



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



## Patient – practitioner communication and contact lens compliance during a prolonged COVID-19 lockdown

Genis Cardona <sup>\*</sup>, Silvia Alonso, Anna Busquets

School of Optics and Optometry of Terrassa, Universitat Politècnica De Catalunya, c/Violinista Vellsola, 37, E08222, Terrassa, Spain

### ARTICLE INFO

#### Keywords:

Contact lens compliance  
Contact lens storage case  
COVID-19  
Handwashing  
Patient-practitioner communication

### ABSTRACT

**Purpose:** Ocular manifestations and ocular transmission of SARS-CoV-2 in contact lens (CL) wearers may be fostered by non-compliance with care and maintenance instructions which, in turn, may be aggravated by inadequate patient-practitioner communication. The purpose of this research was to determine CL use, compliance and patient-practitioner communication during a 3-month long COVID-19 lockdown in Spain.

**Methods:** An online survey (developed using Google Forms) retrospectively evaluated CL compliance during the 3-month lockdown (responses captured between 15th July and 10th August, 2020), with particular emphasis on patient-practitioner communication, handwashing practices and CL case hygiene and replacement.

**Results:** A total of 247 responses were collected and analysed. Most participants used monthly replacement soft lenses (64.8 %) and multipurpose solutions (75.7 %), with 86.6 % of them owning a storage case for their lenses. During lockdown, a significant percentage of participants ceased lens wear (28.4 %) or reduced wearing time (49.2 %). Regarding patient-practitioner communication, 54.3 % of respondents received specific instructions, mostly about handwashing (93.3 %) and storage case hygiene (48.5 %). The most frequent non-compliant practices were inadequate handwashing (36.4 %), and overextending monthly or two-weekly replacement lenses (35.2 %). Many respondents never cleaned (23.0 %) nor replaced (16.3 %) their storage case, and 27.8 % of them reported not having been informed about case hygiene by their practitioners.

**Conclusion:** Contact lens compliance, particularly in terms of handwashing and storage case hygiene, was poor during a prolonged COVID-19 lockdown, thus stressing the need to foster patient-practitioner communication strategies to curtail the possibility of ocular transmission and the risk of virus tropism.

### 1. Introduction

Following the statement of the Health World Organization declaring coronavirus disease 2019 (COVID-19) a pandemic [1], the rapidly increasing number of contagions and foreseeable saturation of the public and private health service intensive care units in Spain prompted the declaration of a nationwide State of Alarm on March 13, 2020, and a lockdown of all non-essential sectors was imposed on March 14, 2020. On April 28, 2020, the government announced a plan for easing lockdown restrictions consisting of four de-escalation phases to which different regions of Spain could progressively transition according to health indicators such as number of cases and capacity of the healthcare system. The State of Alarm ended on June 21, 2020. At the time of writing (August 13, 2020), the accumulated number of COVID-19 contagions in Spain is of 329,784, with a total death toll of 28,579 [2], and new restrictions are being imposed or considered to curtail new local

outbreaks of the disease.

Current existing evidence supports that contact lens (CL) wearers are not at increased risk of developing ocular complications related to COVID-19 [3]. Although the Severe Acute Respiratory Syndrome Coronavirus - 2 (SARS-CoV-2) has been found in tears of patients with and without conjunctivitis [4,5], studies on the actual occurrence or activation of the virus-binding angiotensin converting enzyme 2 (ACE2) on the intact ocular surface (cornea and conjunctiva) remain inconclusive [3,6]. In contrast, other receptors with coronavirus binding properties have been observed in dendritic cells and fibroblasts [7], opening the door to the possibility of opportunistic infection if the integrity of the ocular surface is compromised.

Contact lens compliance is, at best, a challenging aspect of CL wear, with reported pre-pandemic levels of non-compliance ranging from 40 % to 91 % depending on the characteristics of the study sample, modality of lens wear, care regime and other factors [8–10]. At both ends of

<sup>\*</sup> Corresponding author.

E-mail address: [genis.cardona@upc.edu](mailto:genis.cardona@upc.edu) (G. Cardona).

<https://doi.org/10.1016/j.clae.2021.02.019>

Received 17 August 2020; Received in revised form 10 February 2021; Accepted 28 February 2021

Available online 2 March 2021

1367-0484/© 2021 British Contact Lens Association. Published by Elsevier Ltd. All rights reserved.

the compliance spectrum, daily disposable lens wearers show the best adherence to replacement schedules [11], whereas lens case cleaning and replacement showed the least amount of compliance [12].

During the month of April, many international CL associations and regulatory bodies in Spain and worldwide [13–17] issued recommendations on CL compliance which stressed the need for strict handwashing routines, complete lens cleaning (including rubbing and rinsing) and disinfection, careful adherence to replacement schedules and lens cessation in those patients diagnosed with COVID-19 or experiencing symptoms compatible with COVID-19 or other conditions such as flu or cold. Although these recommendations were addressed to both practitioners and CL wearers, it is debatable whether they reached wearers if not via their eye care providers.

Fluid and frequent communication between practitioners and patients may have been hindered during the prolonged COVID-19 full lockdown and de-escalation phases in Spain, when many optometry practices were closed or only operating in case of emergencies. On the other hand, CL wearers may have developed different wear and compliance routines during these months, as they may have changed their wearing habits, experienced difficulties obtaining their lenses, opted for other lens and care products than recommended by their providers, or refrained from using lenses altogether. Indeed, a survey completed by 737 Spanish CL wearers at the end of April 2020 revealed that 46 % of them had ceased lens wear during the first month of lockdown, with a significant correlation between perceived risk of COVID-19 infection due to lens wear and discontinuation [18]. Interestingly, 87.9 % of respondents reported not having received any information related to lens wear and COVID-19 from their eye care providers and 5.3 % extended lens replacement beyond the recommended intervals. Another survey, distributed in Spain during the first week of May 2020 and collecting 260 responses, revealed that 67 % of participants used their CL less during lockdown and reported improved handwashing routines since the start of the pandemic, although 64 % of users followed inadequate storage lens case hygiene practices [19].

It was the aim of the present research to further explore different aspects of CL wear, mainly related to patient-practitioner communication, as well as compliance with care and maintenance, with special attention to handwashing and case cleaning and replacement, during the 3-month lockdown and de-escalation period in Spain.

## 2. Methods

An ad hoc survey (available upon request from the authors) was developed using Google Forms (Google LLC, Mountain View, CA, US). The survey, in Spanish, was divided into 5 sections and required an estimated four minutes for its completion. The survey consisted of a combination of compulsory and non-compulsory items to allow respondents to skip questions not relevant to their particular use of contact lenses. The first section explored demographic details such as geographical location, age, gender, need for social interaction (graded from 0 to 10), current or past COVID-19 diagnosis and personal situation during lockdown (response options were staying at home or working at an essential service / taking care of relative), and at the moment of completing the survey. The second section collected information on current type and replacement schedule of CLs, care and maintenance products, use of CL storage case and habitual place of acquisition of CLs and maintenance products. The third section investigated whether during lockdown respondents had received specific information from their practitioners on CL care and replacement, handwashing, CL case cleaning and replacement and on how to proceed if new CLs or products were required. The fourth section explored changes in CL use during lockdown and different aspects related to CL compliance, with particular attention to handwashing and CL case hygiene and replacement. These aspects were explored through multiple-response items in which participants could tick more than one answer and including “either-or” type responses. Finally, on section five respondents were asked to rate (from

0 to 10) their perceived risk of CL wear during the COVID-19 crisis, whether they had searched for online information on CL wear and COVID-19 (respondents could provide links to their information sources) and, if they also used spectacles, whether they believed that spectacles provided adequate protection against SARS-CoV-2 infection. Survey items were designed on the basis of the experience of the authors and on published literature on contact lens compliance [8–12].

The survey link was distributed between July 15, 2020 and August 10, 2020 through personal and social networks by following a snowballing sampling strategy in which respondents were instructed to recruit future subjects from among their acquaintances. Participation was voluntary, responses were anonymous and no identifiable data were collected. Consent was evidenced by the action of submitting the complete questionnaire and on the first page of the survey a contact email was provided in case participants needed additional information before answering the survey. This study was part of a larger research effort exploring several aspects of contact lens compliance which was approved by an Institutional Review Board (Universitat Politècnica de Catalunya). The study followed the tenets of the Declaration of Helsinki.

The IBM Statistical Package for the Social Sciences (SPSS) Statistics v.25 (IBM Corp. NY, US) was used for statistical analysis following prior data review and cleaning. Responses are summarized as frequencies, means and standard deviations or medians, and non-parametric analysis was employed for inferential statistics (Chi-square and Spearman coefficient of correlation). A p-value of 0.05 or less was considered to denote statistical significance.

## 3. Results

### 3.1. Participant demographics

A total of 249 responses were collected which, following manual data review for inconsistencies (for example, ticking both “either-or” items) or incomplete surveys, and subsequent cleaning, resulted in 247 valid completed surveys. Participant age was  $28.0 \pm 10.4$  years. Seventy-six percent of respondents were female. Only two participants (0.81 %) had been positively diagnosed of COVID-19. In terms of work situation at the moment of responding the survey, 39.3 % were traveling to work, 36.4 % of respondents were students, 16.2 % were working from home and 8.1 % were either unemployed or awaiting the resolution of a redundancy plan. During lockdown, however, the majority of respondents (82.6 %) stayed at home and only went out when strictly necessary.

### 3.2. Contact lens wear and care at the moment of responding the survey (n = 247)

Regarding CL wear at the moment of completing the survey, most respondents used soft lenses (96.4 %) and reported following a monthly replacement schedule (64.8 %) (Fig. 1). Of note, 9.7 % of participants

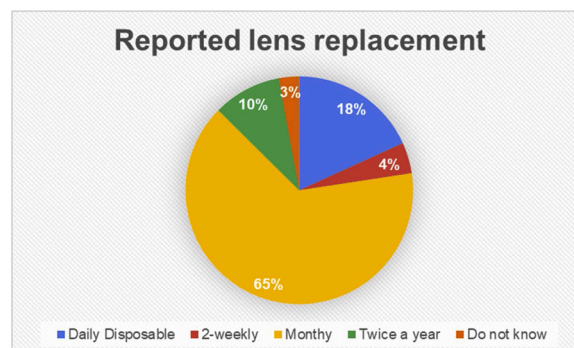


Fig. 1. Reported contact lens replacement schedule (n = 247 responses).

reported replacing their lenses twice a year, and 2.9 % of them did not know or remember their replacement schedule. In terms of care and maintenance, 75.7 % of respondents used a multipurpose solution, 2.7 % used a peroxide-based solution and 7.3 % reported other options, while 14.3 % did not know or remember the type of solution they used. Most respondents (86.6 %) owned a storage case for their lenses. Finally, 90.0 % of participants acquired their CLs in optometric practices (with a preference for nationwide optical retail chains), and 10.0 % ordered them online. Responses of users unsure of replacement schedule and/or type of solution, as well as those of rigid gas permeable lens wearers, were excluded from the analysis of other items referring to CL replacement and solutions during lockdown.

### 3.3. Patient-practitioner communication during lockdown (n = 247)

More than half of the respondents (54.3 %) received specific instructions from their eye care providers during the lockdown. When asked about how practitioners preferred to communicate with them, respondents noted that practitioners favoured telephone communication (37.3 %), followed by instant message services (19.4 %), letter or email (18.7 %) or other (24.6 %). Of these communications, 93.3 % stressed the need of complete handwashing prior to manipulating CLs, 48.5 % offered recommendations regarding hygiene of the storage case, and 40.3 % and 34.3 % provided instructions on how to proceed if new CLs or care products were needed and in case of emergency, respectively. Only 13.4 % and 5.2 % of the communications recommended a change in CL type / replacement schedule or care and maintenance regime, respectively. In particular, only one practitioner advised a change from multipurpose solution to a peroxide-based solution and none of the communications recommended a change from monthly to daily replacement. A statistically significant difference was found when comparing the percentage of eye care providers offering specific instructions to their patients and the type of optometric centre ( $\chi^2 = 7.894$ ;  $p = 0.005$ ). Overall, practitioners from small independent optometric centres were more communicative than those from large nationwide optical chains. Interestingly, only 6.5 % of respondents were proactive in searching information on CL wear and COVID-19 on their own (two links were provided, leading to non-specialized websites).

### 3.4. Contact lens wear and care during lockdown (n = 202)

During lockdown, a significant proportion of participants ceased lens wear completely (28.4 %) or used them less hours (49.2 %) (Fig. 2), while a small number of respondents either made no change to (19.8 %) or increased wearing time (2.6 %). Amongst the reasons for ceasing lens wear or reducing the number of hours, a lack of need when staying at home was the most frequently cited option (85.7 %), followed by "to save money" (9.4 %), with only 0.5 % of respondents reporting concern with the safety of lens wear as the reason for lens cessation. In this context, perceived risk of CL wear during COVID-19 was graded with a

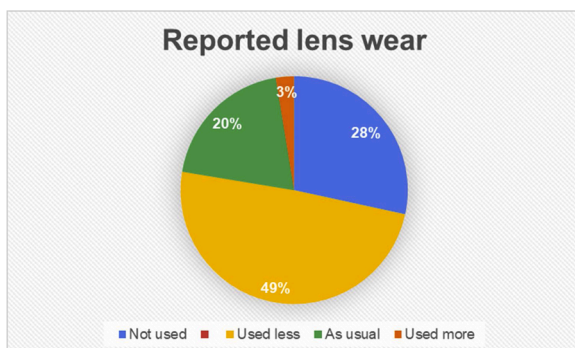


Fig. 2. Reported use of contact lenses during lockdown (n = 202 responses).

median of 4 (ranging from 0 to 10). No statistically significant correlation was found between perceived risk and neither age, nor need for social interaction (graded from 0 to 10). When asked to provide a reason for their perception of increased risk, 83.0 % of those participants grading perceived risk with a score of 5 or more noted concern with the possibility of virus transmission between hands and CL / ocular surface.

Fig. 3 summarizes the most frequently reported non-compliant practices of those respondents using CLs during lockdown (n = 145). Percentages add to more than 100 %, as many users reported more than one instance of non-compliance. In particular, the most frequent non-compliant practice was inadequate handwashing (36.4 %), followed by extending the replacement date of monthly or two-weekly CLs (35.2 %) and extending solutions beyond their relative expiration date (16.1 %). Of interest, 21.3 % of participants reported both overextending their CL replacement and inadequate handwashing, and 9.7 % added extending solutions to those practices. Of those participants using their CLs during lockdown, 29.2 % selected the "none of the above" response option.

A statistically significant trend was observed between perceived risk of lens wear during the COVID-19 pandemic and the number of reported non-compliant practices ( $\rho = -0.237$ ;  $p = 0.005$ ) in which compliance improved in those wearers considering CL wear more dangerous. Non-compliance was not found to be associated with age or need for social interaction, and gender was not a factor influencing compliance.

### 3.5. Handwashing during lockdown (n = 145)

Upon examining with more detail handwashing practices of respondents using their CL during lockdown (n = 145), most participants reported using a non-disposable cloth towel to dry their hands (51.2 %), followed by not always washing hands before lens removal (46.4 %) or lens insertion (38.1 %) (Fig. 4). Although 51.1 % of respondents always used water and soap to clean their hands, almost one third of these failed to dry their hands correctly. The most common combination of handwashing malpractices was failing to clean hands before lens insertion and lens removal (35.4 %).

### 3.6. Storage case hygiene and replacement during lockdown (n = 143)

Regarding storage case hygiene, 27.8 % of those respondents using a storage case for their CLs during lockdown (n = 143) admitted never having received instructions on cleaning or replacing it. Although 21.1 % and 15.2 % of participants cleaned their cases at least once a week or replaced them once a month, respectively, a similar percentage never cleaned (23.0 %) or never replaced (16.3 %) them (Fig. 5). Thirteen

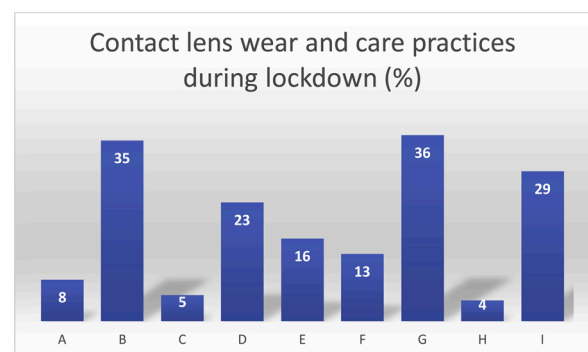
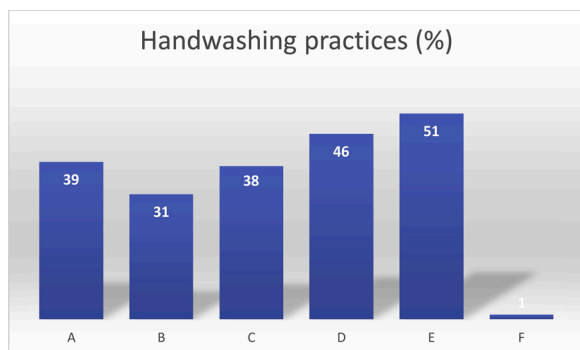
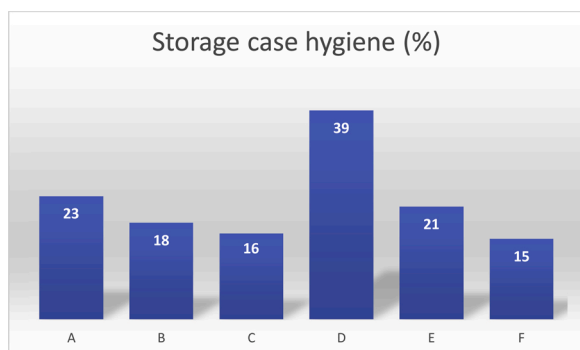


Fig. 3. Reported frequency of contact lens use, care and maintenance practices during lockdown (n = 145 responses). A: Buy CLs or solutions from non-habitual physical retailer; B: Extend monthly or two-weekly replacement; C: Extend daily replacement; D: Extend solutions; E: Sleep with CLs when not recommended; F: Use tap water with CLs; G: Inadequate handwashing; H: Change brand or type of CLs or solutions when not recommended; I: None of the above.



**Fig. 4.** Reported frequency of handwashing practices during lockdown ( $n = 145$  responses). A: Always clean with water and soap before lens manipulation; B: Not always use soap; C: Not always wash hands before lens insertion; D: Not always wash hands before lens removal; E: Use of a cloth towel to dry hands; F: Blow dry hands.



**Fig. 5.** Reported frequency of non-compliant contact lens storage case hygiene and replacement during lockdown ( $n = 143$  responses). A: Never clean; B: Clean when I remember; C: Never replace; D: Replace when I remember; E: Clean at least once a week; F: Monthly replacement.

respondents (9.1 %) never cleaned and never replaced their storage cases.

### 3.7. Considerations on spectacle wear and protection against SARS-CoV-2 ( $n = 247$ )

Finally, 35.6 % of participants acknowledged their belief that common spectacle wear offered protection against ocular transmission of SARS-CoV-2.

## 4. Discussion

In Spain, visual health is mainly provided by licenced optometrists working in private or ophthalmological practices or large nationwide optical retail chains. During lockdown and the first phases of de-escalation, most optometric practices in Spain remained closed, while some of them operated only in case of emergency and always requiring prior telephone or online appointment.

Results of the present survey of CL wearers revealed that 96.4 % of respondents used soft lenses, a percentage larger than that reported by Morgan et al. in their 2019 International Contact Lens Prescription Survey, although that survey was addressed to practitioners and not final users [20]. Respondents ceased lens wear (34.4 %) or reduced wearing time (48.6 %) during the 3-months COVID-19 lockdown. These findings are in agreement with previous surveys conducted at the start of the lockdown period in Spain [18,19] and also in the UK and Ireland [21, 22]. The main reason for ceasing lens wear or reducing wearing time was a “lesser need” of them at home.

In contrast with previous research conducted at the start of the lockdown period in Spain, in which 87.9 % of respondents noted not receiving any specific instructions from their eye care providers [18], more than half of the present participants were contacted by their practitioners with information on CL wear during the COVID-19 pandemic. This information highlighted the need for correct handwashing (93.3 % of communications) and hygiene of the storage case (48.5 % of communications). The improvement in patient-practitioner communication probably reflected the growing body of scientific evidence on CL wear and COVID-19, in particular the review paper by Jones and co-workers [3], published in April 2020, which was the source of the recommendations issued by many regulatory institutions, amongst them those of the Spanish Consejo General de Colegios de Ópticos-Optometristas (CGCOO) [13]. These recommendations were sent by direct email to all licenced optometrists in Spain (more than 17,000) and also included information on how to proceed with patient referral, emergency visits and individual protection and hygiene at the office, amongst others. Interestingly, a second survey distributed in Spain at the beginning of May 2020 already revealed improved handwashing routines, thus evidencing the growing general concern on halting virus transmission [19].

Most patient-practitioner communications did not include modifications in replacement schedules (such as changing from monthly replacement to daily disposable lenses) or, with one exception, care and maintenance strategies (such as changing from multipurpose to peroxide-based solutions). This may be a conservative approach in which the opportunity to improve CL wear safety was considered less imperative than the alternative of maintaining the current successful fitting and care scheme, given the difficulty to physically attend many optometric centres. However, it must be acknowledged that with the available information the reasons compelling practitioners to recommend different CL replacement schedules could not be determined. In addition, as the exact moment and frequency patient-practitioner communication took place was not investigated, it is unclear whether these recommendations actually arose from recently published scientific evidence about CL wear and COVID-19 [3].

Overall, several typical non-compliant practices were also noted during the lockdown period, such as overextending replacement times (more evident in monthly replacement schedules), overextending solutions beyond their relative expiration dates or sleeping with CLs when not recommended. In addition, even if most practitioners provided instructions on how to proceed if new CLs or solutions were required, a percentage of respondents opted to acquire their CLs and solutions at non-habitual optometric practices or online, even at the expense of changing brands of CLs and solutions. Inadequate handwashing was also widely reported, both before inserting and removing CLs, with many participants using non-disposable cloth towels to dry their hands. The need for adequate handwashing and drying of hands, which is critical to avoid ocular transmission of pathogens in general and SARS-CoV-2 in particular, needs to be reinforced with detailed clear-cut instructions from practitioners, once again emphasising the relevance of fluid patient-practitioner communication advocated by previous researchers [3,23,24]. A recent survey of CL compliance in UK and Ireland described better handwashing practices in these countries, with 96.0 % of participants using soap and water to clean their hands, although the use of cloth towels was also frequently reported [22]. It would be interesting to compare the instructions offered by eye care providers in UK and Ireland with those of their Spanish counterparts to determine how is handwashing explained to CL wearers.

Interestingly, many respondents noted they did not clean or periodically replace their CL case, in agreement with published literature [12], and a large percentage (27.8 %) of them claimed they had never been instructed about case hygiene by their eye care providers. Other authors have also noted that even compliant CL wearers may not be aware of the need for proper storage case care and replacement [10]. The relevance of this finding is highlighted by the documented half-life

of SARS-CoV-2 on plastic surfaces of up to 16 h [25], although future studies are required to determine whether SARS-CoV-2 can be isolated from the interior, and the exterior, of used CL cases. Indeed, many CL wearers, including daily disposable users, carry their cases in their possibly less than aseptic handbags, and may manipulate them after washing their hands: if the order of handwashing and case manipulation is not correct, a recurrent situation may present in which hands and the outside of cases contaminate one another, resulting in subsequent transferral of pathogens to both CLs and the ocular surface, and in an increase in the viral load on the tear film [26]. Although evidence suggests that ocular surface manifestations of SARS-CoV-2 may be limited to infrequent cases of conjunctivitis, the possibility of tropism from the ocular surface to respiratory tissues and the gastrointestinal tract by way of tears evacuated through the puncta, the nasolacrimal duct and into the nasopharyngeal space needs to be considered [27,28], thus stressing the need to prevent initial transmission to the ocular surface of the virus.

It is also worth noting that 35.6 % of participants thought that spectacle lens wear offered them protection against SARS-CoV-2 ocular infection, in contrast to published evidence [3] but reflecting popular belief fostered by some media outlets. Therefore, it is also critical to provide wearers with instructions on spectacle wear, as those users ceasing CL wear may feel misguidedly safe with their spectacles.

Although survey response presented a good geographical distribution, most completed surveys (82.3 %) were from the metropolitan area of Barcelona, thus limiting the extrapolation of the current findings to more rural areas of Spain, in which access to operating optometric centres may have been more challenging. Besides, as in most study designs based on voluntary surveys, findings may be influenced by non-response bias and the nature of the employed sampling procedure did not allow to estimate participation rate. In addition, it must be considered that some responses may not be completely reliable, as the survey was retrospective and required participants to remember specific details of CL wear and care, such as the exact expiration date of solutions. Also, the study only explored soft CL wear (with a larger percentage of reusable than daily disposable CLs, as well as multipurpose solutions). Users of these types of CLs may be assumed to present a different set of behaviours to those of other wearing modalities, such as rigid or orthokeratology lenses. In addition, even if the present findings do not separate wearers according to replacement schedule, users were directed to response options only applicable to their wearing modality (e.g., “extend monthly or two-weekly replacement”, “extend daily replacement”, etc.). A larger sample, with a more evenly distributed percentage of replacement schedules and care regimes, would be needed to independently and fully explore each of these options. Finally, it is debatable whether these results may have application in other countries with a different regulation of optometric practice. However, given the ubiquity of non-compliant behaviours, particularly in terms of lens case hygiene, it may be safely assumed that the present findings should prove useful to eye care providers worldwide.

In conclusion, although many CL wearers reported using their lenses less during the prolonged COVID-19 lockdown in Spain, and despite the efforts of practitioners to provide instructions to their patients, reported compliance with handwashing, programmed replacement and, particularly, storage case hygiene remained low. Fluid communication between practitioners and their patients, which is always important, is essential in these complex times. Practitioners need to provide wearers with precise, detailed, easy-to-follow instructions based on the latest scientific evidence and recommendations from the corresponding regulatory bodies.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Declaration of Competing Interest

The authors report no declarations of interest.

## References

- [1] World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19—11 March 2020. 2020 [Accessed 7 August 2020], <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020>.
- [2] Johns Hopkins University. COVID-19 dashboard by the center for systems science and engineering, <https://www.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6> [Accessed 13 August 2020].
- [3] Jones L, Walsh K, Willcox M, Morgan P, Nichols J. The COVID-19 pandemic: important considerations for contact lens practitioners. *Cont Lens Anterior Eye* 2020;43:196–203. <https://doi.org/10.1016/j.clae.2020.03.012>.
- [4] Xia J, Tong J, Liu M, Shen Y, Guo D. Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection. *J Med Virol* 2020;92:589–94. <https://doi.org/10.1002/jmv.25725>.
- [5] Xie HT, Jiang SY, Xu KK, Liu X, Xu B, Wang L, et al. SARS-CoV-2 in the ocular surface of COVID-19 patients. *Eye Vis (Lond)* 2020;7:23. <https://doi.org/10.1186/s40662-020-00189-0>.
- [6] Lang J, Yang N, Deng J, Liu K, Yang P, Zhang G, et al. Inhibition of SARS pseudovirus cell entry by lactoferrin binding to heparan sulfate proteoglycans. *PLoS One* 2011;6:e23710. <https://doi.org/10.1371/journal.pone.0023710>.
- [7] Willcox MDP, Walsh K, Nichols JJ, Morgan PB, Jones LW. The ocular surface, coronavirus and COVID-19. *Clin Exp Optom* 2020;103:418–24. <https://doi.org/10.1111/cxo.13088>.
- [8] Hickson-Curran S, Chalmers RL, Riley C. Patient attitudes and behavior regarding hygiene and replacement of soft contact lenses and storage cases. *Cont Lens Anterior Eye* 2011;34:207–15. <https://doi.org/10.1016/j.clae.2010.12.005>.
- [9] Efron N. The truth about compliance. *Cont Lens Anterior Eye* 1997;20:79–86. [https://doi.org/10.1016/s1367-0484\(97\)80002-1](https://doi.org/10.1016/s1367-0484(97)80002-1).
- [10] Rueff EM, Wolfe J, Bailey MD. A study of contact lens compliance in a non-clinical setting. *Cont Lens Anterior Eye* 2019;42:557–61. <https://doi.org/10.1016/j.clae.2019.03.001>.
- [11] Dumbleton KA, Richter D, Woods CA, Aakre BM, Plowright A, Morgan PB, et al. A multi-country assessment of compliance with daily disposable contact lens wear. *Cont Lens Anterior Eye* 2013;36:304–12. <https://doi.org/10.1016/j.clae.2013.05.004>.
- [12] Morgan PB, Efron N, Toshida H, Nichols JJ. An international analysis of contact lens compliance. *Cont Lens Anterior Eye* 2011;34:223–8. <https://doi.org/10.1016/j.clae.2011.08.001>.
- [13] Argudo-Iturriaga M, Valero T, García-Lázaro S, Pérez-Cambrodí RJ. Consejo General de Colegios de Ópticos-Optometristas de España (CGCOO). Protocolos de higienización y seguridad en los establecimientos sanitarios de óptica y otros lugares de ejercicio profesional. Versión 1.1. June 2020. 2020 [Accessed 25 July 2020], <http://www.cgcoo.es/comunicados-covid-19>.
- [14] The College of Optometrists. Coronavirus (COVID-19) pandemic: guidance for optometrists. 2020 [Accessed 8 August 2020], <https://www.college-optometrists.org/the-college/media-hub/news-listing/coronavirus-covid-19-guidance-for-optometrists.html>.
- [15] British Contact Lens Association (BCLA). Contact lens wear and coronavirus (COVID-19) guidance. 2020 [Accessed 12 July 2020], <https://www.bcla.org.uk/Public/Public/Consumer/Contact-lens-wear-and-Coronavirus-covid19-guidance.aspx>.
- [16] International Association of Contact Lens Educators (IACLE). IACLE position statement on COVID-19 pandemic and contact lens wear. 2020 [Accessed 22 July 2020], <https://iacle.org/industry-informer-position-statement-covid-19/>.
- [17] American Optometric Association (AOA). Contact lens wear & coronavirus. Do's & Don'ts. 2020 [Accessed 22 June 2020], <https://www.aoa.org/patients-and-public/caring-for-your-vision/contact-lenses/dos-and-donts>.
- [18] García-Ayuso D, Escámez-Torrecilla M, Galindo-Romero C, Valiente-Soriano FJ, Moya-Rodríguez E, Sobrado-Calvo P, et al. Influence of the COVID-19 pandemic on contact lens wear in Spain. *Cont Lens Anterior Eye* 2020. <https://doi.org/10.1016/j.clae.2020.07.002>.
- [19] Vianya-Estopa M, García-Porta N, Piñero DP, Simo Mannion L, Beukes EW, Wolffsohn JS, et al. Contact lens wear and care in Spain during the COVID-19 pandemic. *Cont Lens Anterior Eye* 2020. <https://doi.org/10.1016/j.clae.2020.11.001>.
- [20] Morgan PB, Tranoudis IG, Efron N, Jones L, Merchan NL, et al. International contact lens prescribing in 2019. *Contact Lens Spectrum* 2020;35:26–32. Available at: <https://www.clspectrum.com/issues/2020/january-2020/international-contact-lens-prescribing-in-2019> [Accessed 28 December 2020].
- [21] Morgan PB. Contact lens wear during the COVID-19 pandemic. *Cont Lens Anterior Eye* 2020;43(3):213. <https://doi.org/10.1016/j.clae.2020.04.005>.
- [22] Vianya-Estopa M, Wolffsohn JS, Beukes E, Trott M, Smith L, Allen PM. Soft contact lens wearers' compliance during the COVID-19 pandemic. *Cont Lens Anterior Eye* 2020. <https://doi.org/10.1016/j.clae.2020.08.003>.
- [23] Orsborn G. The importance of credible information about contact lens wear during pandemic. *Cont Lens Anterior Eye* 2020;43:214–5. <https://doi.org/10.1016/j.clae.2020.04.008>.
- [24] Cho P, Boost M. COVID 19-An eye on the virus. *Cont Lens Anterior Eye* 2020;43:313–4. <https://doi.org/10.1016/j.clae.2020.05.011>.

- [25] van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 2020;382(16):1564–7. <https://doi.org/10.1056/nejmc2004973>.
- [26] Wu YT, Willcox MD, Stapleton F. The effect of contact lens hygiene behavior on lens case contamination. *Optom Vis Sci* 2015;92:167–74. <https://doi.org/10.1097/oxp.0000000000000477>.
- [27] Hong N, Yu W, Xia J, Shen Y, Yap M, Han W. Evaluation of ocular symptoms and tropism of SARS-CoV-2 in patients confirmed with COVID-19. *Acta Ophthalmol* 2020. <https://doi.org/10.1111/aos.14445>.
- [28] Sadhu S, Agrawal R, Pyare R, Pavesio C, Zierhut M, Khatri A, et al. COVID-19: Limiting the risks for eye care professionals. *Ocul Immunol Inflamm* 2020;28(5): 714–20. <https://doi.org/10.1080/09273948.2020.1755442>.