1-2 days a month	10 (2)
Less than once per month	71 (14.4)
Never	390 (78.9)
Frequency of hand wash before CLs use	
Always	271 (54.5)
Sometimes	152 (30.6)
Rarely	41 (8.2)
Never	33 (6.6)
Rubbing CLs with fingers before soaking them in the solution	
No	280 (56.5)
Yes	147 (29.6)
Not applicable	69 (13.9)
Rinsing CLs case	
No	70 (14.1)
Yes	398 (79.9)

(Contd...)

**Table 2: (Contd...)**

Not applicable	30 (6)
Frequency of change of CLs solution	
Daily	57 (11.5)
On alternate days	47 (9.5)
Weekly	133 (26.9)
Less often than weekly	202 (40.8)
Not applicable	56 (11.3)
Frequency of replace of CLs with new ones	
Daily	22 (4.5)
Weekly	19 (3.9)
Every 2 weeks	21 (4.3)
Monthly	94 (19.4)
Every 6 months	136 (28)
Yearly	193 (39.8)
CLs choose and follow-up schedule (%)	
Ophthalmologist/optometrist/optician prescription for CLs	
No/yes	343/151
Ophthalmologists/optometrists/opticians visit for eye or CLs follow-up	
Once every 2 weeks	4 (0.8)
Once every 6 months	60 (12)
Once a year	121 (24.3)
Never	313 (62.9)

CL: Contact lens

Regarding CL hygiene, the majority of wearers reported that they did not share their CL with others (390 (78.9%) students). 271 (54.5%) students followed hand hygiene before handling CLs while 193 (38.8%) students reportedly rarely followed hand hygiene and 33 (6.6%) indicated that they never washed their hands before handling CLs. Furthermore, 147 (29.6%) students reported that they rubbed their CLs with fingers before soaking in the solution, while 349 (70.4%) replied in the negative. Furthermore, 398 (79.9%) students reported that they rinsed their CLs, while 100 (20.1%) students reported negatively. A changed CL solution occurred in 237 (47.9%) of wearers at least weekly, and the majority of wearers replaced their lens storage case at least once every 6 months, 193 (39.8%) of students replaced their lens storage case yearly.

A total of 151 (30.6%) students had their CL after specialist consultation. 64 (12.8%) students had at least aftercare every 6 months and 121 (24.3%) students consulted specialists for aftercare at least yearly. 313 (62.9%) of the participants did not request any specialist assistance.

**Eye Complications Associated with CL use**

Eye complications associated with CL use were listed in Figure 3. Among participants 253 (52.2%) students reported that they had at least one problem related to the use of CL. Out of which 260 (79.7%) of the students quoted allergy either to CL or its solution, followed by dry eyes in 132 (40.2%) students, corneal abrasions in 58 (17.4%) students, CU in 26 (8%) students, and 53 (16.3%) students were advised to quit CL use by their

**Table 3: Risk factors for ocular complication among CLs users**

Factors	Complication		
	Yes	No	P value
Had a pair of glasses	126	92	0.007
Vision correction/cosmetic or fashion reason	98/155	74/156	0.079
Frequency of CLs use			0.006
Daily	43	21	
Weekly	23	13	
Monthly	24	15	
Only on special occasions or other events (cosmetically)	162	180	
The daily wearing time/hours			0.024
<6 h	63	79	
6-8 h	146	131	
12-24 h	33	16	
1-2 days	4	1	
More than 2 days	6	2	
Frequency of sleep with CLs			0.018
Every day	6	2	
1-2 days a week	12	1	
1-2 days a month	5	2	
Less than once per month	15	12	
Never	215	213	
Frequency of taking shower with CLs			0.004
Every day	11	7	
1-2 days a week	9	3	
1-2 days a month	8	2	
Less than once per month	23	7	
Never	201	211	
Rubbing CLs with fingers before soaking them in the solution			0.038
No	145	128	
Yes	80	61	
Not applicable	26	42	
Ophthalmologist/optometrist/optician prescription for CLs			0.029
No/yes	165/88	170/61	
Ophthalmologists/optometrists/opticians visit for eye or CLs follow-up			0.035
Once every 2 weeks	4	23	
Once every 6 months	36		
Once a year	67	51	
Never	146	158	

CL: Contact lens

doctor. 232 (47.8%) of the students faced no problems associated with the use of CL.

**Factors Associated with Eye Complication Due to CL use**

Factors associated with Eye complications due to CL use were listed in Table 3. Among several factors studied, we found that CL wearer who had a pair of glasses had less complication ( $P = 0.007$ ). In Addition, prolonged use of CL ( $P = 0.006$ ) and frequent use of them per day ( $P = 0.024$ ) were associated with complication. Sleeping with CL or taking shower reported to be associated with complication ( $P = 0.018$  and  $P = 0.004$ ), respectively. CL users who did not rub their lenses with fingers before soaking them in the solution commonly experienced complications ( $P = 0.038$ ).

Users who choose their CL after specialist consultation and were regularly visiting a specialist did not correlate with complication free and those who encountered complications.

**Factors Associated with CU Due to CL use**

Factors associated with CU among CL wearer were shown in Figure 4. Among several factors studied, we found that CU among CL wearer was associated with prolonged period of CL usage ( $P = 0.043$ ), frequent daily use of CL ( $P = 0.019$ ), sleeping with CL ( $P < 0.0001$ ), and water activity in the form of taking a shower or swimming ( $P = 0.002$  and  $P = 0.016$ ).

**DISCUSSION**

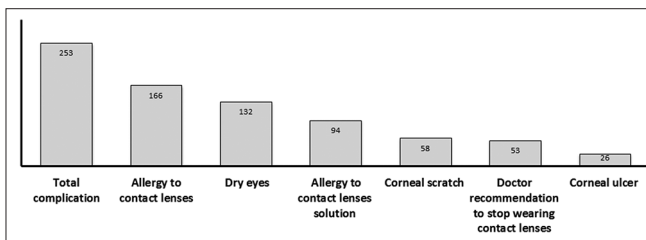
Across the world, CL is widely distributed among young adults, for reasons such as cosmetic or therapeutic, since its first use in 1887.<sup>17</sup> Then onward, there has been continuous improvement in lens materials, disinfecting, and storing solutions. Nowadays, single solution to rinse, disinfect, and store for CL has replaced the conventional rubbing or enzymatic cleaning.<sup>16</sup> However, CL usage is associated with increased incidence of ocular complication, among them; CU is the most severe one which can predispose to visual loss.<sup>1-5</sup> We found that 543 (50.1%) of respondents

were CL users, 150 (27.6%) of them stop wearing CL for varying reasons. One of the reasons is the occurrence of complications in 12 (9.9%). As all our subjects were in the same year, so no significant difference could be reported in age between CL wearer and non-wearer. Gender was significantly varied between CL wearer and non-wearer. Our finding was consistent with previous reports.<sup>18-21</sup> In our study, we found that cosmetic purpose was the main reason for CL use, our finding was similar to previous reports.<sup>19,22</sup> In our study, ocular complication due to CL use were found in 253 (52.2%) of participants as compared to 79.3% in another study.<sup>19</sup>

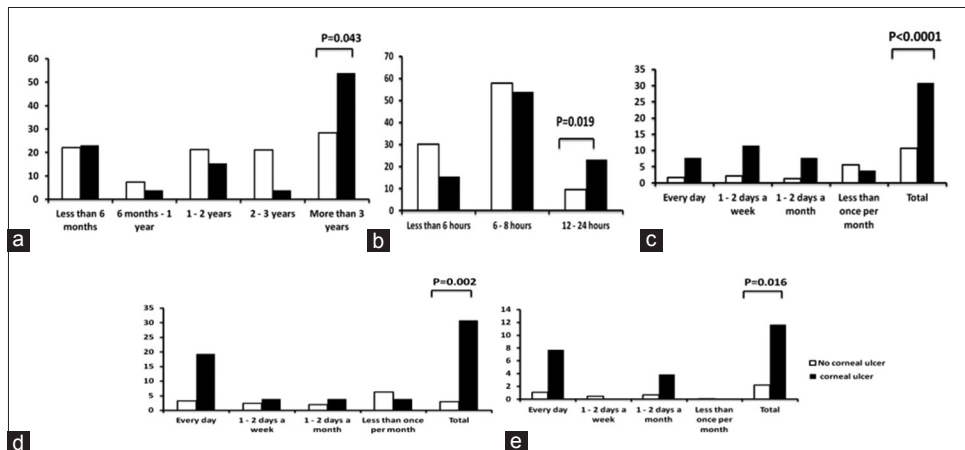
Several studies reported the incidence of microbial keratitis among CL users. According to one study microbial keratitis and subsequently, CU occurred in about (1.1-2/10,000, 2.2-4.5/10,000, and 10.3-35/10,000) per year for the rigid CL user, disposable soft CL, and extended-wear soft CL, respectively.<sup>6,17</sup> Another report showed a high incidence of CU (57-86%) among CL users.<sup>23</sup> These high percentages can be explained by the fact that this report (1983) was during the era when CL material and solution were still underdeveloped.

From our study, we stressed the fact that CU as a devastating complication which can end with visual loss. Our results showed that prolonged use CL, frequent daily use CL, and sleeping with CL in addition to participating in water activity in the form of taking a shower or swimming while wearing CL were the major risk factors for CU acquisition among CL users.

The corneal surface is constantly lubricated by the tear film that maintains oxygenation and moisture. Therefore, prolonged use especially overnight can provoke hypoxia and hypercapnia of the corneal epithelium, resulting in ischemic necrosis, which will lead to CU.<sup>9,10,14</sup> Similar to



**Figure 3: The frequency of eye complication due to contact lens use**



**Figure 4: (a) Period of contact lens use, (b) daily use of contact lens, (c) sleeping with contact lens, (d) taking a shower with contact lens, (e) swimming with contact lens**

our finding, prolonged use of CL were associated with eye problems.<sup>19</sup> In addition, sleeping with CL was found to be a major risk factor for CU among CL users in several reports.<sup>6-11</sup> Lam *et al.* reported a five-fold increase in the risk of microbial keratitis among patients who wear their CLs overnight.<sup>7</sup> In another study, more than half of CL wearer who had CU reported that they were sleeping with their CLs (11) and swimming (33%) with their CL and (26%) of them do not follow hand reported to be associated with infected keratitis.<sup>11,12</sup> Failure to comply with instruction of use, poor hygiene are risk factor for CU in CL wearer in our study.<sup>22</sup>

Lack of hygiene and improper care of CL can predispose to the colonization of the CL surface with bacteria, leading to biofilms formation, especially with *P. aeruginosa*.<sup>24,25</sup> Previous reports showed that *P. aeruginosa* and *S. aureus* are the most common frequently isolated organism.<sup>4,6,11,13-15</sup> In one study, pseudomonas account for 24% of organisms related to CL-induced ulcer.<sup>11</sup>

These microorganisms contain special structures known as pathogen-associated molecular patterns. These structures activate the innate immune response, mainly toll-like receptors (TLRs) that are expressed throughout the ocular tissue.<sup>26,27</sup> This triggered innate immune response mediates further activation of adaptive immune response. All together develop a defense against microbes which can precipitate corneal inflammation. Up-regulation of TLR was reported in patients with vernal keratoconjunctivitis.<sup>27,28</sup>

Our finding suggested that all the risk factors associated with eye complication among CL wearer are preventable. The prospective CL user must be educated and counseled regarding the proper lens care, duration of usage and hygiene practice while dealing with CL. Prolonged wear of CL, wearing it overnight and swimming or taking a shower while wearing CL must be avoided. CL must be bought from authorized eye care professionals, who can choose well-fitting CL, and provide advice for regular after-care.<sup>13,16</sup> Any individual with known risk factors of developing CU must be advised that if they experience any unexpected symptoms following CL use they must remove CL and seek medical advice as soon as possible for confirmation and early management to prevent loss of vision. Thus, increasing public awareness of prospective CL users on proper lens care and wear duration is crucial.

## CONCLUSION

With the widespread use of CL, CU associated with CL wear became more prevalent. Therefore, it is better to consider the identified risk factors in this study in the care

of CL wearer, which can help to focus effective prevention and treatment strategies.

## REFERENCES

1. Mah-Sadorra JH, Yavuz SG, Najjar DM, Laibson PR, Rapuano CJ, Cohen EJ. Trends in contact lens-related corneal ulcers. *Cornea* 2005;24:51-8.
2. Goh PP, Shamala R, Chandamalar S, Tai XY; National Eye Database Study Group. Contact lens-related corneal ulcer: A two-year review. *Med J Malaysia* 2010;65 Suppl A:120-3.
3. Moriyama AS, Hofling-Lima AL. Contact lens-associated microbial keratitis. *Arq Bras Oftalmol* 2008;71:32-6.
4. Bourcier T, Thomas F, Borderie V, Chaumeil C, Laroche L. Bacterial keratitis: Predisposing factors, clinical and microbiological review of 300 cases. *Br J Ophthalmol* 2003;87:834-8.
5. Yildiz EH, Airiani S, Hammersmith KM, Rapuano CJ, Laibson PR, Virdi AS, *et al.* Trends in contact lens-related corneal ulcers at a tertiary referral center. *Cornea* 2012;31:1097-102.
6. Cheng KH, Leung SL, Hoekman HW, Beekhuis WH, Mulder PG, Geerards AJ, *et al.* Incidence of contact-lens-associated microbial keratitis and its related morbidity. *Lancet* 1999;354:181-5.
7. Lam DS, Houang E, Fan DS, Lyon D, Seal D, Wong E; Hong Kong Microbial Keratitis Study Group. Incidence and risk factors for microbial keratitis in Hong Kong: Comparison with Europe and North America. *Eye (Lond)* 2002;16:608-18.
8. Stapleton F, Keay L, Edwards K, Naduvilath T, Dart JK, Brian G, *et al.* The incidence of contact lens-related microbial keratitis in Australia. *Ophthalmology* 2008;115:1655-62.
9. Dart JK, Radford CF, Minassian D, Verma S, Stapleton F. Risk factors for microbial keratitis with contemporary contact lenses: A case-control study. *Ophthalmology* 2008;115:1647-54, 1654.e1-3.
10. Efron N, Morgan PB. Rethinking contact lens associated keratitis. *Clin Exp Optom* 2006;89:280-98.
11. Lam JS, Tan G, Tan DT, Mehta JS. Demographics and behaviour of patients with contact lens-related infectious keratitis in Singapore. *Ann Acad Med Singapore* 2013;42:499-506.
12. Lelievre L, Borderie V, Garcia-Hermoso D, Brignier AC, Sterkers M, Chaumeil C, *et al.* Imported pythium insidiosum keratitis after a swim in Thailand by a contact lens-wearing traveler. *Am J Trop Med Hyg* 2015;92:270-3.
13. Morgan PB, Efron N, Hill EA, Raynor MK, Whiting MA, Tullo AB. Incidence of keratitis of varying severity among contact lens wearers. *Br J Ophthalmol* 2005;89:430-6.
14. Stapleton F, Keay LJ, Sanfilippo PG, Katiyar S, Edwards KP, Naduvilath T. Relationship between climate, disease severity, and causative organism for contact lens-associated microbial keratitis in Australia. *Am J Ophthalmol* 2007;144:690-8.
15. Prokosch V, Gatziofias Z, Thanos S, Stupp T. Microbiological findings and predisposing risk factors in corneal ulcers. *Graefes Arch Clin Exp Ophthalmol* 2012;250:369-74.
16. Najjar DM, Aktan SG, Rapuano CJ, Laibson PR, Cohen EJ. Contact lens-related corneal ulcers in compliant patients. *Am J Ophthalmol* 2004;137:170-2.
17. Loh K, Agarwal P. Contact lens related corneal ulcer. *Malays Fam Physician* 2010;5:6-8.
18. Abbouda A, Restivo L, Bruscolini A, Pirraglia MP, De Marco F, La Cava M, *et al.* contact lens care among teenage students in Italy: A cross-sectional study. *Semin Ophthalmol* 2015:1-7.
19. Unnikrishnan B, Hussain S. Pattern of use of contact lens among college students: A cross-sectional study in coastal Karnataka. *Indian J Ophthalmol* 2009;57:467-9.
20. Lee YC, Lim CW, Saw SM, Koh D. The prevalence and pattern of contact lens use in a Singapore community. *CLAO J* 2000;26:21-5.
21. Riley C, Chalmers RL. Survey of contact lens-wearing habits and attitudes toward methods of refractive correction: 2002 versus 2004. *Optom Vis Sci* 2005;82:555-61.
22. Lembach RG. Use of contact lenses for management of keratoconus. *Ophthalmol Clin North Am* 2003;16:383-94.

23. Galentine PG, Cohen EJ, Laibson PR, Adams CP, Michaud R, Arentsen JJ. Corneal ulcers associated with contact lens wear. *Arch Ophthalmol* 1984;102:891-4.
24. Behlau I, Gilmore MS. Microbial biofilms in ophthalmology and infectious disease. *Arch Ophthalmol* 2008;126:1572-81.
25. Toutain-Kidd CM, Kadivar SC, Bramante CT, Bobin SA, Zegans ME. Polysorbate 80 inhibition of *Pseudomonas aeruginosa* biofilm formation and its cleavage by the secreted lipase LipA. *Antimicrob Agents Chemother* 2009;53:136-45.
26. Wilson RH, Maruoka S, Whitehead GS, Foley JF, Flake GP, Sever ML, *et al.* The Toll-like receptor 5 ligand flagellin promotes asthma by priming allergic responses to indoor allergens. *Nat Med* 2012;18:1705-10.
27. Bonini S, Micera A, Iovieno A, Lambiase A, Bonini S. Expression of Toll-like receptors in healthy and allergic conjunctiva. *Ophthalmology* 2005;112:1528.
28. Chung SH, Nam KH, Kweon MN. *Staphylococcus aureus* accelerates an experimental allergic conjunctivitis by Toll-like receptor 2-dependent manner. *Clin immunol* 2009;131:170-7.

**How to cite this article:** Bamahfouz AY, Nafady-Hego H, Jouhargy S, Qadir MA, Qutub WNJ, Bahubaishi KM, Al-Ghamdi AA. Awareness of Contact Lens Care among College Students in Saudi Arabia. *Int J Sci Stud* 2016;4(1):90-96.

**Source of Support:** Nil, **Conflict of Interest:** None declared.