

# The Use of Contact Lenses Among Keratoconus Patients in Saudi Arabia: Prevalence, Habits and Complications

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## Abstract

**Background:** Keratoconus (KC) is a progressive, bilateral, asymmetrical condition characterized by corneal ectasies and a thin, cone-shaped cornea. Keratoconus can affect visual acuity by inducing myopia and irregular astigmatism. Contact lenses (CL) play an important role in the correction of visual problems due to this condition, but pose certain difficulties. The process of contact lens fitting is usually complex and difficult. A major risk factor for adverse contact lens-related events is lack of patient compliance to required hygiene practices.

**Aims:** To determine the prevalence of contact lens use as well as the attitudes toward contact lens usage and its complications among keratoconus patients.

**Methods and Material:** This cross-sectional study included 112 keratoconus patients who were treated with contact lenses; subjects were from different areas of Saudi Arabia. A voluntary self-administered questionnaire was used to collect data regarding prevalence, habits and outcomes of contact lens use among keratoconus patients.

**Results:** Of 112 respondents, 84.8% were treated with hard lenses, while 23.2% used soft lenses. Complications were reported among 57.1%, the most common being dry eyes. Regarding hygiene habits, 66.3% reported washing their hands before wearing their lenses, while 33.7% did not. Moreover, 69% of the participants made sure that there were no scratches or breaks in the edges of the contact lenses before wearing them. The majority of participants reported that they had never slept with lenses on (68.4%), while 13.7% kept their lenses on during naps.

**Conclusions:** The results of this study highlight negative habits of contact lens use and complications experienced by users. Although the study shows good practice among keratoconus patients, health education on contact lens hygiene is recommended to improve patient behaviour and prevent severe complications. In addition, further research must be undertaken to evaluate the awareness of contact lens related complications among KC patients.

**Key words:** Contact Lenses Keratoconus Saudi Arabia Eye Hard Soft hygiene wearing

## Introduction

Keratoconus is an ophthalmologic condition characterized by a thin cornea with protruding ecstasies, or cones. It is a progressive, bilateral, asymmetrical, and commonly isolated disorder. It can induce myopia and irregular astigmatism which do not improve by wearing spectacles, especially in advanced stages(1,2). The characteristic sign is the appearance of Vogt's striae, which is produced by the compression of the Descemet membrane and appears as a fine vertical line(3). A recent study estimated the prevalence of keratoconus to be 138:100,000 in the general population(4). Ethnicity and gender have not been proven to be associated, although it most commonly occurs in the second decade of life(1). Despite intensive laboratory and clinical investigations the etiology of keratoconus remains unclear. Both environmental and genetic factors can play major roles in its pathogenesis, and it is believed to be an inheritant disorder(5). Although keratoconus has well described clinical symptoms, it can go unnoticed in early stages if an anterior corneal topography is not performed(2). The most common treatment is contact lenses (CL). If this modality fails, invasive treatments may be performed to rehabilitate vision. These include intrastromal corneal ring segments, corneal cross linking, lamellar or penetrating keratoplasty(1,2). However, patients tend to prefer contact lenses over surgical treatment. The prevalence of using contact lenses in Saudi Arabia for refractive purposes was found to be 19%(6).

The best options of contact lenses are rigid gas permeable (RGP) lenses, hybrid contact lenses, soft toric or spherical lenses, and scleral contact lenses. The process of contact lens fitting is usually complex and difficult for keratoconus patients due to the unique irregularities in each cornea(7). Moreover, studies have shown a lack of awareness among CL users regarding hygiene practices when using contact lens, which may lead to serious complications(8). A limited number of studies have been done to determine the habits of keratoconus patients using contact lenses and their outcomes. This study aims to determine hygiene practices and the outcome of contact lenses among keratoconus patients.

## Subjects and Methods

This cross-sectional study targeted keratoconus patients in Saudi Arabia. It was reviewed and approved by the private hospital human research Ethics Committee, and it adheres to the tenets of Declaration of Helsinki. The study was conducted from January 2020 to November 2020. Those included in the study were male and female keratoconus patients aged 18 years and above. The exclusion criteria were those who did not sign the informed consent, and those below 18 years of age. The sample size needed was calculated using OpenEpi v.3 (Mini & Nobili, 2017) to be 81 participants, based on the following parameters: a confidence level of 95%, a margin error of 5%, with the prevalence of keratoconus among Saudi population being 5.56%(9). The data was collected by self-administered questionnaires distributed electronically through social media. The data was analyzed using the

Statistical Package for Social Sciences Program (IBM SPSS Statistics, Version 24).

Chi square was used to attain a P-value between dependent and independent categorical data to estimate associations where P-value  $\leq 0.05$  is considered significant.

## Results

We received 112 responses to our questionnaire, all of whom were diagnosed with keratoconus and were using contact lenses. The majority (59.8%) were males, and 46.4% of the sample were 31 to 40 years old. Sixty-three percent were employed, and 56.3% had university education. Demographics are demonstrated in Table 1. Some participants reported the usage of different types of lenses during their life. At the time of the study, 84.8% of participants used hard lenses and 23.2% used soft lenses. Most of the sample (83.0%) were diagnosed when they were between the ages of 18 and 30 years, while 13.4% were diagnosed at over 30 years old, and 3.6% at less than 18 years old. Moreover, 59.8% reported that they continuously visited their ophthalmologist, and 72.3% declared that they had a visit during the last year. More than a quarter of the sample reported that their condition worsened with time, while 47.3% indicated that their condition is stable, and 25% did not know if there were any changes (Table 2).

Complications due to contact lens use were reported among 57.1% of the sample. They included dry eye (35.1%), eye redness (22.3%), headache (16.9%), sensitivity (14.2%), and inflammation (11.5%) (Figure 1).

Regarding hygiene practices, 69.4% of participants usually made sure that their lenses had no scratches or breaks before wearing them, with females doing so most frequently (90.3% of females compared to 59.3% of males). Sixty-eight percent of the participants clean their lenses daily, with younger participants reported doing so most often. Most of the sample wash their hands before wearing their lenses, while 66.3% wash their lenses after wearing them. Forty-eight percent reported using special contact lens solutions to clean their lenses, with 41.1% using only water. Forty-seven percent replace their cleaning solution most days, while 40% replacing it daily, and 11.6% doing so rarely (Table 3).

Most of our participants never sleep while wearing their lenses (68.4%), while 13.7% wear them during naps. Younger participants and males were the most common to deny wearing lenses during sleep and while showering. Forty-four percent reported that they had never taken a shower while wearing their lens, and 80% did not wear them while swimming. All participants denied sharing their lenses with others.

More than half the participants (55.7%) do not take a rest in the middle of the day while wearing the lens. The lenses are most commonly worn for 6 -8 hours daily (41.1%), while 22.1% wear their lens for more than 12 hours daily (Table 4).

<b>Table 1: Demographic factors of participants</b>	<b>Variable</b>	<b>Frequency</b>	<b>Percent</b>
Age (years)	18-30	36	32.1
	31-40	52	46.4
	More than 40	24	21.4
Gender	Male	67	59.8
	Female	45	40.2
Marital status	Single	37	33.0
	Married	67	59.8
	Divorced	8	7.1
Profession	Students	16	14.3
	Employee	71	63.4
	Retired	4	3.6
	Other	21	18.7
Educational level	Secondary school	27	24.1
	University	63	56.3
	Higher degree	22	19.6

Table 2: Keratoconus condition of the participants		Frequency	Percent
How old were you when you were diagnosed with keratoconus?	Less than 18	4	3.6
	18-30 years	93	83.0
	More than 30	15	13.4
Your keratoconus condition	Worsened with time	31	27.7
	Is constant	53	47.3
	I do not know	28	25.0
Do you see an ophthalmologist periodically and continuously?	Yes	67	59.8
	No	45	40.2
When was the last time you had an eye exam?	Less than 1 year ago	81	72.3
	Less than 5 years ago	31	27.7

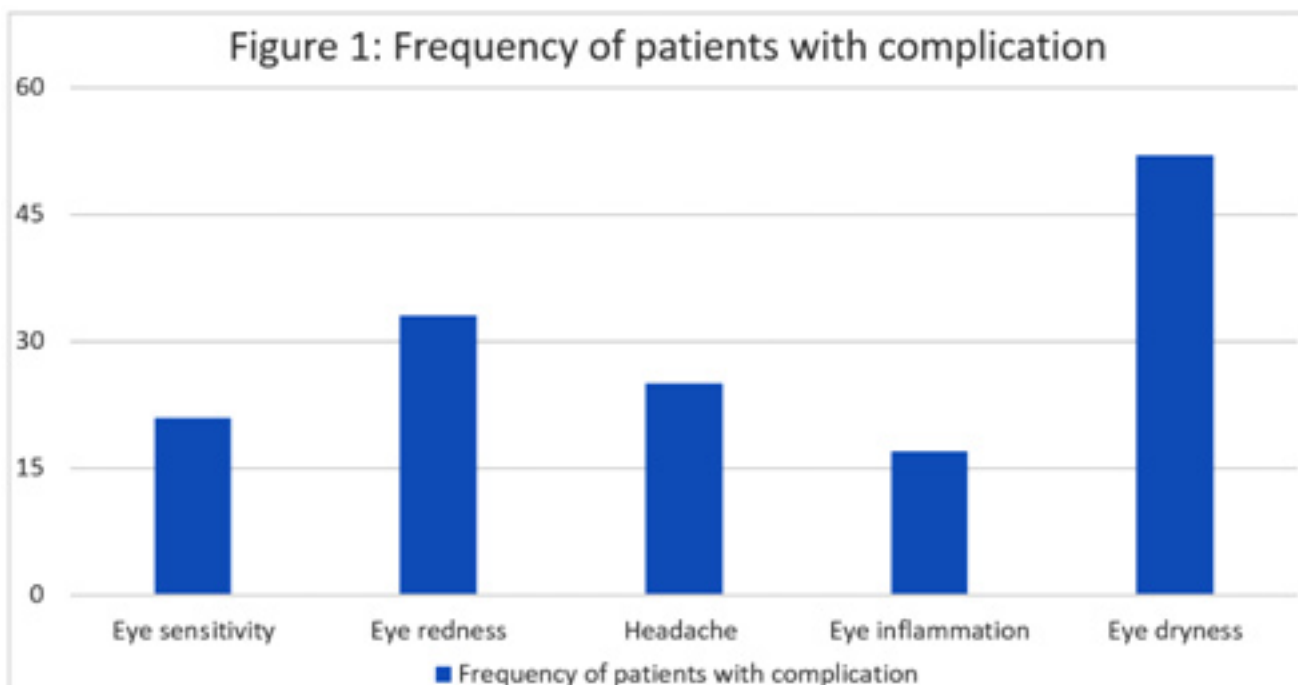


Table 3: Demographic factors and some habits during wearing lens		Age				Gender	
		Frequency	18-30	31-40	More than 40	Male	Female
Do you make sure there are no scratches or breaks in the ends of the contact lens before wearing?	Yes	66 (69.4%)	22 (70.9%)	30 (66.7%)	14 (73.7%)	38 (59.3%)	28 (90.3%)
	No	29 (30.6%)	9 (29.1%)	15 (33.3%)	5 (26.3%)	26 (40.7%)	3 (9.7%)
Cleaning lenses	Daily	65 (68.4%)	24 (77.4%)	28 (62.2%)	13 (68.4%)	43 (67.2%)	22 (71.0%)
	Weekly	18 (18.9%)	5 (16.1%)	9 (20.0%)	4 (21.1%)	11 (17.2%)	7 (22.6%)
	Monthly	8 (8.5%)	2 (6.5%)	4 (8.9%)	2 (10.5%)	6 (9.4%)	2 (6.5%)
	Yearly	2 (2.1%)	0 (0.0%)	2 (4.4%)	0 (0.0%)	2 (3.1%)	0 (0.0%)
	Never	2 (2.1%)	0 (0.0%)	2 (4.4%)	0 (0.0%)	2 (3.1%)	0 (0.0%)
Washing hands before putting on lenses	Yes	90 (94.7%)	31 (100.0%)	41 (91.1%)	18 (94.7%)	60 (93.8%)	30 (96.8%)
	No	5 (5.3%)	0 (0.0%)	4 (8.9%)	1 (5.3%)	4 (6.3%)	1 (3.2%)
Do you wash and clean your lenses after wearing them?	Yes	63 (66.3%)	23 (74.2%)	29 (64.4%)	11 (57.9%)	40 (62.5%)	23 (74.2%)
	No	32 (33.7%)	8 (25.8%)	16 (35.6%)	8 (42.1%)	24 (37.5%)	8 (25.8%)
If the answer to the previous question is yes, how do you wash it?	With the special contact lens solution	63 (94.0%)	22 (91.7%)	28 (93.3%)	13 (100.0%)	38 (90.5%)	25 (100.0%)
	With only water	4 (6.0%)	2 (8.3%)	2 (6.7%)	0 (0.0%)	4 (9.5%)	0 (0.0%)
How do you clean your contact lens case?	With the special contact lens solution	46 (48.4%)	15 (48.4%)	24 (53.3%)	7 (36.8%)	31 (48.4%)	15 (48.4%)
	With only water	39 (41.1%)	11 (35.5%)	18 (40.0%)	10 (52.6%)	26 (40.6%)	13 (41.9%)
	With water and soap	7 (7.4%)	3 (9.7%)	2 (4.4%)	2 (10.5%)	4 (6.3%)	3 (9.7%)
	Never wash it	3 (3.1%)	2 (6.5%)	1 (2.2%)	0 (0.0%)	3 (4.7%)	0 (0.0%)
Replacing the cleaning solution	Most days	45 (47.4%)	13 (41.9%)	25 (55.6%)	7 (36.8%)	27 (42.2%)	18 (58.1%)
	Every day	38 (40.0%)	15 (48.4%)	14 (31.1%)	9 (47.4%)	28 (43.8%)	10 (32.3%)
	Rarely	11 (11.6%)	2 (6.5%)	6 (13.3%)	3 (15.8%)	8 (12.5%)	3 (9.7%)
	Never	1 (1.0%)	1 (3.2%)	0 (0.0%)	0 (0.0%)	1 (1.6%)	0 (0.0%)

Table 4: Habits while wearing lens among demographics		Age			Gender	
		18-30	31-40	More than 40	Male	Female
Sleeping with lenses	Never	22 (71.0%)	31 (68.9%)	12 (63.2%)	45 (70.3%)	20 (64.5%)
	Only during naps	5 (16.1%)	6 (13.3%)	2 (10.5%)	5 (7.8%)	8 (25.8%)
	More than once	1 (3.2%)	6 (13.3%)	2 (10.5%)	8 (12.5%)	1 (3.2%)
	Rarely	3 (9.7%)	2 (4.4%)	3 (15.8%)	6 (9.4%)	2 (6.5%)
Sharing lenses	Never	31 (100.0%)	45 (100.0%)	19 (100.0%)	64 (100.0%)	31 (100.0%)
Showering with lenses	All the time	2 (6.5%)	3 (6.7%)	5 (26.3%)	8 (12.5%)	2 (6.5%)
	Frequently	5 (16.1%)	9 (20.0%)	2 (10.5%)	11 (17.2%)	5 (16.1%)
	Sometimes	5 (16.1%)	15 (33.3%)	7 (36.8%)	24 (37.5%)	3 (9.7%)
	Never	19 (61.3%)	18 (40.0%)	5 (26.3%)	21 (32.8%)	21 (67.7%)
Swimming with lenses	All the time	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Frequently	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Sometimes	4 (12.9%)	12 (26.7%)	3 (15.8%)	12 (18.8%)	7 (22.6%)
	Never	27 (87.1%)	33 (73.3%)	16 (84.2%)	52 (81.3%)	24 (77.4%)
Number of hours spent wearing contact lenses	6-8 h	12 (38.7%)	21 (46.7%)	6 (31.6%)	23 (35.9%)	16 (51.6%)
	12h	11 (35.5%)	15 (33.3%)	9 (47.4%)	24 (37.5%)	11 (35.5%)
	Over 12 h	8 (25.8%)	9 (20.0%)	4 (21.1%)	17 (26.6%)	4 (12.9%)
Taking a break from contact lenses for one to two hours after wearing them for about 12 hours	Yes	10 (35.7%)	20 (47.6%)	9 (50.0%)	25 (41.0%)	14 (51.9%)
	No	18 (64.3%)	22 (52.4%)	9 (50.0%)	36 (59.0%)	13 (48.1%)

## Discussion

This study set out to determine the attitudes toward contact lens use among keratoconus patients, and to highlight the complications related to their usage. In order to perform that, a survey was distributed among patients with keratoconus who used contact lenses. Although the targeted sample size was 81, we were able to collect a sample of 112 participants with a response rate of 138%. In our study, males represented a higher percentage of the sample than females. While some studies showed similar results,(10) others reported the opposite(11,12). Most of our sample were diagnosed with keratoconus between the ages of 18 and 30 years old, which is similar to other studies where the median age of diagnosis was 22 years old(13).

More than half of the sample reported at least one side effect while using contact lenses, such as dry eye (35.1%), eye redness (22.3%) and headache (16.9%). Similarly, a study which focused on those who wear contact lenses due to a variety of reasons found that half of the participants had at least one complication, most commonly an allergy related to the contact lens or its solution(8).

In our study, dryness of the eye was the most common complication of CLs among KC patients. In contrast, a study was done in Jeddah among the general population and reported side effects among 30%, with red eye and conjunctival inflammation being the most common(14). A higher incidence was reported in Brazil and India(15,16). In the United States, around 30% of CL users experienced side effects that required medical attention(17).

Moreover, wearing contact lenses may be associated with habits that can negatively affect the condition of both keratoconus and the eye itself. In this study, the majority of participants ensured the absence of scratches or breaks in their lenses before wearing them, and most of them reported that they washed their lenses daily. Nearly 94% of participants reported washing their hands before handling their contact lenses, and 66.3% cleaned their lenses after wearing them, most frequently with contact lens solution. In contrast, a study was done in Makkah among college students found that only half of respondents washed their hand before wearing lenses(8). A study conducted in Riyadh reported similar good practice as 89.4% of participants washed their hands before handling contact lenses(6). This variation of the percentage between our study and the earlier findings are perhaps due to differences in target population and wearing purposes.

Moreover, the majority of participants in our study stated that they had never slept with lenses on, while 13.7% kept their lenses on during naps. Conversely negative habits were reported in Jeddah among the general healthy population, where a higher incidence of wearing lenses during sleep was observed,(14) while the incidence was much lower in Riyadh (6). However, a study conducted in the Maldives found a quarter of participants slept overnight or napped while wearing CLs,(18) as did a majority of CL wearers in the United States(17). This might indicate that keratoconus patients have better knowledge on handling

CLs than healthy individuals, and it is possible that our participants were instructed properly about contact lens care and they were informed about the consequence of bad practice.

Compared to the US study(17), almost all of our participants stated that they had never shared their lenses with others. The findings in the current study are slightly consistent with the findings of Riyadh study, as 72.4% of participants had never shared their lenses with others (6). In addition, in the present study 55% and 20% reported that they shower and swim with lenses on, respectively. These rates are lower than a study conducted in the United States, but higher than a study in Makkah where around 15% and 7% of participants took showers and went swimming, respectively, with CLs (8). A study conducted in the Maldives found that 35.5% wore CL during showering and swimming(18). The important issue emerging from these findings is that patients need to be educated to avoid exposing contact lenses to any water source, as evidence suggested that risk of infection and inflammatory processes related to contact lenses is higher with exposure to any source of water (19).

Finally, the daily duration of CL use was all day without rest for half of our sample, and 12 hours for 22.1%. However, a study conducted in Thailand with a different target population suggests that wearing contact lenses for a longer period per day is more likely to be associated with significant ocular outcomes for healthy individuals(20). In contrast, KC patients are allowed to use CLs for therapeutic purposes for long period of time per day while taking precautions.

To the best of the authors' knowledge, this is the first study conducted to assess the prevalence, habits and complications of contact lenses use among KC patients. Our study had a few limitations. Although we collected a larger sample than calculated, the sample size was still relatively small due to the difficulty of locating participants who both had keratoconus and wore contact lenses. Around 200 participants were excluded as the inclusion criteria did not apply to them. Another limitation was using a self-reported questionnaire, which could lead participants to answer with what they believed should be the correct answer, and may not reflect their actual habits. Therefore, the same study conducted in a more controlled environment may yield more accurate results.

## Conclusion

Many complications of CL have been reported among keratoconus patients, with dry eye, eye redness and headaches being the most common. Although many good practices have been addressed in this study, habits such as swimming and showering while wearing lenses, that may negatively affect the eye, were reported. Finally, we suggest that practitioners educate keratoconus patients more regarding complications related to contact lens use and further research is needed to evaluate awareness about serious ocular complications that are associated with contact lenses.

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