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Factors that influence the success of contact lens fitting in presbyopes: a multicentric survey.

Running short title

Factors influencing the success of CL fitting in presbyopia

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Abstract

Objectives: To evaluate the key factors behind successful and unsuccessful wear of contact lenses (CLs) for patients with presbyopia.

Method: A multicentre survey was conducted using a questionnaire, in eight CL centres, among two groups of presbyopes: Successful Wearers (SWs), those who were presbyopic and wearing CLs successfully and Unsuccessful Wearers (UWs) who tried unsuccessfully to wear CLs to manage their presbyopia and had stopped wearing CLs.

Results: A total of 237 completed questionnaires were returned; 178 from SWs and 59 from UWs. SWs used CLs 5.8±1.5 days a week and additional reading spectacles were never used by half of the SWs. Among SWs the most important reason to continue wearing CLs was convenience (61%) whilst among UWs the most important reason to discontinue wearing CLs was poor vision (80%). A logistic regression analysis showed that the absence of astigmatism ($p<0.05$), a higher subjective satisfaction ($p<0.05$), a better subjective perceived vision at distance ($p<0.05$) and a lower subjective loss of visual contrast ($p< 0.05$) amongst SWs and these may be able to predict success of CL use for presbyopia.

Conclusions: This study explores the predictors for determining successful or unsuccessful CL wear amongst presbopes. Amongst ophthalmic, demographic, lifestyle and subjective variables the latter seems to be of greater importance in determining the success of CL wear. Therefore it is necessary that subjective variables are taken into account by the CL practitioner when approaching presbyopic CL fitting in practice.

Key Words: Attitudes, motivation, presbyopia, Contact lenses

Predicting which patients will become successful contact lens (CL) wearers is important for researchers and clinicians to make happy successful wearers, to reduce chair time and decrease dropout rates. This is particularly true for presbyopes, whose CL use decreases as their presbyopia increases,[1,2] with retention rates falling from 75% to 63%, over the age of 45 years.[3]

Fitting CLs to presbyopes for the first time may be even more difficult, since they present additional barriers compared to people with ametropia such as myopia.[4] Moreover, many changes in tear film and ocular surface occurring with age could potentially decrease CL comfort in presbyopes.[5-7]

Notwithstanding this, many presbyopes express an interest in correction with CL,[8] especially if good vision and comfort can be achieved.[9]

Looking at the literature it is possible to identify factors that have been reported as good predictors of success or failure in published research studies (such as cohort study or randomised clinical trials). A synopsis of various factors in relation with success/failure of CL fitting in presbyopes are reported in Table 1 and Table 2. However, there is a hierarchy in terms of quality of evidence to support clinical decisions. Usually this hierarchy is represented in the evidence-based pyramid where the expert opinion is traditionally placed at the lowest level of the pyramid while experimental studies are reported at a higher level.[31]

Table 1 combines three main areas that have been reported as being important for successful CL fitting in presbyopes according to textbook sources. The first being the refractive correction at distance; significant spherical refractive correction is considered a factor influencing good success [10-11,13-16] whilst a high amount of astigmatism is generally considered a possible factor leading to failure.[12,14] The second group of factors appears to be good ocular health; tear film and ocular surface

quality are important factors influencing success.[10,12] Finally, many personal characteristics such as motivation, ability to accept visual compromises and being hyper-critical are reported as factors influencing either success or failure.[12-16]

Clearly, the different methods to correct presbyopia using CL are another important factor that can affect directly the chance of the success, interacting with the patient needs. Indeed, different methods offer different results in terms of quality of vision at distance and at near. In case of monovision, the patient can achieve very good vision for distance in one eye and in the fellow very good vision for near but with a decrease in stereopsis,[32-34] contrast sensitivity[35] and an increase in central suppression[33-34] and in light disturbance.[36] On the other hand, multifocal CLs can preserve stereopsis,[37] but with the introduction of certain perceptual compromises[36,38] due to simultaneous optical imagery.[39] These barriers may represent the reason why in the 2011'international survey of Morgan et al[2], approximately the 60% of presbyopic CL wearers worldwide were being fitted with distance correection only and being offered supplementary reading spectacles to aid near vision.

This study aims to clarify some of the factors predicting success or failure of CL use amongst presbyopes. In particular, an element of novelty of the present study was to consider the wearers' personal characteristics (motivation, attitudes) which are considered extremely important for the potential impact on the success of CL wear.[30, 40-41]

Success factors	Failure factors
• Definite need for a visual correction;[10] • Having myopia or hyperopia higher than 1.00 D;[11] • Low amount of astigmatism;[12] • Good ocular health;[10,12] • Tear BUT over 10 seconds;[10,12] • Strong motivation (patients don't want to use spectacles or there is an interference of spectacles with lifestyle);[12-15] • Being able to accept some compromise in distance and near vision;[16] • Fulfilling the standard criteria for successful CL wear;[16,17] • History of successful contact lens wear;[10,14] • Patient education and explanation.[12]	• New wearer with very low ametropia[10,13] or emmetropia;[10,14,16] • High amount of astigmatism (specific for simultaneous vision CLs);[14] • Amblyopic patients;[12, 15] • A tear BUT shorter than 10 seconds and/or phenol red thread test lower than 9 mm;[10] • Irregular cornea;[12] • Small pupil size (specific for simultaneous vision CLs);[14] • Being satisfied with spectacles wear;[14] • Very critical patients[16] or with unrealistic expectations;[14] • Unwilling to accept vision compromise[16] especially for distance vision in case of simultaneous vision CLs;[14] • Having the need of a good and sustained close vision;[16] • Having basic contraindications to CL wear;[16] • Poor handling.[10,16]

Table 1: Overview of the main success/failure factors for CL fitting in presbyopes according to textbook sources.

Study	CL approach studied	Poor predictor/s of success/failure	Good predictor/s of success/failure
Koetting, 1970^[18]	Monovision	Age, Stereopsis	
Du Toit at al, 1988[19]	Monovision	Age, gender, pupil size, immediate reaction to monovision, near refractive error, motivation, self-efficacy, distance and near refractive error, reading addition.	Difference in stereopsis between binocular and monovision condition associated with the psychological trait "super-ego strength" were able to predict success
Schor et al, 1987[20]	Monovision		Better interocular suppression at higher contrast level in successful subjects
Gauthier et al, 1992#[8]	Monovision		Poor vision and difficulty in handling were reported as reason for discontinuing
Erickson & McGill, 1992[21]	Monovision	Laterality of sighting dominance Laterally of distance/near correction	Smaller reduction of stereopsis in successful group Smaller reduction of binocular visual acuity in successful group
Collin & Bruce, 1994§[22]	Monovision		Reduced stereoacuity at near with monovision resulted in a reduced level of wearer satisfaction.
Back, 1995[23]	Monovision	Gender, occupation, distance Rx, near addition, previous lens-wearing experience, sighting dominance, high and low contrast distance visual acuity. high contrast near visual acuity	Older age among failures Greater levels of ghosting at distance and near in unsuccessful group Reduction of stereoacuity at distance in unsuccessful group Slight reduction of low contrast near visual acuity in unsuccessful group
Jones et al, 1996[24]	Monovision		A proactive, free trial approach improved success.
Erickson & Erickson, 2000[25]	Monovision		Men scored as introverts adapting less well to monovision Women with difficulty perceiving a visual pattern against visual background noise adapting less well to monovision.
Westin et al, 2000°[26]	Monovision		Practitioner fitting philosophies (such as use use of sighting eye to determine the distance eye, taking occupational factor into account etc)
Woods et al, 2009[27] ¶	Multifocal and monovision CL	Visual Acuity (High and low contrast), Stereopsis, Critical Print Size at MNread test.	Subjective satisfaction
Papas et al, 2009†[28]	Multifocal CL	Visual Acuity (High and low contrast) Information collected by practitioners in early stages of assessment about subjective variables	
Sivardeen et al, 2016*[29]	Multifocal and monovision CL	Gender, sex, age, lifestyle and personality, refractive error, magnitude of the near addition power, pupil size and decentration, naked eye aberrations, stereopsis, defocus curve	
Diec et al, 2017[30]	Multifocal	Initial performance at fitting	

^Success measured as a function of subjective satisfaction.
No statistical comparison provided between successful wearers and unsuccessful wearers. Only reasons for discontinuing provided.
§ Stereoacuity is not a direct measure of success. The authors argued that subjects' satisfaction might be an indirect measure of success.
° Level of success with monovision based on practitioner opinion.
¶ No success/failure analysis provided. However their findings should be considerate in this perspective: subjective satisfaction suggested to discriminate between correction options. Objective measures (high and low contrast VA, stereopsis and Critical Print Size) did not discriminate.
† No success/failure analysis provided. However their findings should to be considerate in this perspective. Objective measures such as visual acuity, were not related to subjective satisfaction. Subjective responses generally worsen during adaptation, so early responses may not reflect final results.
* Analysis of factors influencing preference for different multifocal CLs or monovision, so not directly related to success in CLs wear.

Table 2: Chronological overview of the main outcomes from the published literature of research studies reporting factors linked to CL fitting success for presbyopes.

Methods

A multicentre survey was conducted at 8 different contact lens practices in Rome (Italy) were selected. Each practice showed a good level of experience in presbyopic CL fitting (minimum ten years of active practice in the field), similar educational background of the CL principal practitioner (Italian Diploma in Optometry or Degree in Optometry) and routinely using CLs from at least three different manufacturers. The principal CL Practitioner in each centre was asked to select presbyopes (over 45 years old) and deem them as successful or unsuccessful CL wearers according to the following selection criteria:

-Successful Wearers (SWs): presbyopes currently wearing CLs successfully for at least six months. This group had tried successfully, in the last 12 months, to cope with presbyopia either with CLs specifically fitted to avoid the use of reading glasses such as monovision, multifocal CLs or modified monovision (singe vision in one eye and a multifocal in the other) or with single vision CLs for vision at distance plus the use of reading glasses. This group consists of patients who were CL wearers before the onset of presbyopia or patients who started wearing CLs at the onset of presbyopia.

-Unsuccessful Wearers (UWs): presbyopes who had given up wearing CLs. This group had tried unsuccessfully, in the last12 months, to cope with presbyopia either with CLs specifically fitted to avoid the use of reading glasses such as monovision, multifocal CLs, or modified monovision (singe vision in one eye and a multifocal in the other) or with single vision CLs for vision at distance plus the use of reading glasses. This group consists of patients who were CL wearers before the onset of presbyopia or patients who started wearing CLs at the onset of presbyopia.

Both groups were asked to answer an anonymous questionnaire in the absence of the CL practitioner. No compensation was given for participation. The study was approved

by the Ethics Board of the Department of Social and Developmental Psychology at Sapienza University of Rome and conducted according to the tenets of the Declaration of Helsinki.

Two separate versions of the questionnaire were prepared; one for SWs and another for UWs. A summarized version of the two questionnaires is reported in Appendix 1 and 2 respectively. The questionnaires were made up of three sections: general information; CL history and current wearing pattern; and attitudes and subjective responses to CL wear.

The *general information* section was exactly the same for SWs and UWs. It included variables linked to personal characteristics such as gender, age, occupation, hobbies/interests and hours spent reading and using a digital display screen at work and at home respectively.

In the *CL usage history* section the first two questions were the same for SWs and UWs: previous use of CLs before the onset of presbyopia; and the number of years of previous use. Only for the SWs did the questionnaire ask further questions about the current use of CLs.

Finally, in the *attitudes and subjective responses to CLs* section, ten questions (from Q.3.1 to Q3.10) were asked. The first 9 questions were the same for both groups. These questions explored the strength of motivation, the level of general satisfaction obtained with CLs, the vision obtained at far, intermediate distances (PC) and fthe level of several symptoms experienced with CLs during near vision tasks. For all these questions the subject was asked to complete their grading of their opinion or symptom on a Likert scale that ranged from 1 (nothing/definitely poor) to 5 (very much/definitely good). The tenth question was slightly different and explored the main reason for

continuation of CL use for SWs and main reason for discontinuation in CL use for UWs.

Once the subject completed the questionnaire the CL practitioner completed the refraction details (spectacles refraction and near addition) and the relevant information about contact lens used or previously tried.

3. Statistical analyses

SWs and UWs groups were compared for each variable using either a t-test or the corresponding non-parametric test (χ^2, Mann-Whitney) as appropriate. In order to predict the success of CL wearing in presbyopes a logistic regression analysis was used. It was run by analysing different variables associated with the successful wear (Table 1 and Table 2), that were collected both from UWs (coded as 0) and SWs (coded as 1) and in four main areas:

-Demographics: gender and age;

-Near activity commitments: overall screen time per day, overall reading time per day.

-Ophthalmic variables: use of CLs before presbyopia onset, magnitude of the mean spherical equivalent (in order to evaluate the effect of the refractive error as a value away from emmetropia), presence of astigmatism (≥0.50 of cylinder), addition at near, modality of CLs fitted for the correction of presbyopia (five groups; single vision CLs associated with reading spectacles, monovision, multifocal CLs with the same optical design, multifocal CLs with different optical design and one multifocal CL paired with one single vision CL), previous experience in CLs before presbyopia and modality of replacement (daily disposable versus reusable).

- Opinion and subjective responses to the fitting variables: from Q.3.1 to Q.3.9 in the

two questionnaires (see appendix 1 and 2).

The analyses were run using only those participants who scored on all the variables included in the model (listwise deletions of participants).

Results

A total of 237 completed questionnaires were returned from the eight CL centres; 178 from SWs and 59 from UWs. In each centre 30 ± 13 (range 20-58) questionnaires were collected. The participant demographics and details about refraction and contact lenses are reported in Table 3 and 4 respectively. Subjects were divided into two sub groups depending on the level of astigmatism; if the cylinder was ≥0.50DC in both eyes they were classed as astigmatic and non-astigmatic if the cylinder <0.50DC. The CL wearing subjects were divided into two sub groups depending on their CL modality; daily disposable wearers and non-daily disposable wearers.

Subjects obtained information about how to correct their presbyopia with CLs from an Optician or an Optometrist (65.8%), from friends or relatives (21.5%), from an Ophthalmologist (5.9%), from advertising (4.6%) or from other sources (1.7%) whilst 0.4% did not provide any information.

SWs used CLs 5.8 ± 1.5 (range 1-7) days per week. Additional reading spectacles were used by SWs: never in 51.1%, sometimes in 32.0%, often in 6.7%, very often in 4.5%, always in 4.5% and 1.1% did not answer. The main reason indicated by SWs to continue wearing CLs (Q.3.10) is reported in Figure 1 for the overall group of SWs and separately for the two sub groups of SWs: those who were habitual CL wearers before presbyopia occurred (n=92) and those who began wearing CLs after the onset of presbyopia (n=86). No statistically difference was found between the distribution of the

preferences of the two sub groups of SWs (χ^2=5.3, p=0.51). Amongst UWs, the main reason why they dropped out CLs (Q.3.10) is reported in Figure 2.

In Table 5 the attitudes and subjective perceptions of results of SWs and UWs are reported.

	Overall Sample	**SWs**	**UWs**	**Comparison SWs versus UWs**
Age (years)	56.0 ± 7.4 Range 45 to 79	56.5 ± 7.5 Range 45 to 79	54.6 ± 6.9 Range 45 to 76	t-test=-1.79, p=0.08
Gender	Females, 167 (70.5%) Males, 70 (29.5%)	Females, 127 (71.3%) Males, 51 (28.7%)	Females, 40 (67.8%) Males, 19 (32.2%)	χ^2=0.27, p=0.60
Occupation	Employee, 81 (34.2%) Retired, 27 (11.4%) Educator 31 (13.1%) Self-employed/manager 42 (17.7%) Housewife 37 (15.6%) Other employments, 18 (7.6%) No response, 1 (0.4%)	Employee, 60 (33.7%) Retired, 21 (11.8%) Educator 24 (13.5%) Self-employed/manager 32 (18.0%) Housewife 30 (16.9%) Other employments, 10 (5.6%) No response, 1 (0.6%)	Employee, 21 (35.6%) Retired, 6 (10.2%) Educator 7 (11.9%) Self-employed/manager 6 (16.9%) Housewife 7 (11.9%) Other employments, 8 (13.6%) No response, 0 (0.0%)	χ^2=4.9, p=0.55
Other Activity	Sport, 133 (56.1%) Near Activity, 28 (11.8%) Other, 76 (32.1%)	Sport, 105 (59.0%) Near Activity, 21 (11.8%) Other, 52 (29.2%)	Sport, 28 (47.5%) Near Activity, 7 (11.9%) Other, 24 (40.7%)	χ^2=2.87, p=0.24
Overall screen time per day (at work and at home)	4.4 ± 3.1 Range 0.0 to 12.0	4.3 ± 3.2 Range 0.0 to 12.0	4.5 ± 2.7 Range 0.0 to 11.0	t-test=0.40, p=0.69
Overall reading time per day (at work and at home)	4.2 ± 2.7 Range 0.0 to 14.0	4.1 ± 2.8 Range 1.0 to 14.0	4.4 ± 2.5 Range 1.0 to 10.5	t-test=0.94, p=0.35

Table 3: Participant Demographics. SWs= Successful Wearers. UWs = Unsuccessful Wearers

	Overall Sample	SWs	UWs	Comparison SWs versus UWs
Previous use of CL	Yes, 115 (48.5%) No, 121 (51.1%) No response, 1 (0.4%)	Yes, 92 (51.7%) No, 85 (47.8%) No response, 1 (0.5%)	Yes, 23 (39.0%) No, 36 (61.0%)	χ^2=3.33, p=0.19
Number of years of previous CL use (for those who were CLs wearers before presbyopia onset)	21.6 ± 10.4 Range 1 to 50	21.8 ± 10.6 Range 1 to 50	20.7 ± 10 Range 2 to 35	t-test=-0.44, p=0.66
MSE of CLs RE	-0.44 ± 3.10D (range +7.0/-9.50D)	-0.55 ± 3.24D (range +7.00/-9.50D)	-0.09 ± 2.64D (range +5.13/-7.50D)	t-test=1.10, p=0.27
MSE of CLs LE	-0.39 ± 3.15D (range +7.13/-11.0D)	-0.50 ± 3.28D (range +7.13/-11.0D)	-0.06 ± 2.73D (range +5.25/-7.50D)	t-test=1.01, p=0.31
Mean MSE in both eyes	-0.41 ± 3.08D (range +7.06/-9.0D)	-0.53 ± 3.20D (range +7.06/-9.0D)	-0.07 ± 2.67D (range +5.13/-7.50D)	t-test=1.07, p=0.29
Absolute MSE of CLs RE	2.55 ± 1.81D (range 0.0/9.50D)	2.71 ± 1.85D (range 0.0/9.50D)	2.10 ± 1.62D (range 0.0/7.50D)	**t-test=-2.38, p=0.02**
Absolute MSE of CLs LE	2.56 ± 1.86D (range 0.0/11.0D)	2.70 ± 1.92D (range 0.0/11.0D)	2.16 ± 1.64D (range 0.0/7.50D)	t-test=-1.91, p=0.06
Mean of Absolute MSE of CLs in both eyes	2.56 ± 1.76D (range 0.0/9.00D)	2.70 ± 1.79D (range 0.0/9.00D)	2.12 ± 1.62D (range 0.0/7.50D)	**t-test=-2.24, p=0.03**
Presence of Astigmatism (cyl ≥ 0.50 in both eyes)	52 (21.9%)	33 (18.5%)	19 (32.2%)	**χ^2=4.83, p=0.03**
Addition	2.21 ± 0.51 Range 0.75 to 3.50	2.22 ± 0.51 Range 0.75 to 3.50	2.18 ± 0.50 Range 1.00 to 3.00	t-test=-0.54, p=0.59
CL approach to presbyopia*	Single vision CLs and reading spectacles 14 (5.9%) Monovision 31 (13.1%) Multifocal CLs with the same optical design 161 (67.9%) Multifocal CLs with different optical design 25 (10.5%) One multifocal CL and one monofocal CL 6 (2.5%)	Single vision CLs and reading spectacles 10 (5.6 %) Monovision 27 (15.5%) Multifocal CLs with the same optical design 122 (68.5%) Multifocal CLs with different optical design 14 (7.9%) One multifocal CL and one monofocal CL 5 (2.8%)	Single vision CLs and reading spectacles. 4 (6.8 %) Monovision 4 (6.8 %) Multifocal CLs with the same optical design 39 (66.1 %) Multifocal CLs with different optical design 11 (18.6 %) One multifocal CL and one monofocal CL 1 (1.7 %)	χ^2=7,62 p=0.11
Manufacturer**	Alcon, 92 (38.8%) Bausch & Lomb, 31 (13.1%) Cooper Vision, 59 (24.9%) Johnson & Johnson, 36 (15.2%) Other manufacturers, 19 (8.0%)	Alcon, 71 (39.9%) Bausch & Lomb, 24 (13.5%) Cooper Vision, 39 (21.9%) Johnson & Johnson, 28 (15.7%) Other manufacturers, 16 (9.0%)	Alcon, 21 (35.6%) Bausch & Lomb, 7 (11.9%) Cooper Vision, 20 (33.9%) Johnson & Johnson, 8 (13.6%) Other manufacturers, 3 (5.1%)	χ^2=3.84, p=0.43
Modality of replacement	Daily disposable, 58 (24.5%) Reusable, 179 (75.5%)	Daily disposable 49, (27.5%) Reusable 129, (77.5%)	Daily disposable 9 (15.3%) Reusable 50 (84.7%)	χ^2=3.61, p=0.06

*Type of CL approach for the correction of presbyopia regularly utilised in SWs and the one utilised more intensely/with the best subjective results, even though not enough to guarantee maintaining the use, during the trials in UWs.
**The manufacturer of CLs regularly utilised by SWs or the manufacturer of CLs utilized more intensely/with the best subjective results, even though not enough to guarantee maintaining the use, during the trials in UWs.
MSE: mean spherical equivalent. RE: right eye. LE: Left eye.

Table 4: "Details of CL used by successful (SWs) and unsuccessful (UWs) presbyopic wearers.

	Overall Sample mean ± SD (range), mode	**SWs** mean ± SD (range), mode	**UWs** mean ± SD (range), mode	**Comparison SWs versus UWs**
Q.3.1 "How much did you want to solve your near visual needs with CLs?"	4.0 ± 0.9 (1-5), 4	4.1 ± 0.8 (range 2 to 5), 4	3.6 ± 1.1 (1 to 5), 4	Mann-Whitney test, **P<0.001**
Q.3.2 "How would you describe your satisfaction with CLs in managing your near visual needs ?"	3.6 ± 1.1 (1-5), 4	3.9 ± 0.8 (range 1-5), 4	2.6 ± 1.0 (1-5), 2	Mann-Whitney test, **P<0.001**
Q.3.3 "How would you describe your visual performance at distance (driving, TV etc) you had with your CLs?"	3.8 ± 1.1 (1-5), 4	4.1 ± 0.8 (1-5), 4	2.8 ± 1.3 (1-5), 2[a]	Mann-Whitney test, **P<0.001**
Q.3.4 "How would you describe your visual performance at intermediate distance (desk PC) you had with your CLs?"	3.7 ± 0.9 (1-5), 4	4.0 ± 0.8 (1-5), 4	2.8 ± 0.9 (1-5), 3	Mann-Whitney test, **P<0.001**
Q.3.5 "How would you describe your visual performance at near distance (book or newspaper reading, mobile phone, tablets etc) you had with your CLs?"	3.3 ± 1.1 (1-5), 3	3.5 ± 0.9 (1-5)), 3	2.5 ± 1.1 (1-5), 2	Mann-Whitney test, **P<0.001**
Q.3.6 "How much did you experience loss of visual contrast with your CLs?"	1.5 ± 0.7 (1-4), 1	1.4 ± 0.6 (1-4), 1	1.8 ± 0.8 (1-4), 1	Mann-Whitney test, **P=0.001**
Q.3.7 "How much did you experience blurred/doubled vision with your CLs?:"	1.6 ± 0.8 (1-5), 1	1.5 ± 0.7 (1-5), 1	1.8 ± 0.9 (1-4), 1	Mann-Whitney test, **P=0.001**
Q.3.8 "How much did you experience shadows, glare or haloes in your vision with your CLs?"	1.7 ± 1.1 (1-5), 1	1.5 ± 0.7 (1-5), 1	2.3 ± 1.3 (1-5), 1	Mann-Whitney test, **P<0.001**
Q.3.9 "How much do you experience visual sickness or nausea with your CLs?"	1.1 ± 0.3 (1-3), 1	1.1 ± 0.3 (1-3), 1	1.2 ± 0.5 (1-3), 1	Mann-Whitney test, **P=0.006**

Table 5: Attitudes and subjective perception amongst subjects. SWs= Successful Wearers. UWs = Unsuccessful Wearers. [a]Multiple modes exist. The smallest value is shown.

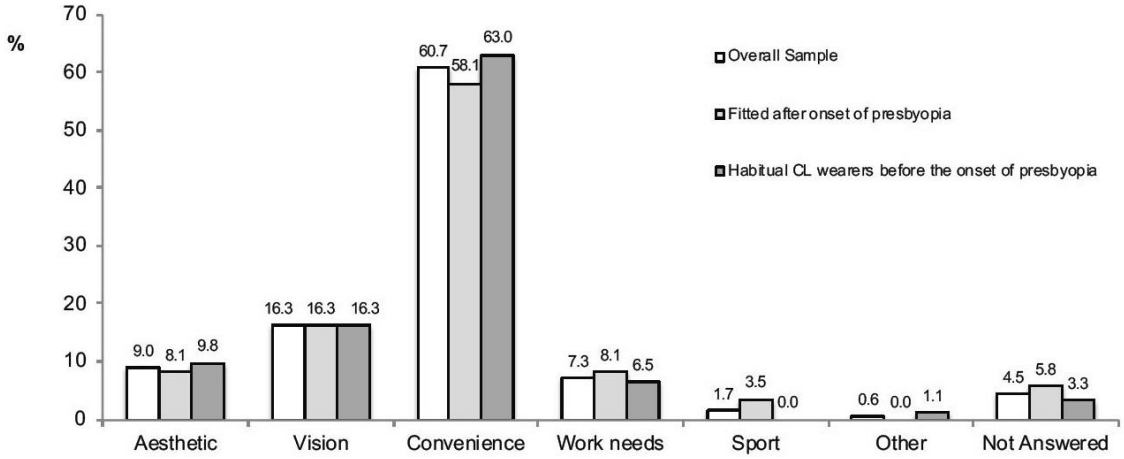

Figure 1: Main reason to continue with CLs use reported by SWs (Q.3.10 in Table 1). The data is reported for the overall sample (n=178), only for those who were habitual CL wearers before presbyopia occurred (n=92) and for those who began CL usage after the onset of presbyopia (n=86).

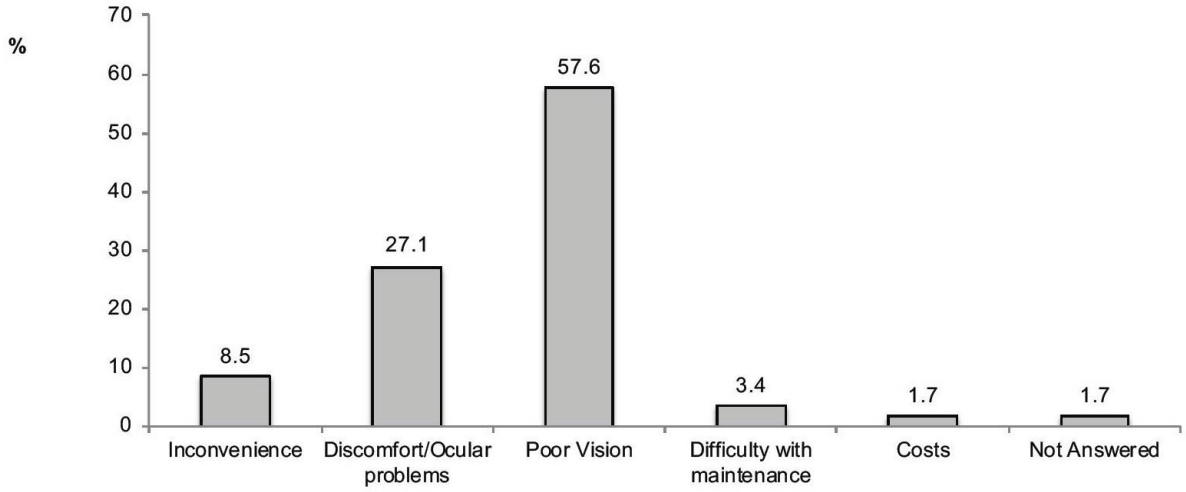

Figure 2: Main reason for dropout of CL wear for UWs (Q.3.10 see Table 2).

Factors affecting success of CLs wear in presbyopes

Results of the logistic regression analysis showed that the model explained a significant proportion of variance (Negelkerke R^2=0.62, p < 0.001). Only four variables: presence of astigmatism (Wald = 6.32; p < 0.05); subjective satisfaction (Q.3.2) (Wald = 6.53; p < 0.05); subjective perceived vision at distance (Q.3.3) (Wald = 7.38; p < 0.01); and subjective loss of visual contrast (Q.3.6) (Wald = 4.03; p < 0.05) were significant (Table 6).

Variable	***B (SE)***	***Wald***	***d***	***OR (95% CI)***
Gender	0.35 (0.57)	0.38	1	1.42 (0.47-4.36)
Age	0.08 (0.04)	2.93	1	1.08 (0.99-1.17)
Overall screen time per day (at work and at home)	0.00 (0.10)	0.00	1	1.00 (0.83-1.21)
Overall reading time per day (at work and at home)	0.05 (0.10)	0.25	1	1.05 (0.87-1.28)
Previous use of CLs	0.11 (0.50)	0.05	1	1.11 (0.42-2.96)
Mean of Absolute MSE of CLs	0.17 (0.15)	1.17	1	1.18 (0.87-1.59)
Presence of Astigmatism (cyl ≥ 0.50 in both eyes)	-1.38 (0.55)	**6.32***	1	0.25 (0.09-0.74)
Addition	-0.56 (0.57)	0.96	1	0.57 (0.19-1.76)

CL approach to presbyopia	Single vision CLs and reading spectacles		6.76	4	
	Monovision	-3.61 (1.82)	3.94	1	0.03 (0.00-0.96)
	Multifocal CLs with the same optical design	-1.18 (1.83)	0.41	1	0.30 (0.01-11.1)
	Multifocal CLs with different optical design	-2.12 (1.58)	1.80	1	0.12 (0.01-2.65)
	One multifocal CL and one monofocal CL	-3.07 (1.68)	3.35	1	0.05 (0.00-1.24)
Modality of replacement		0.60 (0.57)	1.10	1	1.83 (0.59-5.62)
Q.3.1 “How much did you want to solve your near visual needs with CLs?”		0.16 (0.28)	0.36	1	1.18 (0.69-2.02)
Q.3.2 “How would you describe your satisfaction with CLs in managing your near visual needs ?”		0.87 (0.34)	**6.53***	1	2.40 (1.23-4.68)
Q.3.3 “How would you describe your visual performance at distance (driving, TV etc) you had with your CLs?”		0.81 (0.30)	**7.38****	1	2.24 (1.25-4.01)
Q.3.4 “How would you describe your visual performance at intermediate distance (desk PC) you had with your CLs?”		0.51 (0.36)	1.99	1	1.67 (0.82-3.39)
Q.3.5 “How would you describe your visual performance at near distance (book or newspaper reading, mobile phone, tablets etc) you had with your CLs?”		0.36 (0.32)	1.33	1	1.44 (0.78-2.67)
Q.3.6 “How much did you experience loss of visual contrast with your CLs?”		-0.68 (0.34)	**4.03***	1	0.50 (0.26-0.98)
Q.3.7 “How much did you experience blurred/doubled vision with your CLs?:”		0.76 (0.40)	3.61	1	2.14 (0.98-4.70)
Q.3.8 “How much did you experience shadows, glare or haloes in your vision with your CLs?”		-0.13 (0.27)	0.23	1	0.88 (0.52-1.49)
Q.3.9 “How much do you experience visual sickness or nausea with your CLs?”		0.00 (0.76)	0.00	1	1.00 (0.23-4.40)

Table 6. Unstandardized regression coefficients and odds ratios for predictors of successful wear of contact lenses (CLs) for patients with presbyopia (valid cases N=231). B (SE): beta values and their standard errors. Wald: Wald statistic. df: degree of freedom. OR(95%CI): odds ratio and its confidence interval.

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Discussion

The main objective of this study was to obtain information about factors potentially linked to success of CL wear amongst presbyopes. This study used a multicentric survey to study the factors affecting success of CLs wear in presbyopes and allowed the determination of successful or unsuccessful wearers based upon the evidence of the actual behaviour of patients. In other prospective studies the analysis was based on the potential success (not necessarily actual success) estimated from practitioners[26] or from the same patients on the basis of initial experience.[19; 25].

It is interesting to observe that the primary reported reason why presbyopes continue to wear CLs in SWs was convenience (60.7%) and this was no different between those who were habitual CL wearers before presbyopia occurred and those who began to wear CLs after the onset of presbyopia (Figure 1). The literature does not show other studies where this was seen. It could be possible to speculate that in this group (SWs) people felt particularly strong about the inconvenience of spectacles and looked at CLs specifically to cope with this issue. Conversely, the main reason that caused UWs to dropout of CL wear was poor vision (57.6%) followed by discomfort (27.1%). It is well known that discomfort is the main reason to drop out in younger people, [42-43] but it is evident that poor vision with CLs is an important factor for dropout in older people.[8, 42] Rueff et al[44] reported that vision and discomfort were equally reported as primary reasons for CL dropout amongst presbyopes. The question arises as to why in this study the importance of poor vision relates so highly to dropout. One explanation could be taken from Rueff et al[44] who noted that the main reason to dropout changed if

responses were divided in people who began CL wear before the age of 40 years or after. In that study 44% due to poor vision and 22% due to discomfort.

The logistic regression presents a more detailed picture of the demographics, near activity commitment, ophthalmic variables and attitude variables related to successful wearers. The results show that patients without astigmatism were more satisfied and experienced better subjective vision at distance and had a lower loss of visual contrast which meant a stronger possibility of success.

The importance of astigmatism correction to prevent dropout of CLs has been shown in non-presbyopic subjects[45] and it is considered an important factor to succeed in presbyopic CLs fitting (see Table 1). Considering the current availability of toric multifocal CLs and the possibility to correct astigmatism with monovision as well CL practitioners should always consider astigmatism correction in presbyopes.

The last three factors that resulted being potential predictors of success were all in the sphere of subjective outcomes. This is in agreement with past studies in the literature. For example it has been demonstrated that whereas objective measures, such as visual acuity, are not a good indicator of potential success of CL wear in presbyopes[28] but subjective satisfaction appears more related to success.[27] In the present study subjective satisfaction was measured with a single items (Q3.2); however many specific instruments have been tailored and are available to measure particular aspect of satisfaction such as the Near Activity Vision Questionnaire that specifically assess quality of vision at near in presbyopes.[46-47]

Furthermore, two main aspects of the patient's subjective experience seem importance to monitor, namely the distance visual performance (Q3.3) and the visual contrast (Q3.6). There is strong evidence that objective visual performance at distance can be reduced in multifocal CLs whilst contrast sensitivity can be reduced

both with monovision and multifocal CLs.[48] However, it should be remembered that it is the individuals' subjective perception of these that is relevant. Therefore, it is important to check the outcomes of CLs in real life situations where the objective outcomes are judged by the wearer on the base of the personal needs. A good clinical strategy to achieve this consists in providing trial lenses to obtain subjective feedback from real life situations.[15, 28]

There are many factors highlighted in the literature which can lead presbyopes to wear or not to wear CL. However, the rapid changes in CLs manufacturing in terms of materials and optics available as well as the changes in the life style and needs of presbyopes can alter the entire scenario. This paper aimed to explore the predictors determining successful or unsuccessful CLs wear. This was achieved by jointly considering different factors encompassing ophthalmic, demographic, lifestyle and subjective variables. The latter in particular were demonstrated to be of great importance in determining the success of CL wear and therefore necessary to be taken into account by the CL practitioner in approaching presbyopes in practice.

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