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Assessment of contact lens wearers' attitude toward contact lens wear and care during Coronavirus Disease 2019 (COVID-19) pandemic: A cross-sectional online survey

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ABSTRACT

Aim: COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Several reports have provided conflicting recommendations regarding contact lenses (CL) use during COVID-19, causing confusion among CL wearers. The aim of this study is to assess CL wearers' attitudes toward CL wear and care during COVID-19 pandemic.

Methods: A web-based cross-sectional online survey was used to assess the participants' attitude toward CL wear and care during the COVID-19 pandemic. The survey layout was based on Google form® specifically developed for CL wearers. Demographic characteristics and CL history and profile were also collected for each participant.

Results: A total of 196 CL wearers completed the online survey with an average age was 26 (\pm 4.1) and 90.8 % of participants were females. As reported by the participants, social media was the main source of information about COVID-19. 38.8 % of the study population reported stopping CL wear during the pandemic. The main stated reason for lens discontinuation was decreased social activities during the pandemic. 61.2 % of participants continued lens wear, with the majority reported considerable changes in their behaviors toward CL wear and care during the pandemic. This includes reinforced hands cleaning before and after lens wear, disinfecting of CLs and CL case and less frequent CL aftercare visits.

Conclusion: The majority of the study population have continued CL wear during the pandemic. Contact lens wearers reported profound changes in attitudes toward CL wear including improved care and maintenance. Additionally, changes in CL purchase habit have been reported with more tendency for online purchase. CL cessation has been associated with several perceived reasons mainly attributed to reduced outdoor activity and fear of ocular infection. Levels of compliance among CL wearers should be assessed and reinforced during the current pandemic and similar lockdown situation to reduce possible CL-related complications and dropout.

1. Introduction

The emergence of novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes coronavirus disease 2019 (COVID-19), has become a major health concern. On 30 January 2020, the World Health Organization (WHO) declared COVID-19 as the sixth public health emergency, and subsequently defined it as a pandemic on 11 March 2020 [1].

According to the disease prevention and control studies, COVID-19 can be transmitted from human-to-human through direct channels such as shaking hands or inhaling airborne droplets, or via indirect channels such as interacting with a contaminated surface and then

touching one of the proposed transmission routes: the eyes, mouth and [2–5]. Respiratory transmission is proven to be the major route for COVID-19 infection [6,7], with ocular surface involvement in COVID-19 transmission being controversial [8,9]. Conjunctivitis and ocular surface inflammation were generally reported among COVID-19 patients [2, 10–13]. Willcox et al. have proposed that the ocular surface is a possible site of infection for COVID-19 [7]. However, the role of ocular secretions in COVID-19 transmission has not been confirmed yet. A prospective case-series study, conducted by Karimi et al., has reported a positive tear reaction for SARS-CoV-2 in 3 patients, who were also presented with conjunctivitis [14]. Furthermore, recent research has suggested that COVID-19 can remain on hard surfaces including spectacles from hours

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to days, and then can be transferred to wearers' hands and faces [15]. On the other hand, other studies reported no association between contact lens (CL) wearing and COVID-19 infection [16,17].

Different reports have provided conflicting advice regarding CL use during COVID-19.

Some reports considered CL safe and not related to COVID-19 infection [16,18]. Other reports including a guidance from the American Academy of Ophthalmology and an article released by the British Broadcasting Corporation (BBC) considered CL unsafe and advised CL wearers to cease CL wear and use spectacles to minimize the risk of COVID-19 transmission [19].

With the increased concern regarding the possible role of CLs in disease transmission, it is important for CL practitioners to assess behaviors of CL wearers toward CL wear and care in time of crisis as in COVID-19 pandemic. Recent studies from the UK and Spain have assessed patients' attitudes toward CL wear and care during the COVID-19 pandemic, where the vast majority of participants in these countries reported discontinuation of wearing CL during the pandemic [18,20, 21].

In a previous report, Bakkar et.al, have reported an acceptable level of CL compliance among CL wearers in Jordan [22]. However, this work was conducted before the COVID-19 pandemic. The current study aims to assess the impact of COVID-19 on CL wearers behaviors toward CL wear and care in Jordan during the lockdown caused by the COVID-19 pandemic, where access to eye care practitioners (ECPs) is limited.

2. Methods

2.1. Study sample and design

A cross-sectional web-based study was conducted using Google form® survey. The survey was made available to fill in from August 7th to August 20th 2020 to assess CL attitudes among CL wearers in Jordan during COVID-19 pandemic. The participants were invited to fill in the online questionnaire via online link circulated to social media networks (such as Facebook, Whatsapp, LinkedIn, and Twitter).

Eligibility criteria included CL wearers older than 18 years old, living in Jordan and who wear CLs for at least 3 months prior to the announcement of COVID-19 pandemic.

2.2. The questionnaire

The online questionnaire was designed in Arabic language for CL wearers using Google Forms® (Google Inc., CA, USA).

Questions were suggested and reviewed by the research team based on previous literature on CL compliance [22–31]. The questionnaire was further reviewed by a focus group consisted of 3 optometrists who are involved in CL fitting and known to the research group, in order to ensure ease of understanding and appropriateness of questions when used in a setting where Jordanian Arabic is used. The reviewed questionnaire was then administered to 20 CL wearers in order to check the respondent's comprehension of the questions and the required response time. Responses from this pilot sample were not included in final data analysis of the study. The final version of web-based questionnaire was distributed online for a period of 2 weeks with estimated time needed to answer the questionnaire was approximately 8 min on average.

The final survey consisted of variety of questions covered five major areas: sociodemographic information of participants (such as: age, gender, education level and smoking habit), information related to CL wear (such as type of CLs, modality of CLs, wearing time per day, CL experience in months, and care regime) and source of information about COVID-19 infection. Participants who responded that they stopped CL wear during the pandemic were electronically directed to a set of statements representing possible reasons for stopping CL wear. Participants were asked to express their agreement on each given statement on a 5-point Likert scale (1: strongly disagree, 2: disagree, 3: neutral, 4:

agree, 5: strongly agree). On the other hand, participants who reported continuation of CL wear during the pandemic were directed to other statements to express their personal agreement with possible changes in their attitudes toward CL wear and care using a 5-point Linkert scale.

2.3. Data analysis

Data were analysed using the statistical Package for Social Sciences software version 25 (SPSS, International Business Machine Corp. IBM, Chicago, IL, USA).

Data was tested for normality using histogram eyeball test, Shapiro-Wilk test, and Kolmogorov-Smirnov test. Descriptive statistics were used to describe items included in the survey. Continuous data were summarised in form of means and standard deviations, and percentages were used to describe the categorical data. Chi-square tests were performed when comparing two dichotomous variables and t-test was used to compare paired samples. Level of significance was set at p<0.05.

2.4. Ethics approval

The study protocol was approved by the Institutional Review Board (IRB) at Jordan University of Science and Technology (J.U.S.T) (Irbid, Jordan). The aim and importance of the study was explained to the participants and an electronic Informed consent was obtained from all participants prior to proceeding to the survey questions by clicking a check box in the online survey. Participation in this study was voluntary. To ensure the privacy and confidentiality, the anonymity of participant's personal information was preserved. The study protocol was conducted in accordance with the Declaration of Helsinki principles.

3. Results

3.1. Participants' demographics

A total of 196 CL wearers completed the online survey. There was 178 (90.8 %) female and 18 (9.2 %) male. The mean age of participants 26 (± 4.1) years with the majority of the study population in the age group of 21–30 years. The participants' demographic characteristics are shown in [Table 1](#).

3.2. CL wear profile

All participants reported CL wear experience with a range of 3

Table 1
Demographic characteristics of the study population (n = 196).

| Characteristics | N (%) |
|--------------------|------------|
| Age | |
| 18-20 | 21 (10.7) |
| 21-30 | 118 (60.2) |
| 31-40 | 39 (19.9) |
| >41 | 18 (9.2) |
| Gender | |
| Female | 178 (90.8) |
| Male | 18 (9.2) |
| Education | |
| Elementary/PRIMARY | 2 (1) |
| High school | 7 (3.6) |
| College | 27 (13.8) |
| Bachelor | 143 (73) |
| Higher education | 17 (8.7) |
| Smoking | |
| Yes | 39 (19.9) |
| No | 157 (80.1) |

months to 130 months with the 54.6 % of the study population have a CL wear experience longer than 36 months. Paired sample *t*-test showed a statistically significant difference in CL wear time per day (in hours) before and after the announcement of COVID-19 announcement ($p < .001$) with the 95 % CI of the difference did not contain zero confirming the *t*-test result (95 % CI: (1.151–1.462). Similarly, there was a significant difference in method of purchase of CL before and after COVID-19 announcement ($p < .001$) with the 95 % CI of the difference did not contain zero confirming the *t*-test result (95 % CI: (–0.095 to –0.027).

Table 2 presents information related to CL wear profile of the study population.

3.3. Sources of information on COVID-19

Participants were asked about their source of information about COVID-19 during the lockdown. 174 (88.8 %) of the study sample received information on COVID-19 through social media and applications, 90 (45.9 %) through TV and 69 (35.2 %) via family and friends.

Of the study population, 139 (70.9 %) believe that COVID-19 can transmit through the eye or contaminated CL with the virus itself, whereas 24 (12.2 %) do not think the eye or CL play a role in the virus transmission, and 33 (16.8 %) do not have any information on this

Table 2
Contact lens information of the study population.

| Information | N (%) |
|---|------------|
| CL wear modality | |
| Daily disposable wear | 16 (8.2) |
| Monthly replacement | 92 (46.9) |
| 3–6 months | 61 (31.1) |
| Yearly replacement | 27 (13.8) |
| Type of CL | |
| Soft CL | 191 (97.4) |
| Gas permeable CL | 5 (2.6) |
| Reasons for CL wear | |
| Myopia | 125 (63.8) |
| Hyperopia | 3 (1.5) |
| Astigmatism | 9 (4.6) |
| Keratoconus | 2 (1) |
| Cosmetic (coloured) CL | 57 (29.1) |
| CL experience | |
| ≤12 months | 45 (23) |
| 13–36 months | 44 (22.4) |
| >36 months | 107 (54.6) |
| CL wearing time per day before COVID-19 announcement | |
| 3–6 h | 80 (40.8) |
| 7–12 h | 103 (52.6) |
| More than 12 h | 13 (6.6) |
| CL wearing time per day after COVID-19 declaration | |
| 0 | 76 (38.8) |
| 1–2 | 20 (10.2) |
| 3–6 h | 63 (32.1) |
| 7–12 h | 29 (14.8) |
| More than 12 h | 8 (4.1) |
| CL care system | |
| Multipurpose contact lens solution | 142 (72.4) |
| Hydrogen peroxide | 46 (23.5) |
| No solution | 8 (4.1) |
| CL purchase before COVID-19 declaration | |
| Eye care practitioner (ECP) | 184 (93.9) |
| Via Internet | 12 (6.1) |
| CL purchase after COVID-19 announcement | |
| Eye care practitioner (ECP) | 172 (87.8) |
| Via Internet | 24 (12.2) |

regard.

3.4. CL wear during the COVID-19 pandemic

The results of this study showed that the majority (61.2 %) of participants used their lenses during the lockdown, while the rest of the participants discontinued lens wear. Possible reasons for CL cessation during the lockdown and changes in CL wear and care behaviors will be addressed in the next sections.

3.5. Cessation of CL wear during the pandemic

A total of 76 (38.8 %) of respondents reported CL wear cessation during the COVID-19 pandemic. The most common reason for CL discontinuation was reduced outdoor activity during the lockdown. 27.6 % included fear of possible CL contamination and ocular infection. While the minority (3.2 %) of the participants declared financial issues a reason to cease CL wear during COVID-19 pandemic. Table 3 outlined participants' agreement with possible reasons for CL cessation during COVID-19 pandemic.

3.6. Continuation of CL wear during the pandemic

120 (61.2 %) respondents reported using their CL during the pandemic even in a reduced-basis. Table 4 shows participants' agreement with possible changes in their attitudes toward CL wear and care. The majority of participants reported that they have reinforced the habit of hands cleaning and disinfecting their CLs and CL case during the COVID-19 pandemic. In addition, the majority (72.5 %) also reported that they have less frequently contacted their ECPs during the pandemic.

4. Discussion

Compliance in CL wear has been extensively studied in the literature [22–32], with a growing evidence that poor CL compliance is related to contact lens-associated ocular complications including infection [32–34].

During the COVID-19 pandemic, it is believed that the pandemic has affected patients' attitudes toward overall health care issues. This may be attributed to several possible exacerbating consequences of the pandemic including: limited access to health care system as a result of lockdown and demand of social distancing [35,36]; effects on mental health and well-being such as fear and stress [37]; and profound impact on economic situation of both governments and individuals [38]. It is also suggested that CL wearers are among patients who were affected in regard to their lenses wear and care attitudes during the pandemic [18, 20].

Jordan is considered one of the leading countries in controlling COVID-19 infection [39]. On the March 14th the Jordanian authorities declared a state of emergency enforcing a round-the-clock lockdown, closing all shops, restaurants, banks, and cancelling all public events, except for essential services such as food supplier markets and pharmacies [39]. In addition, the governorates were isolated, and citizens were prohibited from mobilizing between them unless holding permissions. These early restrictions had led to significant reduction in the number of cases locally; therefore, from the 1st of June 2020, the government started easing the imposed restrictions by opening many health and trade sectors including optometric practices and ophthalmic clinics.

This study aims to study the impact of COVID-19 pandemic on personal CL wearers' attitudes toward CL wear and care in Jordan. The study used online-based questionnaire distributed on a sample of CL wearers. The characteristics of the study sample are in agreement with previous reports on CL trends and compliance in Jordan in terms of age, gender, CL modality, CL type and type of CL care solution [22,40].

The majority of participants indicated that their main source of information about COVID-19 is through internet and social media with 70

Table 3

Responses for reasons for contact lens wear cessation during COVID-19 pandemic, represented by patients' levels of agreement. N = 76.

| Reasons for CL discontinuation during COVID-19 pandemic | Strongly disagree N (%) | Disagree N (%) | Neutral N (%) | Agree N (%) | Strongly agree N (%) |
|---|-------------------------|----------------|---------------|-------------|----------------------|
| 1 Limited access to purchase site for CLs and care solutions replacement during the lockdown | 31 (40.8) | 2 (2.6) | 13 (17.1) | 18 (23.7) | 12 (15.8) |
| 2 Decreased social activities during COVID-19 pandemic (visit, work, sport) | 7 (9.2) | 4 (5.3) | 3 (3.9) | 9 (11.8) | 53 (69.7) |
| 3 Financial concerns i.e. can afford paying for new lenses or lens care solution | 44 (57.9) | 11 (14.5) | 14 (18.4) | 4 (5.3) | 3 (3.9) |
| 4 Fear of risk of infection by COVID-19 | 28 (36.8) | 10 (13.2) | 8 (10.5) | 9 (11.8) | 21 (27.6) |
| 5 Certainty that spectacles wear provides a protection shield for the eye and the face from the infection | 30 (39.5) | 13 (17.1) | 19 (25) | 4 (5.3) | 10 (13.2) |

Table 4

Responses for changes in attitudes toward CL wear and care during COVID-19 pandemic, represented by patients' levels of agreement. N = 120.

| Personal attitudes toward CL wear and care during COVID-19 | Strongly disagree N (%) | Disagree N (%) | Neutral N (%) | Agree N (%) | Strongly agree N (%) |
|--|-------------------------|----------------|---------------|-------------|----------------------|
| 1 I have reduced CL wear time during the day. | 27 (22.5) | 13 (10.8) | 27 (22.5) | 23 (19.2) | 30 (25) |
| 2 I have changed my CLs to another type. | 84 (70) | 19 (15.8) | 13 (10.8) | 2 (1.7) | 2 (1.7) |
| 3 I have changed my CL care solution to another type. | 76 (63.3) | 18 (5) | 12 (10) | 6 (5) | 8 (6.7) |
| 4 I have frequently used hand disinfectant/ sanitizers before and after lens wear during the COVID-19 than before. | 16 (13.3) | 10 (8.3) | 18 (15) | 17 (14.2) | 59 (49.2) |
| 5 I have done more hands washing before lens wear during the COVID-19 than before. | 11 (9.2) | 8 (6.7) | 12 (10) | 19 (15.8) | 70 (58.3) |
| 6 I have done more cleaning of the lens through "rub and rinse" during the COVID-19 than before | 22 (18.3) | 10 (8.3) | 32 (26.7) | 16 (13.3) | 40 (33.3) |
| 7 I have done more cleaning of the lens case during the COVID-19 than before. | 14 (11.7) | 17 (14.2) | 29 (24.2) | 22 (18.3) | 38 (31.7) |
| 8 I have replaced my CL case more frequently during the COVID-19 than before. | 26 (21.7) | 26 (21.7) | 38 (31.7) | 13 (10.8) | 17 (14.2) |
| 9 I have avoided rubbing my eyes while and without wearing CLs during the COVID-19 than before. | 12 (10) | 8 (6.7) | 19 (15.8) | 28 (23.3) | 53 (44.2) |
| 10 I kept more attention for not to extend the life of my CLs (longer than recommended) during the COVID-19 than before. | 25 (20.8) | 19 (15.8) | 25 (20.8) | 18 (15) | 33 (27.5) |
| 11 I have more frequently contacted ECP in regard to my CLs during the COVID-19 than before. | 63 (52.5) | 24 (20) | 16 (13.3) | 5 (4.2) | 12 (10) |
| 12 I have changed the way of CL purchase during the COVID-19. | 83 (69.2) | 17 (14.2) | 9 (7.5) | 6 (5) | 5 (4.2) |

% of the participants have believed of possible ocular or contact lens involvement in the transmission of the disease. This is a good lesson that can be learnt from the pandemic; patients can revert to alternative methods of communications related to CL care better than traditional ways of written or verbal instructions. Hence, ECPs should be encouraged to enhance alternatives ways of communication with their patients; such as virtual health systems including e.g., teleoptometry, telephonic or online consultation. In addition, online follow-ups should be implemented to reinforce proper CL wear practices during the pandemic and similar lockdown circumstances, and this, in turn, could minimize the risk of CL related complications and dropout. However, this enterprise might be new-fangled in Jordan because of the lack of experience and legislation related to telehealth in general and teleoptometry in particular. In the UK, Nagra et al. have also pointed to possible limitations of using teleoptometry by ECPs because of difficulties in the development of optometry specific evidence-based guidance for teleoptometry [41].

The study showed significant changes in the frequency of CL wear during the COVID-19 pandemic, where less than half of the participants have discontinued CL wear during the pandemic. However, the CL cessation rate in the current study is lower than the cessation rate reported by recent reports from the UK and Spain, where the vast majority of participants in these countries were reported to totally discontinue wearing CL during the pandemic [18,20,21]. A possible explanation for difference in CL discontinuation rate of the current study and other studies could be explained by the difference in outbreak rate of the disease, where in Europe the number of registered cases was significantly higher than the registered cases in Jordan at the time of conducting the studies [42]. Other possible reason might be related to the difference in gender distribution in the current study (90 % females) and other studies (64 % in Spain and 79 % in the UK), where female CL wearers more tempted to wear their lenses for cosmetic and appearance determinations, which may explain the relatively lower cessation rate in the current study compared to other studies. Also, referring to previous

CL compliance levels from UK and Spain [28], the compliance rate in Jordan is higher compared to compliance rates in these countries [22], which may explain the lower rate of cessation and the reported improved CL hygiene habits during COVID-19 among CL wearers who continued lens wear even in a reduced basis time.

In the current study, the main stated reasons for lens discontinuation by the participants was decreased social activities such as social visits, work, and sports during COVID-19 pandemic. This is in accordance with recent reports on reasons for CL discontinuation during the COVID-19 [18,20]. Fear of virus transmission and ocular infection was listed as the second main reason for CL discontinuation. This suggests a possible relationship between the personal perceived risk of infection and the cessation of wearing CL. While, there is little evidence on the role of CL in the transmission of the virus, there is growing concern that the virus could be transmitted through CLs into the eye through hands when touching contaminated surfaces or appliances [7,9,14,16].

According to the current study, the majority of the respondents (61.2 %) have continued wearing CL during the pandemic. However, around half of the participants in this group reported wearing their lenses on a reduced time and frequency basis. This result is in agreement with recent reports from Europe where CL wearers continued their CL wear in a part time and reduced-frequency basis during the pandemic [18,20, 21].

Respondents in the group that have continued CL wear also reported as exerting some changes in their attitude toward CL wear and care when compared to the era before the announcement of COVID-19. Generally, participants expressed agreement with most aspects related to changes in CL wear attitudes listed in the questionnaire.

The majority of participants reported that they have improved their contact lens hygiene habits during COVID-19. 74 % of the respondent reported upsurge their hands washing habit and using hand sanitizers prior to lens wear during the COVID-19 than before. Furthermore, half of the participants reported avoiding rubbing their eyes with their hands

whilst wearing their CLs. This attitude is predictable in the light of intense media coverage and recommendations of personal hygiene, including rigorous hands washing before touching the face and eyes to avoid viral transmission [43–45].

In a previous study on CL compliance in Jordan, high to moderate levels of compliance were reported among CL wearers, with an average compliance rate of 75 % across all the questioned behaviours [22]. This may also explain the attitude toward enhanced CL cleaning in the current study. Additionally, around half of the participants reported enforcing their CLs and CL case cleaning during the pandemic. This may indicate possible perception of personal fear by CL wearers that the virus could be transmitted via contaminated surfaces. On the other hand, small percentages of participants reported their personal agreement on changing their type of CL, CL care solution or changing the way for their CL purchase during the pandemic.

Finally, only 14 % of the study sample agreed that they have contacted their ECPs more frequently during the pandemic. This is probably due to the lockdown and limited access to ECPs for routine CL follow-up visits. Instead, few optometric practices in Jordan have introduced hotline services through phone calls and social media (e.g., Facebook, Twitter, WhatsApp.etc.) to their patients. In the future, this should encourage improvement of eye care system in Jordan to enhance patients' communication with their ECPs.

5. Conclusion

This study presents personal subjective attitudes of CL wearers during the ongoing COVID-19 pandemic in Jordan. Participants who continued CL wear reported an impact of the pandemic on many aspects of CL wear, care and purchase. Whereas subjects who stopped wearing their CLs during the pandemic have reported their agreement with many reasons for the cessation.

The study may have several limitations. As the researchers do not have record of participants' CL compliance levels before the COVID-19 announcement, the current study neither reports CL compliance issue during the current pandemic nor comparing changes in CL compliance levels before and following the announcement of COVID-19. In addition, the study used online survey which may associate with self-report bias; where participants often biased when they report on their personal experiences [46]. Also, there is a possibility of self-selection bias where participants that are more compliant with CL care chose to complete the survey [21].

Declaration of Competing Interest

The authors report no declarations of interest.

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