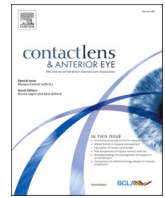




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## Current approaches to soft contact lens handling training – Global perspectives

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## ABSTRACT

**Purpose:** All neophyte contact lens wearers require training on how to handle contact lenses. Currently, almost no published information exists describing the most common approaches used by those involved in such training in soft contact lens wearers. This study aimed to gather information on the approaches taken by those conducting this training worldwide.

**Methods:** An online survey was created in English and translated to Spanish and distributed internationally via social media, conference attendees, and professional contacts. The anonymous survey included information on workplace setting of respondents, information about the typical approaches used for application and removal of soft contact lenses, length of the appointment, and success rate with their approach. Survey responses were received between May 2021 and April 2022.

**Results:** A total of 511 individuals completed the survey and responses were received from 31 countries with 48.7% from the UK. The most common approach taught for application was to have the patient hold the upper eyelashes (84.7%) and to hold the lower eyelid with the same hand as the lens (89.4%). Lenses were applied directly to the cornea by 57.7% of the respondents. The most common approach taught for lens removal was to drag the lens inferiorly from the cornea prior to removal (49.3%). Most respondents did not use videos to aid the teaching appointment (62.0%); however, they felt that their approach was successful in most cases (90). Application and removal training sessions lasted a median of 30 min and contact lenses were typically dispensed after the instructor witnessing successful application and removal three times.

**Conclusion:** Various methods are adopted globally for training of application and removal of soft contact lenses, with many advising a patient-specific approach is required for success. The results of this survey provide novel insights into soft contact lens handling training in clinical practice.

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## 1. Introduction

Eye care practitioners frequently perform contact lens handling and care training in clinical practice (often referred to as the “teach appointment”). The goal of this appointment is to educate new contact lens wearers as they start on their contact lens journey and provide education on how to care for them responsibly. Contact lens care information typically includes hand hygiene instructions, [1] importance of compliance with lens wear and care systems [2] including case cleaning, [3] how to check if a lens is inside-out or damaged, [4–7] instructions on avoiding overnight wear (if daily wear use has been prescribed) [8] and water exposure. [9,10].

Although information regarding contact lens application and removal training is provided in key textbooks as summarised in Table 1, [4–7] there is little evidence-based reasoning to support such handling training practices. [11,12] Walline et al. (2007) [13] compared the chair time associated with soft contact lens fittings in children (8 to 12 year olds) and teens (13 to 17 year olds). A standardised protocol was used, and all participants applied and removed a contact lens three times during the baseline training. Although children were slower than teens during application and removal training (41.9±32.0 vs 30.3±20.2 min), the investigators concluded that this should not be a limiting factor as this task is typically delegated to non-clinical staff members and therefore unlikely to interfere with patient flow.

Given lens handling is a key aspect in successful contact lens wear, [14,15] and is linked to contact lens dropout, particularly in new wearers, [16,17] studies investigating wear instructions should ideally inform clinical management guideline development and optimisation. However, as noted earlier there is a distinct lack of evidence to inform clinical practice on the best methods to train patients in soft lens handling. Before such evidence can be gathered, it is important to understand the current approaches to lens application training. Therefore, the purpose of this work was to capture data on approaches to soft contact lens application and removal using a survey from eye care practitioners (and practice staff) globally.

## 2. Material and methods

### 2.1. Survey development and distribution

A survey was developed to understand the approaches of those performing soft contact lens teach appointments. This was initially created in English and was later translated into Spanish to increase global reach.

Potentially relevant questions and items were identified and reviewed by members of the research team (comprised of 10 experienced optometrists responsible for delivering contact lenses education), until all members were satisfied with the wording and relevance of the final questions. Images were used throughout the survey to illustrate the wording of the questions and answers. A copy of the full questionnaire can be requested by contacting the corresponding author.

The translation to Spanish was conducted by native Spanish speakers and who were also proficient in English (NG-P, MV-E and DP). First, one of the research members (NG-P) provided an initial translation which was later reviewed by another team member (MV-E) to ensure cultural nuances were considered during the translation process. Following this, the panel independently reviewed the proposed survey and agreed minor changes to ensure both surveys conveyed the same meaning in all the questions/answers (NG-P, MV-E, DP). The final survey in both languages comprised 20 questions. To account for different roles across countries, the Spanish version includes ‘Optómetra’ in the list of professions whereas the English version includes the role ‘Dispensing Optician’. Optómetra was considered equivalent to the role of Optometrist for the purpose of data analysis of the responses.

Other aspects captured in the survey included: a) demographic information and b) characteristics of the contact lens application and

**Table 1**

Summary of information provided in contact lens textbooks around application and removal training.

Textbook title	Application & removal procedures (including lens application location)	How to check if lenses are inside-out	Other practical advice and problem solving	Requirements prior to dispensing contact lenses
Contact Lens Practice [4]	✓	✓	✓	“A useful strategy to instil confidence in patients who have never worn lenses previously is to have the patient apply the lenses at the conclusion of the training session, and leave the practice wearing the lenses. The patient will then be forced to confront the challenge of lens handling, rather than as might occur, putting the lenses aside until enough courage can be mustered to wear lenses at a later date.” “Practice staff must be vigilant about the attendance of new wearers to the first follow-up appointment. Any no-shows or cancellations should be contacted to enquire about the progress with lens wear.”
The Contact Lens Manual [5]	✓	✓	✓	“Patient should be competent at lens removal (insertion can be safely practised at home).”
Clinical Procedures in Primary Eye Care [6]	✓	✓	✓	“The patient needs to demonstrate safe application and removal, full understanding of the importance of hygiene, the cleaning regimen, and how to minimise the risk of complications.”
Contact Lenses [7]	✓	✓	✓	“Practice inserting and removing lenses a few times, patients will be more confident and they can go away wearing the lenses.”

removal appointment, including specific questions associated with application/removal of soft contact lenses, use of videos prior to the teaching appointment, role of the person conducting the majority of teach appointments, length of the appointment, and success rate at the end of such appointments. Respondents were given the opportunity to add any additional free text comments at the end of the survey.

The study was conducted online using Qualtrics software (Qualtrics, Provo, UT) and set to allow one submission from an individual IP address to avoid multiple answers from the same person. Respondents

were required to be older than 18 years of age and involved in teaching soft contact lens handling to patients. As patient education on contact lens wear might be delegated, the survey actively encouraged invited responses from all practice members involved in teaching application and removal of soft contact lenses (e.g. students enrolled on optical related courses and relevant practice support staff).

Before launching, the final Qualtrics surveys were reviewed by all members (English survey) and a sub-panel of native Spanish speakers (NG-P, MV-E, DP) to ensure functionality. Both surveys were disseminated using social media and shared among international optometric professional networks and attendees at contact lens conference presentations. Responses to the English version of the survey were received from 28/05/2021 to 05/04/2022, and responses to the Spanish version were received from 23/11/2021 to 03/04/2022.

## 2.2. Ethics approval and study design

Ethics approval was granted by the Vision and Hearing School Research Ethics Panel at Anglia Ruskin University (Cambridge, UK, reference number FSE/SREP/0521-01). The study followed the tenets of the Declaration of Helsinki and respondents gave informed consent online at the start of the survey.

## 2.3. Data analysis

Responses to the online survey were analysed using MedCalc version 18.10 (MedCalc Software Bvba, Ostend, Belgium). The Kolmogorov-Smirnov test was used to assess if the data were normally distributed. As the data showed a non-normal distribution for continuous variables, median and interquartile range (IQR) were reported using the format median ( $\pm$ IQR value). Frequency tables were used to describe categorical values and frequency analyses were used to analyse items with multiple responses using SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). Associations between survey responses and respondent demographics were analysed using chi-square statistics for categorical variables and Kendall's tau-b for continuous variables. A significance level of  $p \leq 0.05$  was used for all analyses.

## 3. Results

### 3.1. Participant demographics

A total of 511 participants completed the anonymous online survey, with 347 completing the English version and 164 completing the Spanish version. An additional 339 surveys were removed because they were blank or incomplete. No further data were discounted during data analysis. The majority of respondents were based in the UK (48.7%) or mainland Spain (22.9%) but responses were received from a total of 31 countries (Table 2).

Table 3 includes demographic characteristics of the participants, with the majority being female (72.0%), with 10 or more years of experience in patient contact lens education (62.0%) and defining their profession as optometrists (73.6%). Among the Spanish respondents, 89.6% identified as optometrists.

### 3.2. Application and removal training

Responses to who conducted the majority of handling training indicated that these appointments were largely conducted by optometrists ( $n=272$ , 53.2%) followed by optical assistants ( $n=124$ , 24.3%) and contact lens opticians ( $n=61$ , 11.9%). Participants indicated that in a typical month prior to any COVID-19 restrictions they conducted 10 ( $\pm 11.8$ ) appointments, lasting 30 ( $\pm 16.0$ ) minutes each.

As reported in Table 4, when teaching soft contact lens application, 84.7% responded that they teach patients to hold the upper eyelid by the eyelashes and a similar percentage (89.4%) teach patients to move the

**Table 2**

Countries where respondents were based ( $n=511$ ).

Country	Number of responses received (n)	Percentage (%)
UK	249	48.7
Spain	117	22.9
India	24	4.7
Argentina	20	3.9
USA	16	3.1
Australia	11	2.2
Mexico	11	2.2
Portugal	9	1.8
Colombia	8	1.6
Ecuador	6	1.2
Bolivia	5	0.9
Republic of Ireland	5	0.9
Other*	30	5.9

\* Countries listed as 'Other' include countries where three or fewer responses were received: Canada, Nicaragua, Singapore, Guatemala, Hong Kong, Kenya, Panama, Russian Federation, Costa Rica, Czech Republic, Dominican Republic, France, Italy, Jordan, Malaysia, Nepal, Peru, Uruguay and Venezuela.

**Table 3**

Respondents' demographics ( $n=511$ ).

Survey question	Response options	N	Percentage (%)	
Q3 - What gender are you?	Male	138	27.0	
	Female	368	72.0	
	Gender diverse	2	0.4	
	Prefer not to say	3	0.6	
Q2 - How many years have you been involved in teaching CL application and removal?	Less than 1 year	29	5.7	
	1-5 years	94	18.4	
	6-9 years	71	13.9	
	10 or more	317	62.0	
Q4 - What is your profession	Optometrist*	376	73.6	
	Contact Lens	51	10.0	
	Optician			
	Ophthalmologist	1	0.2	
	Dispensing Optician	27	5.3	
	Optical Assistant	8	1.6	
	Student (optics course)	42	8.2	
	Other	6	1.1	
	Q5 - Which setting best describes where you currently work?	Hospital setting	40	7.8
		University/	72	14.1
Educational setting				
Independent practice		220	43.1	
Group practice		148	29.0	
Industry setting		14	2.7	
Other	17	3.3		

\*includes  $n=35$  subjects that identified their profession as 'Optómetra'.

lower eyelid down with the same hand as the hand holding the contact lens. Respondents indicated that the location where the contact lens was most commonly applied was directly to the cornea (57.7%). The most typical approaches that were adopted to get the lens to settle upon application included 'move the eye in different positions of gaze while eyelids are held' (53.2%) and 'slowly releasing the eyelids while looking down' (40.7%).

The majority (69.9%) of respondents teach patients to use the dominant hand when handling lenses for both eyes. Typical approaches to identify if the lens was inside out included difference in shape (86.7%) and demonstrating how the lens folded in the palm-crease of the hand (31.1%) (the taco test). Other methods such as checking lens markings are less commonly taught (14.1%) and 10.8% of respondents taught patients to rely solely on vision and/or comfort to identify if the lens was inside-out.

When teaching lens removal, 75.0% of the respondents asked patients to hold eyelids in the same way as for lens application, with the

**Table 4**

Questions exploring aspects relating to application and removal of soft contact lenses. \*Percentage of cases reported for multiple answer question based on total number of cases (n=511) Majority choices are shown in bold.

Survey Question	Response options	n	%
Q11 - How do you teach to hold UPPER eyelid during CL application?	Eyelashes not held	48	9.4
	<b>Eyelashes held</b>	<b>433</b>	<b>84.7</b>
	Upper eyelid not held	20	3.9
	Other	10	2.0
Q12 - How do you teach to hold the LOWER eyelid during CL application?	Lower eyelid not held	0	0
	<b>Lower eyelid held by the same hand as lens</b>	<b>457</b>	<b>89.4</b>
	Lower eyelid held by the opposite hand	47	9.2
	Other	7	1.4
Q13 - Which image BEST describes location where CL applied to the eye?	<b>Directly on cornea</b>	<b>295</b>	<b>57.7</b>
	Temporal conjunctiva	110	21.5
	Inferior conjunctiva whilst patient looking ahead	102	19.9
	Other	4	0.8
Q14 - Approach TYPICALLY used to get the lens to settle (tick all that apply)*	<b>Move eye around different positions while eyelids held</b>	<b>272</b>	<b>53.2</b>
	Move eye around different positions while eyelids released	92	18.0
	<b>Slowly releasing eyelids while looking down</b>	<b>208</b>	<b>40.7</b>
	Move lens with finger	20	3.9
	Massage eyelid once closed	100	19.6
	None	10	2.0
	Other	12	2.3
Q18 - Approach TYPICALLY used to identify if lens is inside out (tick all that apply)*	Folds palm of hand 'taco test'	159	31.1
	<b>Difference in shape</b>	<b>443</b>	<b>86.7</b>
	Markings	72	14.1
	Rely on vision/comfort	55	10.8
	I do not teach about this	4	0.8
	Other	9	1.8
Q16 - Which image BEST represents lens removal?	Pinch directly off cornea	110	21.5
	<b>Drag down and pinch inferiorly</b>	<b>252</b>	<b>49.3</b>
	Drag temporally and pinch	139	27.2
	Rub out	3	0.6
	Other	7	1.4
Q10 - Use of videos ahead of the teaching appointment (tick all that apply)*	<b>I do not use videos</b>	<b>317</b>	<b>62.0</b>
	Video produced by CL company	88	17.2
	Video produced by own practice/company	73	14.3
	Video produced by professional body	50	9.8
	Video found online	41	8.0

remaining indicating that holding the lower eyelid was sufficient to remove the lens. Almost half of the respondents (49.3%) teach patients to drag the lens down and pinch inferiorly to remove lenses, with the next most popular approach being to drag the lens temporally before pinching (27.2%), followed by almost a quarter (21.5%) of respondents teaching patients to pinch lenses directly off the cornea.

Before dispensing lenses, participants witnessed application and removal 3 ( $\pm 1$ ) times and 77.9% of the respondents dispensed lenses after witnessing this skill 2 (n=154) or 3 times (n=244). The majority of respondents (62.0%) said they do not currently use video media ahead of the teach appointment. Respondents felt that their approach to teaching application and removal of soft contact lenses was successful in 90 ( $\pm 15$ ) percent of cases.

Analysis of responses from UK practitioners compared to those based elsewhere showed some statistically significant differences in the likelihood-ratio chi-square statistic: Q11 – How do you teach to hold the upper eyelid? (likelihood ratio=16.2; df=3; p=0.01), Q12 – How do you teach to hold the lower eyelid? (likelihood ratio=9.7; df=2; p=0.008), Q13 – Location where the CL is applied to the eye? (likelihood

ratio=27.7; df=3; p<0.001) and Q16 – How do you teach lens removal? (likelihood ratio=30.5; df=4; p<0.001). Table 5 provides a comparison of the number of responses to these questions by location. Kendall tau-b analysis showed a statistically significant difference between respondents in the UK and those based elsewhere when exploring overall success with application and removal training (graded 0 to 100 in Q19; p<0.001). 63.7% of the respondents based outside of the UK reported a success rate of 90 or higher whereas 42.1% of UK respondents admitted this level of success.

When testing whether professional roles showed differences in their responses, reported success rate was significantly different (Kendall tau-b, p=0.019), with the highest success reported from optometrists and contact lens opticians.

Cross tabulations showed that respondents with different professional roles did not report any differences in the likelihood-ratio chi-square statistic to the following questions: Q11 (p=0.838), Q12 (p=0.422), and Q 16 (p=0.340), which are expanded in Table 5. Responses to Q13 showed that optometrists more commonly reported application directly to the cornea, whereas students more commonly reported application to the temporal conjunctiva (likelihood ratio=32.8, df=18, p=0.018). Interestingly, when investigating whether there were any differences in teaching success by practice setting, no significant difference was found (Kendall tau-b, p=0.460).

Analysis of the free-text comments provided by respondents emphasised that they felt that often the teaching process needed to be patient-specific. As a result, those involved should be confident with a range of different teaching approaches and be able to adapt them to suit the specific needs of the patient. For example, some strategies shared include: *i*) to lower the chin slightly so that patients are looking up into the mirror which allows them to apply the lens in the inferior/temporal conjunctiva, *ii*) asking apprehensive patients to touch the inferior/temporal conjunctiva with their index finger to familiarise themselves with the feeling of touching their own eyes prior to applying lenses and *iii*) start the teaching process by removing contact lenses first to boost confidence. Respondents felt that age and dexterity play an important

**Table 5**

Survey questions relating to application and removal teaching stratified by respondents' location, UK vs other countries.

Survey question	Response options	Total (n)	UK	Other countries
Q11 - How do you teach to hold UPPER eyelid during CL application?	Eyelashes not held	48	25	23
	Eyelashes held	433	219	214
	Upper eyelid not held	20	2	18
	Other	10	3	7
Q12 - How do you teach to hold the LOWER eyelid during CL application?	Lower eyelid not held	0	0	0
	Lower eyelid held by the same hand as lens	457	224	223
	Lower eyelid held by the opposite hand	47	25	22
	Other	7	0	7
Q13 - Which image BEST describes location where CL applied to the eye	Directly on cornea	295	137	158
	Temporal conjunctiva	110	74	36
	Inferior conjunctiva whilst patient looking ahead	101	38	63
	Other	5	0	5
Q16 - Which image BEST represents lens removal?	Pinch directly off cornea	110	44	66
	Drag down and pinch inferiorly	252	105	147
	Drag temporally and pinch	139	94	45
	Rub out	3	1	2
	Other	7	5	2

part in the process, with very young and elderly patients often needing additional time or an additional visit to complete their training. A couple of respondents mentioned that they never complete the 'teach' in one session. One of the responses specifically stated '*I usually always bring patients back for a second teach no matter how good they are*'. Respondents also felt that those involved with teaching new wearers need to show patience and empathy to boost patient confidence and that training should take place in a quiet and private space.

Furthermore, respondents highlighted that the teaching appointment should emphasise the following aspects: *i*) handwashing techniques, *ii*) cleaning, care and storage of contact lenses and any related product (lens cases, suction tool), *iii*) instruction on recommended wearing time, *iv*) the use of written instructions to support verbal information and *v*) the need for patients to sign the patient acknowledgment form on completion of the teaching appointment. Respondents emphasised the importance of avoiding water during lens wear (no swimming or showering with lenses) or whilst caring for the lenses. The comments also mentioned the order in which lenses should be applied to the eye, recommending to always start with the same eye to avoid mixing lenses, and to apply lenses prior to applying make-up. Another topic that appeared in the comments was demonstration of application and removal by the instructor which was highlighted by some respondents as a useful practice, although others reportedly stopped doing this post COVID-19.

#### 4. Discussion

The study data obtained from this anonymous online survey provides valuable novel insights into contact lens handling training for new soft contact lens wearers. Responses were largely completed by optometrists (73.6%) despite the fact that the survey encouraged respondents to distribute the survey among other team members involved in the training. In fact, responses to the Spanish survey included a large proportion of optometrists which might relate to differences in the fitting and dispensing of contact lenses in different regions. The larger proportion of females completing the survey was not unexpected and falls in line with the gender split of registrants in countries such as the UK as reported by the General Optical Council [18] and Spain by the Instituto Nacional de Estadística [19].

Regarding specific techniques taught, the majority of respondents emphasized holding the upper eyelid by the eyelashes (84.7%), lowering the lower eyelid with the same hand as the one holding the contact lens (89.4%) and applying the lens directly onto the cornea (57.7%). These techniques align with established practices described in academic textbooks [4-7] and Table 5 illustrates differences which might be explained by differences in training in different countries. However, for soft contact lens removal training, respondents demonstrated a greater variety of approaches. The most commonly taught method involved dragging the lens down from the cornea and pinching it off the inferior conjunctiva (49.3%), followed by dragging the lens temporally before pinching it off the conjunctiva (27.2%). A smaller percentage of respondents (21.5%) taught the direct pinch-off method from the cornea, a strategy considered less preferable as it risks damaging the cornea. [6] These findings highlight the need for flexibility in teaching approaches, as different individuals may find different techniques more comfortable or suitable for their specific needs.

One of the key findings of the study was the length of time typically allocated to teach appointments (which included other training in addition to lens handling) which showed a median of 30 min. This appears to be in line with the length of time reported by Walline et al. (2007) in teens. [13] However, the survey did not specifically investigate adaptations required in different populations such as younger children and/or those with reduced dexterity or longer nails, although this was mentioned by some in the free-text comments. Suggestions were made to adapt techniques, offer additional sessions, and provide a supportive and empathetic learning environment. These insights

highlight the importance of tailoring teaching methods to meet the unique requirements of each prospective contact lens wearer as emphasised in a recent review. [11].

Respondents of the present survey indicated that most teach appointments were conducted by optometrists. It is unclear whether this might be linked to their mode of practice (with over-representation from hospitals, educational institutions, and independent practices) or a limitation in the wording of Question 6 in the survey, i.e. reporting their own professions rather than the people primarily conducting the teach appointments. Further clarity on this aspect is needed as those delegating this task in practice need to be aware of their responsibilities even during delegated tasks, and need to ensure those undertaking this training are familiar with a wide range of approaches and suitable training to maintain their skills.

Overall, respondents expressed a high level of confidence in their teaching approach, with respondents indicating a success rate of 90 (on a scale 0 to 100, where 100 indicates that their teaching always works, and they do not need to rebook the patient). This indicates that many respondents felt their methods were effective in facilitating proper contact lens application and removal. Despite this, differences were observed when analysing responses and those based outside of the UK reported greater success than respondents based in the UK (63.7% vs 42.1%). This might be explained by differences in professional practice across countries. For instance, in the UK this task is usually delegated to non-clinical team members and therefore clinicians might feel less successful than others that may teach patients routinely.

Sixty-two percent of the respondents reported that they do not currently utilise videos ahead or during the teaching appointment. It is important to note that contact lens handling difficulties, such as struggling with application and removal are one of the top reasons for drop-out, with 25% of contact lens dropouts indicating this as the reason. [17] More recently, Guthrie et al (2022) [20] also noticed that dissatisfaction with lens handling during application could result in overall patient dissatisfaction. Similarly, Morgan and Sulley (2023) [12] suggested that aspects of handling training may impact overall success with lens wear. In line with this, it is possible that despite an initial successful training, novice wearers might experience difficulties at home potentially resulting in contact lens drop-out. For this reason, it would be of interest to investigate whether utilising online video media resources (before, during or after the initial teach appointment) and/or follow-up communication or a routine second teaching appointment could lead to a reduced rate of patient drop-out due to handling difficulties. Although this research focuses on novice wearers, Retaillic and Nagra (2022) [21] have recently reported that established daily disposable wearers may also experience frustrations such as difficulties opening lens blisters and further work is required in this area.

It is important to acknowledge the limitations of this work, such as the self-reported nature of the data and the potential for response bias. The survey did not capture the use of ancillary products such as suction/application devices and whether they are used or recommended. Additionally, the survey primarily captured perspectives from the UK, Spain, and a limited number of countries worldwide. Future research should aim to include a more diverse and representative sample of contact lens practitioners from various regions worldwide to expand on the findings of this study.

In conclusion, the data obtained from this survey has provided information on the diversity of teaching approaches used for soft contact lens application and removal training around the world. The findings show that the techniques employed by different professionals as well as the need for individualised instruction. Respondents felt that there was a high success rate after the initial training session. The study provides valuable insights for eye care practitioners involved or delegating the task of contact lens handling and care training, highlighting the need for further research in this area and facilitating the development of evidence-based guidelines and best practices in contact lens education.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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