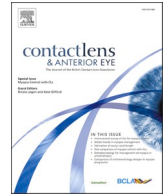




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## Influence of the COVID-19 pandemic on contact lens wear in Spain

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### ABSTRACT

**Purpose:** To investigate the behaviour of contact lens (CL) wearers in Spain during the COVID-19 pandemic.  
**Methods:** An anonymized web-based questionnaire was used to assess demographics, CL history, and activity, CL wear habits and perceived risk of infection due to CL wear during the COVID-19 pandemic.  
**Results:** A total of 737 participants with an average age of 27.4 ( $\pm 9.3$ ) years completed the online questionnaire. The vast majority of respondents were soft CL wearers and reported at least two years of CL wear. Patients concerns about the increased risk of SARS-CoV-2 infection due to CL wear (40.6 % of participants) were significantly related ( $\chi^2(1) = 11.195$ ,  $p < 0.05$ ) to CL discontinuation (46 % of participants) during the COVID-19 pandemic. This fact joins the significant changes in the frequency of CL wear during the COVID-19 pandemic ( $\chi^2(4) = 31.982$ ,  $p < 0.05$ ), with a tendency to increase occasional CL wear from 29.1 % to 61.8 %. Interestingly, the majority of respondent (87.9 %) indicated that no professional had offered them information related to CL wear and COVID-19, and that they had not sought it on their own (82.2 %).  
**Conclusion:** There is a relationship between the perceived risk of infection and CL dropout during the COVID-19 pandemic, and a tendency to change the CL frequency of wear, with an increase in occasional CL wear. During the ongoing pandemic, eye care practitioners should reinforce CL patient education to minimize the risk of SARS-CoV-2 infection and CL-related complications requiring clinical care.

### 1. Introduction

An outbreak of a new coronavirus disease (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), emerged in China by the end of 2019, and quickly spread to the rest of the world. The World Health Organization (WHO) declared, on 11 March 2020, the COVID-19 outbreak a global pandemic [1], with some countries like Italy or Spain being particularly affected. The authorities in many countries have adopted various measures to avoid the spread of the virus and the overcharging of hospitals, going so far as to restrict the free movement of people in some cases. To this end, on 14 March the Spanish government formally declared a state of emergency over the coronavirus, adopting extraordinary measures that placed the entire country in lockdown, with some exceptions for essential activities such

as supermarkets or pharmacies [2]. Therefore, the COVID-19 pandemic has rapidly affected daily life.

According to the European Centre for Disease Prevention and Control, the SARS-CoV-2 is mainly transmitted from human-to-human via respiratory droplets that can be inhaled, when people interact in close proximity, or via direct contact when shaking hands or indirect contact by touching contaminated surfaces, and then touching their own mouth, nose or eyes [3–5]. Some authors have also proposed ocular surfaces as potential targets for COVID-19 infection [6–8]. In addition, there are a few references reporting COVID-19 patients suffering conjunctivitis [4, 8–10] and additionally the SARS-CoV-2 have been detected, although rarely, in the tears and conjunctival secretions of patients with COVID-19 [4,10–13]. Therefore, the fact that COVID-19 can be transmitted through tears is controversial [4,10], but as available evidence

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about COVID-19 is rapidly increasing, it is important to keep up to date about current knowledge.

The impact of COVID-19 on daily life is not unrelated to contact lens (CL) wear and practice [5,14]. CLs are currently a very popular and safe alternative to spectacles with a very low incidence of related complications [15–18]. These complications may range from the less severe including discomfort, inflammation or dryness to the more serious adverse events such as microbial keratitis [16,19–21]. Viral conjunctivitis is the most common form of infectious conjunctivitis overall [22], however it is not a known complication of CL wear. Although the first studies showed no relationship between CL wear and COVID-19 infection [14,23], a work describing the persistence of coronaviruses on inanimate surfaces such as silicone rubber [24] has led some practitioners to suggest that CL wearers may be at increased risk of infection with COVID-19, recommending cessation of CL wear during the COVID-19 pandemic [25]. The aim of this study is to investigate the behaviour of CL wearers in Spain during the COVID-19 pandemic, specifically to identify the reasons of the possible changes in CL wear patterns and their perceived risk of infection due to CL wear.

## 2. Methods

### 2.1. Participants

Participation in the study was voluntary and informed consent was explicit when a participant submitted the questionnaire. The study sample includes CL wearers  $\geq 18$  years of age who were invited to participate in an online survey to assess the impact of the COVID-19 pandemic on their CL wear. The research was carried out in accordance with the tenets of the Declaration of Helsinki and received ethics approval from the University of Murcia Ethics Committee.

### 2.2. The questionnaire

This descriptive study employed online data collection using an anonymized web-based questionnaire hosted on Google Forms (Google Inc., CA, USA). The questionnaire was developed by the authors and further reviewed by a group of CL wearers to ensure understanding and comprehension of the questions with ease and the required time to complete it. Refinements to the questionnaire based on the feedback received during the pilot test were made when needed. Responses from this group were not included in final data of the study. The time needed to answer the questionnaire was approximately 5 min.

The questionnaire was made available via an online link on social networks from 25 April to 1 May 2020, when national lockdown was tightened in Spain and included all non-essential workers. The questionnaire was organized into five sections: General demographic information (age, gender, education level and number of inhabitants on his/her city town), basic questions related to CL history (i.e. type and modality of CL, wearing time per day or contact lens experience), activity during the pandemic, perceived risk of infection due to CL wear during the pandemic and CL wear during the pandemic, with a total of 33 questions. Subsequently all data was exported to Excel spreadsheets (Microsoft Excel, Microsoft Corporation, Redmont, WA, USA).

### 2.3. Statistical analysis

Completed surveys were used in the analyses. Data were analysed using the statistical Package for Social Sciences (SPSS) software version 24 (International Business Machine Corp. IBM, Chicago, IL, USA). Univariate analyses (chi-square test) were performed. Level of significance was set at  $p < 0.05$ .

**Table 1**  
Demographic characteristics of the participants (n = 737).

Characteristics	N (%)	
Gender	Female	499 (67.7 %)
	Male	238 (32.3 %)
Age	18 - 30	562 (76.2 %)
	31 - 45	97 (13.2 %)
	46 - 65	78 (10.6 %)
Education	Undergraduate	177 (24 %)
	Postgraduate	560 (76 %)
City/Town population	< 10,000	110 (14.9 %)
	10,001–20,000	114 (15.5 %)
	20,001–100,000	165 (22.4 %)
	100,001–500,000	176 (23.9 %)
	> 500,001	125 (17 %)
	Don't know	47 (6.4 %)

**Table 2**  
CL wear profile of participants (n = 737).

Information	N (%)	
CL experience	< 6 months	21 (2.8 %)
	6 – 12 months	31 (4.2 %)
	12 – 24 months	54 (7.3 %)
	> 24 months	631 (85.6 %)
Type of CL	Soft CL	701 (95.1 %)
	Gas permeable CL	36 (4.9 %)
Place of purchase	Eye care practitioner	713 (94 %)
	Internet	44 (6%)
CL wearing days per week	Every day	406 (55.1 %)
	Occasional wear	331 (44.9 %)
CL wearing time per day	< 6 h	135 (18.3 %)
	6 – 12 h	471 (63.7 %)
	> 12 h	131 (17.8 %)

## 3. Results

### 3.1. Participants' demographics

A total of 737 participants with an average age of 27.4 ( $\pm 9.4$ ) years completed the online questionnaire. Of them, 67.7 % were female and 32.3 % male. Participants demographics are shown in Table 1.

### 3.2. Contact lens wear profile and behaviours

CL wear profile of participants is shown in Table 2. The vast majority of the study population reported at least two years of soft CL wear and purchased their CL from their eye care practitioner (Table 2). Over half of them wore their CL every day before the declaration of the COVID-19 pandemic, and most of them wore their CL between 6 and 12 h per day (Table 2). Reasons for CL wear include comfort, dislike for spectacles, cosmetics, practitioner recommendations or to improve vision (Fig. 1). Finally, almost all of the participants (666; 90.4 %) had spectacles with their current prescription to replace their CL.

### 3.3. Activity during the COVID-19 pandemic and perceived risk of infection

More than half of the participants (437; 59.3 %) were living in a lockdown situation (neither their activity nor that of the people with whom they lived had led them to get involved with other people). Only 69 (9.3 %) participants thought that someone they lived with had become infected with COVID-19 and only 78 (10.4 %) have had symptoms consistent with COVID-19.

Interestingly, there was a statistically significant relationship

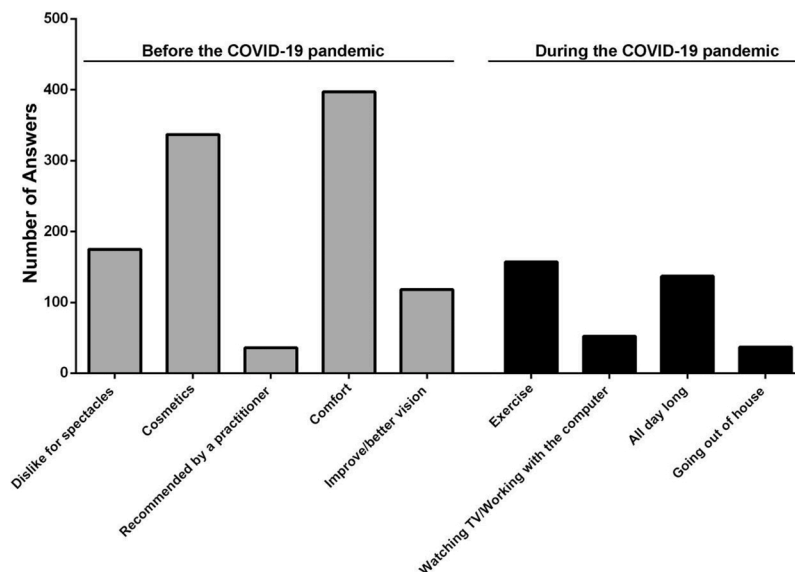


Fig. 1. Reasons for CL wear.

**Table 3**  
Perceived risk of infection and CL wear during the COVID-19 pandemic (n = 737).

		Perceived risk of infection due to CL wear			
		Yes	No	Total	
CL wear during the COVID-19 pandemic	Yes	N	144	254	398
		% by perceived risk of infection	46.8 %	59.2 %	54 %
	No	N	164	175	339
		% by perceived risk of infection	53.2 %	40.8 %	46 %
Total		N	308	429	737
		% by perceived risk of infection	100 %	100 %	100 %

CL wearers that were concerned about the increased risk of infection due to CL wear are more likely to discontinue CL wear ( $\chi^2(1) = 11.195, p < 0.05$ ).

( $\chi^2(1) = 11.195, p < 0.05$ ; Table 3) between those who were concerned about the increased risk of infection due to CL wear (308; 41.8 %) and those who discontinued CL wear (339; 46 %). Surprisingly, most of the participants reported not having sought information on the safety of CL wear during the COVID-19 pandemic (Fig. 2), even when most of them agreed with the need for further information from authorities (Fig. 2C).

3.4. CL wear during the COVID-19 pandemic

A total of 339 participants have ceased CL wear during the COVID-19 pandemic (Table 3). Most of them indicated that they will probably resume CL wear if the COVID-19 pandemic ends (93.2 %; Fig. 3) or if lockdown ends (77.9 %), even if the pandemic is not over. The most common reason for CL discontinuation was the decreased need to wear CL when at home (Fig. 3).

Interestingly, of those participants who needed to replace their CLs during the COVID-19 pandemic, 238 (32.3 %) have ceased CL wear because they had no replacements available, while 39 (5.3 %) did not comply with the replacement schedule and kept wearing their CLs, and 22 (3%) purchased their replacements online.

There was a statistically significant relationship ( $\chi^2(4) = 31.982, p < 0.05$ ; Table 4) when comparing the frequency of CL wear before and during the COVID-19 pandemic, with users reporting wearing CLs less than usual (Fig. 4). Specifically, from those who kept wearing their CLs during the pandemic, a 70.9 % used to wear their CLs every day before the pandemic, while during the pandemic this percentage decreases to 38.2 % (Table 4). Consequently, the percentage of participants wearing their CLs a few days a week increases from 29.1 % to 61.8 % (Table 4), which is consistent with the fact that the main reason for CL wear during the COVID-19 pandemic is exercise (Fig. 1).

Regarding compliance with CL care and hand hygiene, over half of the participants that kept wearing their CLs during the COVID-19 pandemic (226; 56.8 %) indicated that they included a rub and rinse step when cleaning their CL as much as they did before the COVID-19 pandemic, with only 41 (10.3 %) indicating that they have reinforced

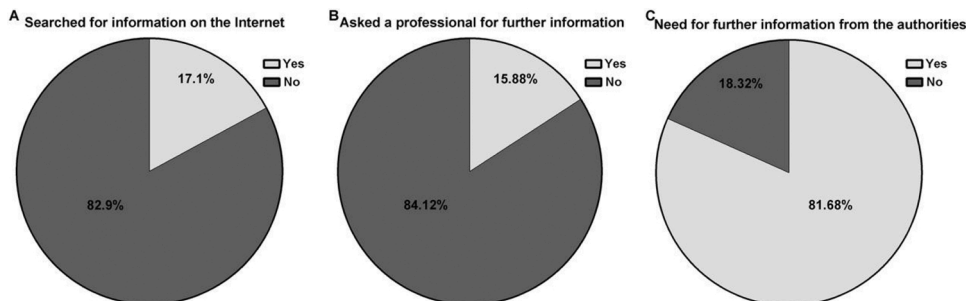


Fig. 2. Search for COVID-19 information (n = 737).

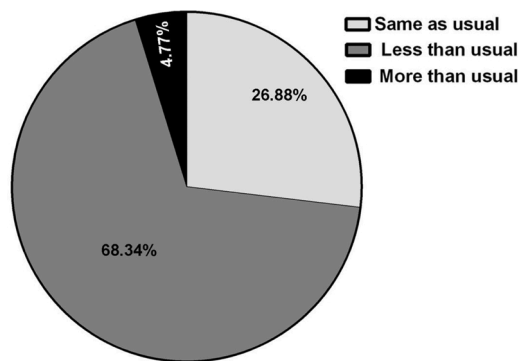
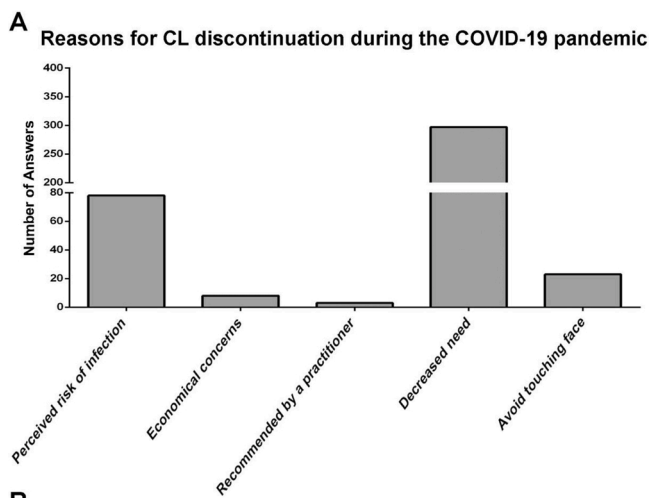


Fig. 4. CL wear compared to before the COVID-19 pandemic. (n = 398).

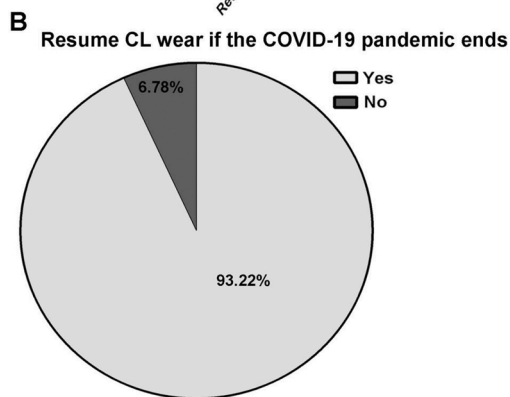


Fig. 3. CL discontinuation during the COVID-19 pandemic. (n = 339).

it. In addition, less than half of them (166; 41.8 %) washed their hands more frequently during the COVID-19 pandemic and only 155 (38.9 %) always followed the 20-second rule, while 61 (15.3 %) participants claimed not to know this rule.

Finally, just over half of the 398 participants that kept wearing their CLs during the COVID-19 pandemic (213) would consider discontinuing CL wear if they became infected with COVID-19 (Fig. 5).

4. Discussion

The COVID-19 pandemic has abruptly changed daily life. The aim of this study is to provide information on how this situation has affected CL wear. The present study identifies a discontinuation rate of CL wear due to the COVID-19 pandemic of 46 %, despite the fact that 90.4 % have updated glasses. The majority of CL wearers who discontinued indicated that they will probably resume CL wear if the COVID-19 pandemic ends. According to the reasons that participants gave for CL wearing, it is assumed that the most common explanation for CL discontinuation could be the decreased need of wearing them while at home in accordance with previous studies [14]. Indeed the majority of participants (85.8 %) indicated this reason for CL discontinuation, while over half of them do not have a concern for CLs increasing the risk of SARS-CoV-2 infection.

Although current evidence suggests that there is no relationship between CL wear and an increased risk of COVID-19 infection [23], there are some concerns related to CL wear: i) CL wearers must touch their face to apply and remove CLs; ii) The possible presence and transmission of the virus via the ocular surface [4,10,12,26], which could not be completely excluded [6,27]; and iii) Non-compliance in CL wear [28,29]. Indeed, if handling is considered a source of contamination of CLs [28], the main concern with CL wear could therefore be that SARS-CoV-2 could be transferred to CLs by hand contact during handling [23], and then from the CL to the ocular surface. According to this study, during the COVID-19 pandemic, 5.3 % of CL users in Spain are wearing their CLs beyond the recommended replacement interval, and 25.9 % indicated that they fail to follow rub and rinse during CL

Table 4 Comparison of CL wearing days per week before and during the COVID-19 pandemic (n = 398).

		CL wearing days per week before the pandemic				
		Every day	Occasional wear	Weekend	Total	
CL wearing days per week during the pandemic	Every day	N	134	15	3	152
		% during	88.2 %	9.9 %	2 %	100 %
		% before	47.5 %	18.3 %	8.8 %	38.2 %
		% over total	33.7 %	3.8 %	0.8 %	38.2 %
	Occasional wear	N	129	57	18	204
		% during	63.2 %	27.9 %	8.8 %	100 %
		% before	45.7 %	69.5 %	52.9 %	51.3 %
		% over total	32.4 %	14.3 %	4.5 %	51.3 %
	Weekend	N	19	10	13	42
		% during	45.2 %	23.8 %	31 %	100 %
		% before	6.7 %	12.2 %	38.2 %	10.6 %
		% over total	4.8 %	2.5 %	3.3 %	10.6 %
Total	N	282	82	34	398	
	% during	70.9 %	20.6 %	8.5 %	100 %	
	% before	100 %	100 %	100 %	100 %	
	% over total	70.9 %	20.6 %	8.5 %	100 %	

During the COVID-19 pandemic there is a significant increase in occasional CL wear ( $\chi^2(4) = 31.982, p < 0.05$ ).



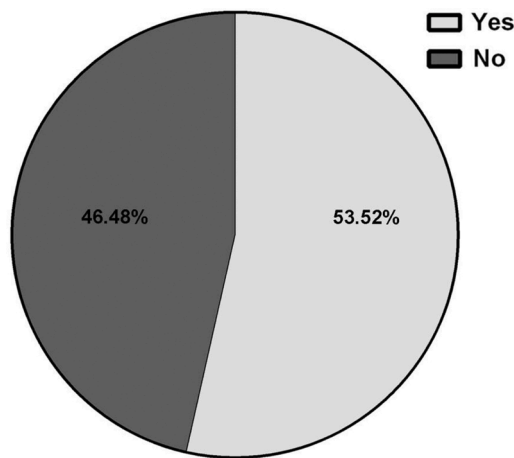


Fig. 5. CL wear discontinuation if infected by COVID-19. (n = 398).

cleaning. Moreover, 27.6 % of participants indicated that they were unaware of (or did not follow) the 20-second rule, even when hand washing is a general recommendation to avoid the spread of the SARS-CoV-2. Interestingly, previous works have identified these behaviours among those with a higher relative risk ratio of CL related complications [29,30]. Finally, 46.5 % of participants that are wearing CLs during the COVID-19 pandemic will not consider ceasing CL wear if they become infected by COVID-19, probably because they do not know that this is a general recommendation.

It is very interesting to note that the majority of respondents (87.9 %) indicated that no professional had offered them information related to CL wear and COVID-19, and that they had not sought it on their own (82.2 %), highlighting that there is a lack of information which could expose them to a higher avoidable risk of COVID-19 infection. These data highlight that eye care practitioners are probably failing to communicate with their patients. Therefore, as more is known about the SARS-CoV-2 and its pathogenesis to ascertain whether the ocular pathway is in fact a mode of transmission, eye care practitioners should strengthen their efforts to improve compliance with CL care and handling instructions given to their patients [29], which would minimize the risk of COVID-19 infection and CL-related complications [23, 31,32] requiring clinical care, and therefore could contribute to avoid the overcharge of the health care system in nations with imposed lockdown, which in Spain was one of the most restrictive in Europe [33].

This study has led to a very interesting observation, that during the COVID-19 pandemic there is a tendency to increase occasional CL wear. Presumably, this change is due to users restricting CL wear to some specific situations/activities or to minimize the risk of exposure to the SARS-CoV-2. During situations like the ongoing pandemic, when some users might be afraid of getting infected by wearing reusable CLs, daily disposable CLs would presumably reduce the rate of CL dropout and offer many advantages to patients [34,35]. Therefore, the questions arise, could the COVID-19 pandemic change the paradigm of CL use? Could most wearers switch from monthly replacement lenses to daily disposable lenses?

One of the limitations of this study is the low number of participants (78) that acknowledged to have had symptoms compatible with COVID-19. It would have been very interesting to have a higher number, as it would have given an idea of whether this circumstance change people's behaviour and therefore what future holds, given the increasing number of people that would presumably become infected by the SARS-CoV-2. Further studies, focused on this issue, are needed to clarify this fact.

In summary, this study shows that during the COVID-19 pandemic there is a relationship between the perceived risk of infection and CL dropout, and that there is a tendency to change the CL frequency of wear, with an increase in occasional CL wear. Based on the limited

evidence available to date, the apprehension that CL wear is a concern in the ongoing COVID-19 pandemic cannot be sustained, especially if patients follow the CL care guidelines provided by eye care practitioners, that should be the same as always. Furthermore, redoubling efforts to provide clinical advice to patients during the ongoing pandemic would not only minimize the risk of become infected by the SARS-CoV-2, but also general CL related complications, therefore minimizing their impact on the healthcare system. Further studies are required to investigate the ability of CL disinfectants to kill the SARS-CoV-2, or its interaction with the ocular surface and the tear film. Eye care practitioners should keep up to date to offer the best advice to their patients, based on the latest available evidence, to ensure that CL wear stays as a safe form of vision correction for millions of people around the world.

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