MEDICAL SCIENCE

Prevalence of Contact Lens usage and relationship between the risky practices and complications among adolescents and adults in Jeddah, Saudi Arabia

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To Cite:
Alghamdi JS, Alhibshi NM, Khayyat ST, Alzhrani RM, Almehmadi WM, Alqahtani MY, Alansari SA. Prevalence of Contact Lens usage and relationship between the risky practices and complications among adolescents and adults in Jeddah, Saudi Arabia. *Medical Science* 2023; 27: e276ms2967.
doi: https://doi.org/10.54905/disssi/v27i136/e276ms2967

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Peer-Review History
Received: 20 March 2023
Reviewed & Revised: 24/March/2023 to 21/June/2023
Accepted: 24 June 2023
Published: 27 June 2023

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

DISCOVERY SCIENTIFIC SOCIETY

ABSTRACT

Contact lens (CL) wearers' lens care habits are critical in lowering the risk of contact lens problems. The general Saudi population has limited knowledge of CLs practice. This study aimed to determine the prevalence of CL's usage, knowledge, practice and complications among adolescents and adults in Jeddah, Saudi Arabia. *Method:* A cross- sectional study was done and data about participants' demographics, wearing contact lenses and knowledge about factors that increases or decreases the risk of experiencing a contact lens related complication and practice related to CL use were collected. *Result:* 89.7% of the participants were females and 85.2% had an age> 18 years. The prevalence of CL use was 64%, 61.2% were using it for cosmetic purposes and 52.1% bought the CL from an optician. The commonly known CL complications were related to sleeping or swimming with lenses. Female participants and those who received information about lens care and hygiene had a significantly higher mean knowledge score about to CL use. Additionally, those who did not have eye infections and who received information on lens care and hygiene had a significantly higher mean practice score. CLs users who had non complications had a significant higher practice score compared to those with no complications. *Conclusions:* Although the majority of participants had knowledge, there is still poor hygienic practice. Raising awareness of Saudi community about CLs wearing hygiene is needed.

Keywords: Prevalence, CLs, risky, practices, complications Jeddah

1. INTRODUCTION

With the development of contact lens materials, the use of contact lenses (CLs) has steadily increased around the world (Key, 2007). Contact lenses (CLs) are divided into three categories: Corrective lenses for refractive problems, cosmetic lenses and therapeutic lenses for corneal illnesses (Ibrahim et al., 2018). According to study done in 2016, around 41 million Americans wear CLs. Furthermore, they stated that over 99 percent of them had at least one dangerous practice related to the risk of eye infection (Ibrahim et al., 2018). They determined that the number of CL users in the United Kingdom has increased from 1.6 million in 1992 to 3.5 million in 2014. Furthermore, the numbers continued to rise until 2016, when they reached 3.7 million.

Furthermore, a study was carried out in Riyadh showed a percentage of 70.2% as a prevalence of CLs use according to their findings (Abahussin et al., 2014). CLs are thought to be a safe and effective way to correct refractive defects (Ibrahim et al., 2018). As long as risky behaviors and unhealthy habits like sleeping or resting while wearing contact lenses or exposing the lenses to water when showering or swimming are avoided. In addition, inadequate CLs hygiene and failure to follow replacement and storage guidelines (Cope et al., 2017). According to certain research, adolescents aged 12-17 years and young people aged 18-24 years in the United States are more likely to develop contact lens-related issues because of high-risk behaviors than older adults aged >=25 years (Cope et al., 2017).

The notable climbing of CLs usage led to increasing of CLs wearers related complications (Bhandari and Hung, 2012). Dry eye, giant papillary conjunctivitis (a disorder defined by an increase in mucous discharge, hyperemia and papillary response greater than 0.3 mm in the upper tarsal conjunctiva) and contact lens-related peripheral ulcer are the most common consequences (is characterized by epithelium excavation and infiltration and an intact bowman layer), microbial keratitis (defined as active inflammation of the cornea caused by microorganisms such Contact lens wear the most important risk factor) and corneal neovascularization (described as the formation of new vessels in the pericorneal plexus capillaries and venules that migrate to the corneal stroma) (Key, 2007; Alipour et al., 2017).

Furthermore, a study conducted in the United States found that CLs wearers experienced symptoms such as burning and itching. The significance of increasing contact lens education and care among CL users. Additionally, contact lens wearers' habits toward lens care are critical in reducing the risk of contact lens problems. Lens type, hygiene compliance, lens case cleaning, wearing duration, replacement schedule and solution system are all examples of proper lens care (Bhandari and Hung, 2012).

However, there is restricted knowledge of CLs practice among general population in Jeddah, SA. Therefore, more epidemiological studies are needed to provide information on the rate of CLs' usage, their related behavioral risk factors and complications (Ibrahim et al., 2018). The aim of this study was to determine the prevalence and to evaluate the association between the risk behaviors of contact lens wearing and possible complications among adolescents and adults population in Jeddah, Saudi Arabia.

2. SUBJECTS AND METHODS

Study design, setting and time frame

A cross- sectional study was done through social media platform in Jeddah, Saudi Arabia in the time from June to July 2022.

Sample size

The minimum sample size for the study was 400 participants; it was calculated based on Creative Research Systems, (2020) website with the confidence level of 95%.

Study participants

Adolescents and adults in Jeddah, Saudi Arabia. The inclusion criteria were any resident in Jeddah with an aged of 12 years and above and the exclusion criteria were any resident outside Jeddah outside this age range.

Data collection

An electronic questionnaire was used for data collection from targeted individuals who voluntarily agree to participate through a social media platform. The questionnaire included items to assess participants' demographics, ever wearing contact lenses and knowledge about factors that increases or decreases the risk of experiencing a contact lens related complication. The questionnaire also included items to assess participants' practice related to CL use.

Ethical considerations

An ethical approval for the study was obtained from the research ethics committee of King Abdul-Aziz University, Jeddah, KSA with an ethical No (HA-02-J-008).

Statistical analysis

Data were analyzed using SPSS version 26, where qualitative data was expressed as numbers and percentages and Chi- squared test ($\chi 2$) was used to test the relationship between variables. Quantitative data was presented as mean and standard deviation (Mean ± SD) and the Mann-Whitney and Kruskal Wallis tests were used for non-parametric variables. A p-value of <0.05 was considered as statistically significant.

3. RESULTS

The study included a total of 506 participants, with the sample size increased slightly for stratification considerations. Table 1 clearly shows that the majority of participants were older than 18 years old (85.2%). 89.7% of the sample's members were female, according to the gender distribution. Most of the participants had a university degree (76.5%) and the majority (94.5%) has adequate Family income.

Table 1 Distribution of studied participants according to their demographics (No.: 506)

Variable	No. (%)
Age	
12-18 years	75 (14.8)
> 18 years	431 (85.2)
Gender	
Female	454 (89.7)
Male	52 (10.3)
Educational year	
Secondary school	100 (19.8)
University	387 (76.5)
Illiterate	2 (0.4)
Middle school	17 (3.4)
Marital status	
Married	140 (27.7)
Unmarried	366 (72.3)
Family income	
Not enough	28 (5.5)
Enough	478 (94.5)

In our study we found that more than half of the participants were currently CL users (64.8%). whereas, 366 (72.3%) have worn CL previously, as in (Figure 1). The primary reason for wearing CL was for cosmetic purposes (61.2%), followed by myopia correction (28.4%). An optician was the most prevalent source of CLs (52.1%). However, 13.6% of participants purchased lenses from the internet.

Moreover, about 26% were wearing cosmetic plano-contact and 70.2% wore CL with no enhancement from others. 36.9% received lens care instructions and only 26.6% were complaining from CL. Additionally, 1 to 5 years had passed after CL's initial prescription for 66.5%, Only 11% of participants were using CL on a daily basis, with a mean usage time of 8.2 ± 6.72 hours per day, while 89% were not, with a mean usage time of 2.6 ± 2.11 days per week.

Table 2 demonstrates the knowledge of the CL users regarding factors that either enhance or lessen the likelihood of developing contact lens complications. Fortunately, a significant percentage of the participants correctly recognized the factors that enhanced CLs-related complications. As evidenced, (95.6%, 68.6%, 54.9% and 84.4%) believed that CL complications increased with sleeping in lenses, sharing lenses with others, replacing lenses less frequently than recommended and swimming with lenses, respectively.

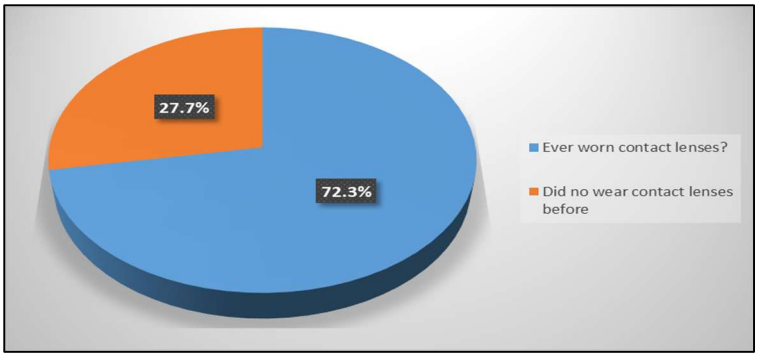

Figure 1 Percentage distribution of studied participants according to ever wearing contact lenses

At the same time, 4.3%, 31.4%, 51.9% and 8.7% thought that CL complications increased with using fresh cleaning solution, adding fresh solution to existing solution in the lens case, rinsing lenses with tap water and replacing the lens case, respectively. Moreover, 78% thought that washing hands prior to handling lenses decreased complications and 64.7% thought that showering in lenses increased it.

Table 2 Distribution of CL wearers according to their knowledge about factors that increases or decreases the risk of experiencing a contact lens related complication (No.: 366)

Statement	Contact lens related complication			
	No effect	Not sure	Increases	Decreases
Sleeping in your lenses	8 (2)	1 (0.2)	350 (95.6)	7 (2.1)
Sharing your lenses with others	7 (2.1)	5 (1)	347 (68.6)	7 (1.4)
Replacing your contact lenses less frequently than recommended	35 (6.9)	60 (1.3)	201 (54.9)	70 (36.9)
Swimming while wearing your contact lenses	3 (0.8)	37 (10.1)	309 (84.4)	7 (4.7)
Using fresh cleaning solution	93 (25.4)	32 (8.7)	16 (4.3)	225 (61.6)
Adding fresh solution to existing solution in your lens case	96 (26.2)	112 (30.6)	115 (31.4)	43 (11.8)
Rinsing your lenses with tap water	48 (13.3)	97 (26.5)	190 (51.9)	31 (8.3)
Replacing your lens case	134 (36.6)	45 (12.2)	32 (8.7)	155 (42.5)
Washing hands prior to handling lenses	44 (12)	15 (4)	22 (6)	285 (78)
Showering in your lenses	48 (13.3)	59 (16.1)	237 (64.7)	22 (5.9)

Table 3 Distribution of CL users according to practice related to CL use (No.:366)

Variable	No (%)
Do you always wash your hands before putting on your lenses?	
No	54 (14.7)
Yes	312 (85.3)
Do you use soap when you wash your hand before use lenses?	
No	136 (37.1)
Yes	230 (62.9)
Do you dry your hands before wearing contact lenses?	
No	81 (22.1)
Yes	285 (77.9)
Do you ever exceed the recommended period of renewal for your lenses?	
No	100 (27.3)
Yes	266 (72.7)
How often do you wash your hands prior to touching your lenses?	
Never	12 (3.2)
Occasionally, but not always	87 (23.7)

I always wash with at least water	129 (35.2)
I always wash with soap and water	138 (37.9)
How often do you renew your lenses?	
Never	29 (7.9)
Daily	20 (5.4)
Weekly	10 (2.7)
Monthly	104 (28.4)
Annually	183 (55.6)
How often do you clean your lenses?	
Daily	79 (15.6)
Weekly	110 (21.7)
Monthly	105 (20.8)
Annually	15 (3)
Never	32 (6.3)
How often do you add fresh cleaning solution to solution that is already in the lens case?	
Never	61 (21.5)
Occasionally	259 (70.7)
Every night	46 (7.8)
How often do you rinse your lenses or your lens case with tap water?	
Never	147 (40.4)
I sometimes rinse my lenses but not my lens case	109 (29.7)
I sometimes rinse my lens case, but not my lenses	48 (13.1)
I always rinse my lenses with tap water	12 (3.2)
I always rinse my lens case with tap water	50 (13.6)
How often do you replace the cleaning solution in your lens case?	
Never	61 (16.6)
Most nights, but occasionally re-use the solution left in the case	276 (75.4)
Every night	29 (8)
How do you clean the case?	
Soap	24 (6.5)
Water	174 (47.5)
Contact lens solution	144 (46)
How often do you replace your lens case?	
I replace it monthly	41 (11.2)
I replace it every time I open a new bottle of cleaning solution	89 (24.3)
I replace it every 3-4 months	77 (21)
Only if my doctor gives me a new one at my yearly visit	68 (18.5)
Never, I have had the same lens case for years	91 (25)
How often do you sleep in your lenses?	
Never	299 (81.6)
Overnight, but less than once per month	4 (1)
Just to take a nap	22 (6)
Do not apply	30 (8.1)
Overnight, once or more per month	9 (2.4)
Overnight as prescribed by my doctor	2 (0.9)
How frequently do you swim or participate in water sports while wearing your lenses?	

Never	329 (79.5)
Occasionally, but not all the time	23 (4.5)
I always do, but throw them away after	5 (13.6)
Always, I don't take them out	9 (2.4)
How often do you share your lenses with friends or family member (sister for example)?	
Never	283 (77.3)
All the time	10 (2.7)
Once or twice in the past	50 (13.6)
Occasionally	23 (6.4)
How often do you shower in your lenses?	
Never	236 (64.4)
Occasionally, less than once per week	40 (10.9)
Frequently, once per week or more	15 (4)
All the time	6 (1.6)
I always take them out or shower before putting them in	69 (19.1)

In regards to the practices related to CL use, as in Table 3, 85.3% always wash their hands before putting on lenses, 62.9% use soap when washing their hands before use and 77.9% dry their hands before wearing lenses, but 72.7% exceed the recommended period of lens renewal. Of CL users, 37.9% always wash hands prior to touching lenses with soap and water, 55.6% renew lenses annually and 21.7% clean the lenses on a weekly basis.

Furthermore, 70.7% occasionally add fresh cleaning solution to the solution that is already in the lens case, 40.4% never rinse their lenses or lens case with tap water, 75.4% replace the cleaning solution in the lens case most nights, but occasionally re-use the solution left in the case and 46% clean the case with the CL solution. Only 24.3% replace their lens case every time they open a new bottle of cleaning solution, 81.6% never sleep in lenses, 79.5% never swim or participate in water sports while wearing lenses, 77.3% never share lenses with friends or family members and 64.4% never shower in lenses (Table 3).

Table 4 Complications of CL wear among studied CL users (No.:366)

Variable	No. (%)
Have you had/experienced a complication from wearing contact lenses?	
No	262 (71.5)
Yes	104 (28.5)
If yes, what complications (No.:104)	
Conjunctivitis	18 (17.3)
Keratitis	23 (31.7)
Abscess	10 (9.6)
Corneal abrasion	12 (11.5)
Acute red eye	28 (26.9)
Corneal ulcer	13 (3)
Have you had an infection since you started wearing contact lenses?	
No	319 (87.1)
Yes	47 (12.9)
Were you able to identify a contact lens-related complication?	
No	279 (76.21)
Yes	87 (23.8)
How long did you wear the CL the day prior to the infection	4.9 ± 5.88
Have you slept with your contact lenses the night before the infection occurred? (No.:47)	

No	27 (57.4)
Yes	20 (42.6)
What have you done to improve the situation? (No.:104)	
Removing lenses	38 (35.5)
Using over-the counter drugs	14 (13.4)
Consultation	26 (25)
Treatment with antibiotic eye drop	18 (17.3)
No thing	8 (8.8)
Did the doctor advise you to avoid wearing contact lenses? (No.:104)	
No	55 (52.8)
Yes	49 (47.2)

As in Table 4, we found that 28.5% of participants had a contact lens-related complication. Keratitis (31.7%) and acute red eye (26.9%) were among the most common, followed by conjunctivitis (17.3%), corneal abrasion (11.5%) and abscess (9.6%). The least common complication, on the other hand, was a corneal ulcer (3%). Of them, 3.8% were able to identify a contact lens-related complication and the mean hours of wearing contact lenses the day the infection occurred was 4.9 ± 5.88 hours.

Of those who had an infection, 42.6% slept with contact lenses the night before the infection occurred, 35.5% responded by removing lenses while, 17.3% required antibiotic eye drop and 13.4% used over-the counter drugs. The doctor advised 47.2% of participants to avoid wearing contact lenses (Table 4).

More than 50% (56%) of the participants do not know that corneal infections can be a complication of the contact lens and 54.1% reported that complications with contact lenses are mildly common. However, 74.6% of the general public reported that they are aware of the risk factors associated with contact lens wear. Additionally, concerning the CL hygiene, about 56.6% of respondents reported receiving information on contact lens care and hygiene; of these, only 14.4% received it directly from an ophthalmologist and 63.1% received it orally. The majority of these respondents (76.3%) found that the information was adequate.

As in Table 5, females and those who received information about lens care and hygiene had a significantly higher mean knowledge score related to CL use (p=< 0.05) and those with an unemployed mother who received information about lens care and hygiene but did not suffer from eye infections had a significantly higher mean practice score related to CL use (p=< 0.05). Furthermore, Figure 2 illustrates that the mean practice scores of those who had complications and those who had no complications were 6.58 ± 6.57 and 2 ± 2.75 respectively with a significant difference (U- test = 2.94, p-value= 0.003).

Table 5 Relationship between CL users' characters and CL use and their knowledge and practice scores

Variable	Knowledge score	p-value	Practice score	p-value
Age				
12-18 years	4.88 ± 1.65*	0.451	8.28 2.06*	0.399
> 18 years	4.97 ± 1.63		8.71 1.86	
Gender				
Female	5.02 ± 1.61*	0.001	8.62 1.86*	0.092
Male	3.41 ± 1.67		10.11 2.47	
Educational year				
Illiterate	4 ± 0.001**	0.116	7 ± 0.001**	0.085
Middle school	6.33 ± 1.96		10 1.67	
Secondary school	4.69 ± 1.34		8.31 2.09	
University	5 ± 1.67		8.71 1.85	
Fathers' occupation				
Un-employed	5.03 ± 1.54*	0.553	8.58 ± 1.54*	0.642
Employed	4.94 ± 1.67		8.71 ± 2.04	
Mothers' occupation				
Un-employed	4.93± 1.55*	0.273	8.82 ± 1.84*	0.035
Employed	5.04 ± 1.79		8.34 ± 1.96	

Family income				
Not enough	4.68 ± 1.46*	0.408	8.2 ± 1.98*	0.4
Enough	4.98 ± 1.64		8.7 ± 1.88	
Did you receive any information about lens care and hygiene?				
No	2.92 ± 1.54*	0.021	8.27 ± 1.79*	0.005
Yes	± 1.74		8.91 ± 1.91	
Had a complication from contact lenses?				
No	4.99 ± 1.43*	0.676	8.76 ± 1.97**	0.285
Do not know	4.34 ± 1.52		8.65 ± 1.68	
Yes	4.96 ± 1.71		8.62 ± 1.85	
Have you ever suffered from eye infections?				
No	4.82 ± 1.54*	0.336	9 ± 1.84*	0.032
Yes	5.03 ± 1.67		8.5± 2 1.9	

N.B.: *= Mann Whitney test ** Kruskal Wallis test

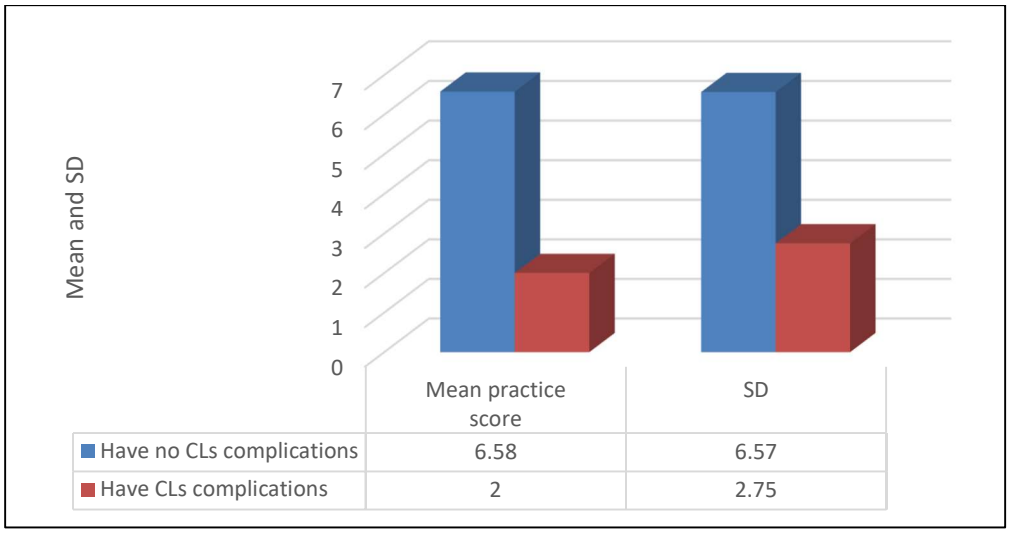

Figure 2 Relationship between having CL complications and mean practice scores among CL users

N.B.: (U- test = 2.94, p-value= 0.003).

4. DISCUSSION

The present study aimed to assess the prevalence of contact lens use and associated risk behaviors and complications among adolescents and adults in Jeddah, Saudi Arabia. It was found that the prevalence of CL's usage in Jeddah was 64%. The cosmetic purposes were the most common reason for wearing CL (61.2%), which is consistent with multiple studies conducted in Saudi Arabia (Abd-Aziz et al., 2019; Ibrahim et al., 2018; Dumbleton et al., 2011). This could explain why females are the primary users of CL's as reported in many studies (Ibrahim et al., 2018; Aldebasi et al., 2016; Gyawali et al., 2014).

Furthermore, the current study revealed that 51.2% of women purchased their CL from an optician, which coincides with a medical student study (Dumbleton et al., 2011). Most of CL uses (95.6%) in the current study thought that CL complications increase with sleeping in lenses. This result coincides with the Malaysian study (Abd-Aziz et al., 2019). Moreover, more than half of the present study participants knew that sharing lenses with others, replacing lenses less frequently than recommended and swimming with lenses also increased the complication of CL. These results indicate that participants' knowledge about CL's exists but there is lack of awareness and compliance which coincides with Dumbleton et al., (2011).

Dumbleton et al., (2011) reported that despite 95% of the participants obtained their CL from professional optometrist still the rate of noncompliance is more than expected. Furthermore, another study done on medical student study revealed that despite having the resources and knowledge still they lack the proper compliance on CLs hygienic practices (Ibrahim et al., 2018; Alghamdi et al., 2022). Most of the present work's participants (85.3%) always wash hands before putting on lenses but only (37.9%) always wash their hand with soap and water prior to touching the lenses. This Figure is lower than reported in Ibrahim et al., (2018), where 57.5% of medical students did.

This discrepancy could be due to difference in the target population. Most of the current study participants (72.7%) exceed the recommended period of renewal for lenses. This result is similar to Aldebasi et al., (2016), where 56% reported lenses overuse. However, this result is in contrary with Gyawali et al., (2014); where 24% use their lenses more than it's recommended. Unfortunately, 40.4% of the present study participants never rinse their lenses or lens case with tap water. Alhumaidi and Yousef, (2018) found that 29.7% reported that they sometimes rinse their lenses with tap water.

Despite that (31.4%) answered that adding fresh solution to existing solution in their lens case will increase risk of complication, only 15% clean their lenses daily. This percentage was even lower in Ibrahim et al., (2018) that was done on medical students. Our study reported that 70% occasionally add fresh cleaning solution to solution that is already in the lens case. This disagrees with Gyawali et al., (2014), where this percentage was 15%. Regardless the discrepancy, this is an important risky behavior as percentage of microbial contamination of lens care solution was 42% as reported by Thakur and Gaikwad, (2014).

According to the Centre for Disease Control and Prevention, (2017), sleeping with lenses increase risk of infection up to 8 times. Fortunately, 81.6% of our study participants reported never sleeping with lenses, a percent that was lower than that reported in Jazan university study (98%) (Abuallut et al., 2021). However, this percent is much higher than reported in a Malaysian study (48.1%) (Abd-Aziz et al., 2019). Worryingly, still small percentage (6%) reported that they take nap with their contact lenses. This is lower than the result revealed from a study done on medical students (18.9%). This could be due to their beliefs that a nap for half hour maybe not harmful as a full night sleeps (Ibrahim et al., 2018).

In our study, 79.5% reported never swim or participate in water sports while wearing lenses but 13.6% reported that they occasionally swim with lenses. This finding is similar to Alhumaidi and Yousef, (2018). This behavior was found to increase the risk of Acanthamoeba keratitis. This is a "parasitic infection free-living amoeba that has been located in various environments including pools, hot tubs, tap water, shower water and contact lens solution. It is both difficult to diagnose and difficult to treat" (Nadia et al., 2021). Previous studies found that sharing contact lens lead to spreading of infection and contamination of the lenses.

Our study found only 6.4% occasionally shared their lenses. On the other hand, previous study reported that 18.4% of the respondents shared their lenses, the complication of CL can be sight threatening and devastating and it can be prevented by practicing simple hygienic behavior while handling CL. In our study, 28.5% of the participants had a complication from wearing contact lenses. This is similar to a study done on medical students which reported a percentage of 30.4% (Ibrahim et al., 2019). However, it is lower than that reported in Gyawali et al., (2014) (38.3%).

Aldebasi et al., (2016) reported that the complication was higher among extended wear CL (97.36%) in comparison with the daily use (60.71%). This study found that of those who had infection, 42.6% slept with contact lenses the night before the infection occurred. In addition, the most common complication reported were keratitis (31.7%), acute red eye (26.9%) then conjunctivitis (17.3%). In contrary, another study reported that acute red eye was the most common followed by conjunctivitis and bacterial keratitis (Aldebasi et al., 2016). This discrepancy could be due to self-reported complication and lack of proper ophthalmology diagnosis.

Those who received information about lens care and hygiene in our study had a significant higher mean knowledge score related to CL use. In addition, participants who received information about lens care and hygiene and who did not suffer from eye infections had a significant higher mean practice score related to CL use. These finding agree with Alobaidan et al., (2018), where awareness and compliance was found to be improved by proper instruction before purchasing CL. A limitation of the present study was the use of a self-reporting questionnaire for data collection that could have a recall bias.

5. CONCLUSION

This study revealed that the majority of the participants had adequate knowledge about CLs use. But still there is poor hygienic practice and compliance which lead to increased contact lenses related complication. Health awareness campaigns should be done to promote health behaviors related to CLs use through social media platforms. Future studies are needed to address reasons behind lack of compliance to hygienic behavior.

Acknowledgments

The authors would like to express their gratitude to Dr Gamal masod for the statistical analysis.

Authors' contribution

Jumana S Alghamdi, Nizar M Alhibshi, Shahad T Khayyat, Raghad M Alzhrani, Wasayf M Almehmadi, Maram Y Alqahtani and Sara A Alansari: They all contributed to the study's design, writing the protocol and planning the study. Everyone collected data

and wrote the case report. The paper has been read and approved by all Co-Authors. The published version of the manuscript has been read and approved by all authors.

Ethical approval

The study was approved by the research ethics committee of King Abdul-Aziz University, Jeddah, Saudi Arabia (Ethical approval code: HA-02-J-008).

Informed consent

An online consent was obtained from all individual participants included in the study before starting the electronic questionnaire.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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