

Original Article

Does dropout happen even with patients fitted with contact lenses for irregular cornea?

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ABSTRACT

Objectives: Different types of contact lenses play a primary role in improving visual acuity in irregular corneas. Although there are multiple evidences for vision improvement with contact lens patients still drop out of lens wear and choose other methods of treatment, surgeries, or discontinue the lenses.

Materials and Methods: Three thousand two hundred patients who were evaluated for 5 years at a specialty contact lens clinic in a tertiary eye care center, but did not return to the clinic for over 18 months from the date of dispensing were identified as dropouts. Only 73 patients were identified as falling under this category of dropout. The reasons for dropout were categorized as comfort-related, vision-related, other reasons, and those who underwent surgical procedures.

Results: Unlike previous studies, which included soft lenses, this study revealed only 2.28% (73/3200) of dropouts. There were 38 patients with unilateral lens fitting and 35 patients with bilateral lens fitting. The visual acuity was significantly improving with contact lens in these eyes. The clinical presentation of these patients was analyzed to know about their stage of disease while they dropout from the contact lens clinic.

Conclusion: Although dropout of contact lens is much lesser in irregular corneal conditions, it is important for the practitioner to be updated with the alternate and latest modality of lens choices to satisfy vision-related and comfort-related issues of patients.

Keywords: Rigid gas permeable (RGP), Scleral contact lens (ScCL), Best-corrected visual acuity (BCVA), collagen cross-linking (C3R), Penetrating keratoplasty (PK)

INTRODUCTION

Corneal surface irregularities could be due to keratoconus, corneal penetrating injuries, and infections leading to corneal scars. Irregular corneas cause significant vision reduction, mainly due to direct obstruction of the rays by opacity or irregularity. Spectacles cannot fully compensate for an irregular corneal surface.^[1]

Treatment options for corneal irregularities and high degree of astigmatism have expanded during recent years, with advanced treatment options in which the tear fluid layer under the contact lens (CL) evens out the irregularity.^[1] The use of corneal rigid gas permeable (RGP) CL might be the first treatment option because it provides good visual acuity, masks a high degree of astigmatism, and has high oxygen permeability and it is also cost-effective for the patients.

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Management of patients with corneal irregularities consists primarily of providing optical correction to maximize visual function. Spectacle correction or soft contact lenses (SCLs) may be sufficient for visual needs in the early or mild stage of irregularity. However, a disease progression gives rise to complex optical aberrations and, in such cases, corneal RGP CL masks these aberrations by allowing a tear lens to form between the CL and the irregular corneal surface. In advanced cases, RGP may be associated with an increased risk of corneal scarring. In such cases, advancements in CL materials and fitting technologies improve ocular comfort and also help in maintaining corneal health.^[2]

Visual acuity will not differ in terms of various RGP lenses, but advanced lenses such as tolerable lens design, and scleral contact lenses (ScCL) may be more comfortable and tolerable for the patient for wearing for long hours, providing high oxygen permeability.^[3] For patients who cannot tolerate the RGP lenses due to the advanced stage of the disease and design of lenses like ScCL could be very useful.^[4,5] Advanced lenses such as Rose-K and ScCL will give patients good visual acuity in the affected eye and also help for better corneal oxygenation.^[6]

In the case of advanced keratoconus, appropriate lens selection and proper lens fitting will help in delaying the need for corneal transplantation. In some cases, even after corneal transplantation, the specialty CLs such as Rose-K and ScCL may need to correct residual astigmatism. Smiddy *et al.* have shown that up to 70% of patients can successfully use CL after corneal grafting.^[7] ScCL can provide a successful, and safe visual and therapeutic solution for ocular conditions when conventional CL and medical treatments have failed, and where surgery is undesirable or contraindicated.^[2-4]

MATERIALS AND METHODS

This study was performed to analyze the reasons for the patient's dropout from a CL clinic after being dispensed with lenses for vision improvement for irregular cornea. The CL clinic in the tertiary center is divided into three categories. The first CL clinic deals with SCL designs and RGP lenses for normal corneas, the specialty clinic deals with different corneal RGP lenses, special design soft and custom toric lenses, and piggyback and hybrid lenses for irregular corneas. The super specialty clinic deals with all kinds of mini-scleral and ScCL.

This study was performed at the specialty CL clinic, which deals with irregular cornea fitting lenses, except mini-scleral and scleral gas-permeable lenses. Medical records of patients who have been dispensed with lenses at the specialty contact clinic were reviewed. The medical records of patients who visited the specialty CL clinic for the 1st time during 2014–2018 were screened for the study.

A total of 3200 medical records of patients who have been fitted with CLs for the 1st time were screened. Records of patients who have not reported to a clinic beyond 18 months after lens dispensing were included in the study, which is the definition for dropout as considered in this study. Patients who visited the ophthalmologist for other treatments but did not visit the CL clinic, and discontinued lenses were also considered as drop out. The information related to the irregular cornea, reason for CL, visual acuity, best-corrected visual acuity (BCVA) with CL, BCVA with spectacles, topography readings, mainly Sim K, Sim K2, corneal thickness, type of lens dispensed, and details of any further treatment apart from CL were documented.

When the reason for dropout is not documented in the medical records or if the patient did not return for a general eye examination, these patients were contacted over the telephone to inquire about reasons for the dropout. The reason for dropout was categorized into four different types, namely, comfort-related, vision-related, and other reasons and undergoing alternative treatments. The patient who has good vision with glasses in one eye and no improvement with CL is categorized as having vision-related problems. A patient who discontinues using CL due to irritations, discomfort, and other problems is categorized as a comfort-related reason for dropout. The patient who cannot do regular follow-ups due to long distances or stops and financial issues is categorized as having other reasons for the category of dropout. The patient who stops some surgery and stops using dispensed CLs and also has good visual acuity in one eye after surgery is considered as undergoing an alternative treatment category of dropout.

RESULTS

There were only 73 of 3200 patients recorded who were identified as falling under the category of dropout definition for this study. These patients did not report to the clinic beyond 18 months of lens dispensing. All the other patients have come for follow-up after lens dispensing.

Out of the 73 patients, 108 eyes were fitted with CL on their last visit to the clinic. There were 38 patients with unilateral lens fitting and 35 patients with bilateral lens fitting. The visual acuity improved with CL in those eyes. The mean unaided visual acuity was 0.92 ± 0.53 and with CL 0.19 ± 0.21 Log Mar acuity ($P < 0.001$). The clinical presentation of these patients was analyzed to find out about their stage of disease while they dropped out of the CL clinic.

The reasons for dropout, of which 36.11% were due to undergoing alternative treatment for corneal irregularities such as collagen cross-linking (C3R), penetrating keratoplasty (PK), deep anterior lamellar keratoplasty (DALK), and lensectomy. The second highest cause of dropout was

discomfort with lenses at 27.78%. There were 21.30% who reported discontinuation due to vision-related problems and only 14.81 reported reasons such as long distance, cost of treatment, disinterest, and difficulty in follow-up, which is mentioned in the pie diagram [Figure 1] below.

In this study dropout, the average age of the subjects who were identified to be dropouts from the clinic was 38 ± 12.21 years. The minimum age is 3 years where the subject had aphakia with irregular cornea due to trauma and surgery, maximum age of 69 years with a diagnosis of irregular cornea. The mean flat and steep K ranged from $50.10 + 9.77 -56 + 10.2D$. The corneal thickness ranged between 383 and 564. The details of age, simulated flat and steep k, and corneal thickness used for this study are mentioned in [Table 1].

This study shows that out of 108 eyes were fitted with CL in which 13 eyes had high refractive errors such as myopia, hyperopia, aphakia, and astigmatism. There were 95 eyes with corneal irregularities. According to Sim K reading and Krumeich classification. Current studies show 24 eyes in stage 1, 20 eyes in stage 2, 7 eyes in stage 3, and 44 eyes with stage 4 corneal irregularity. The other 13 eyes were not classified as they are other than corneal irregularity/pathology, which are listed below [Table 2].

There are 32 Rose-K lenses, 63 RGP CL, 1 customized toric, and 12 Piggyback/Hybrid lenses dispensed for these 108 eyes. The corneal measurements, namely, Sim K, corneal thickness, and BCVA in cases, and surgical procedures underwent in each category of dropout reason are tabulated in [Table 3]. The corneal thickness was higher than $400 \text{ microns} \pm 76$ in the group who dropped out due to comfort-related problems. Other groups mean that corneal thickness was <400 microns. Subjects with vision-related problems had significantly lesser BCVA with lenses compared to other groups. The subjects

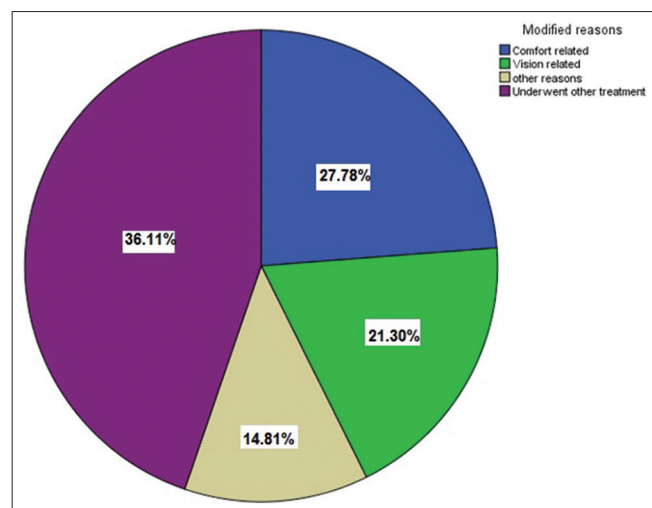


Figure 1: The pie diagram below shows the percentage of eyes in each category.

underwent surgical procedures after lens dispensing due to discomfort, poor vision, or advanced condition.

[Table 4] shows the number of eyes that underwent collagen cross-linking (C3R), DALK, PK, and lensectomy. It is seen that almost 50% of the subjects underwent surgical procedures of which 26 eyes underwent PK, 13 eyes underwent DALK, 14 eyes underwent C3R, and one eye was operated for lensectomy.

[Table 5] summarizes a patient’s status of using lenses or spectacles after losing-to follow-up from the CL clinic. Thirty-nine out of 108 eyes underwent surgery and used spectacles or under follow-up for the postoperative procedure. There were 18 dropout patients who stopped wearing lenses due to difficulty with follow-up and staying in faraway places. Thirteen eyes were comfortable using glasses. Nineteen eyes were from lenses and the other eye’s visual acuity was very good for managing day-to-day activity. There were six eyes, in which patients informed that they were using lenses and following up locally due to difficulty in visiting the follow-up clinic. Hence, of the 108 eyes, only 102 eyes were actual lens dropouts and only six patients are still under CL wear.

DISCUSSION

Unlike previous studies which included SCL wearers, this dropout study revealed only 2.28% (73/3200) of dropouts from our CL clinic. Sulley *et al.*'s study listed the following reasons for dropping out of lenses. It can be due to discomfort,

Table 1: Details of age, simulated flat and steep K, and corneal thickness.

Variable	Age	SIM K	SIM K2	CT
Mean	37.94	56	50.10	375.95
STD	12.21	10.2	9.77	90.62
Median	26	52.7	47.8	383
Minimum	3	37.4	13.3	52
Maximum	69	78.72	74.9	564
Sample	108 eyes	89	89	79

CT: Corneal thickness, STD: Standard deviation

Table 2: Number of eyes with irregular cornea and high refractive error in each group.

Reason for dropout	Total no. of eyes n=108	High refractive error	Irregular cornea
Comfort-related	30	7	23
Vision-related	23	4	19
Other domestic reasons	16	2	14
Underwent other treatment	39	0	39
Total	108	13	95

n=Number of eyes

Table 3: Age, Sim K, BCVA with CL, and corneal thickness at the last dispensing for each group.

Reason for dropout	Total no. of eyes n=108	Age years	Vision Log mar units	Steep K Diopter	Flat K Diopter	Corneal thickness in microns
Comfort	30	30.16±13.17	0.12±0.22	53.53±8.81	47.16±11.18	408.27±76.78
Vision	23	26±9.43	0.34±0.31	54.17±9.66	49.55±7.99	374.82±137.26
Other domestic reasons	16	30.87±18.03	0.19±0.28	50.47±10.77	45.31±8.25	390.50±78.25
Underwent other treatment	39	26.17±9.72	0.16±0.13	60.67±9.63	54.02±9.11	350.68±64.06

BCVA: Best corrected visual acuity, CL: Contact lens, n=Number of eyes

Table 4: Type of surgery underwent after lens dispensing and lost to follow-up.

Reason for dropout	Total no. of eyes n=108	No. of eyes underwent surgery	C3R	DALK	PK	Lenectomy
Comfort	30	7	4	1	2	
Vision	23	5	1	2	3	
Other domestic reasons	16	2	2			
Underwent other treatment	39	39	7	10	21	1
Total	108	53	14	13	26	1

C3R: Collagen cross-linking, DALK: Deep anterior lamellar keratoplasty, PK: Penetrating keratoplasty, n=Total number of eyes

Table 5: Status after lost to follow-up as per telephonic conversation or from the medical record.

Reason for dropout	Total no. of eyes n=108	Using glasses	Good visual acuity in the other eye hence not using any correction	Out of station and hence not in follow-up stopped lenses	Doing follow-up locally using lenses	No. of eyes underwent surgery
Comfort	30	6	10	7	1	7
Vision	23	5	7	6	0	5
Other domestic reasons	16	2	2	5	5	2
Underwent other treatment	39					39
Total	108	13	19	18	6	53

n=Number of eyes

poor vision, handling difficulty, inconvenience, red eyes, loss of interest, cost of the lens, lost lenses, and reaction to care products.^[8] In the present study, we are assessing the reasons for dropout are classified as eye-related problems, lens-related problems, patient-related problems, practitioners' misjudgment, and product non-availability.

The CL serves as a primary visual aid for their vision improvement. In many cases, it becomes mandatory to wear CLs because spectacles do not help and they may not have workable vision with both eyes, unlike soft lenses which are mostly prescribed for avoiding spectacles or as an alternative visual aid. Hence, in this study, the reasons for dropouts are classified as vision-related, comfort-related dropouts, and other reasons. In the dropout study, Sulley *et al.*^[8] explain that lens-related problems where the fittings failed for unforeseen reasons relating to lens performance, the most common being rigid lens discomfort which is present for one-tenth of all the dropouts. Although CL is the main source of visual aid in this study, 27.78% of subjects discontinued due to discomfort, 21.30% due to unsatisfied vision, and 36.11% due

to choosing other alternative treatment, About 14.81% were due to other reasons such as not being able to reach the clinic, disinterest, cost, and local care. The most common reason for dropout is undergoing alternative treatment 36.11%.^[9] The previous studies indicated that 31–64% of CL wearers discontinue CL use due to ocular discomfort; our study correlates with also (27.78%) the same. There are situations when the practitioner/patient might have a dilemma about choosing the type of lens on the first visit. These subjects might be effective lens wearers if followed up and can be shifted to more comfortable options of lenses like hybrids, mini-scleral mini-scleral, or ScCL.

In the lapsed CL wearer study,^[9] it was found that 77% of wearers can be successfully refitted with CL using current products. A small number of subjects (8/12) were refitted and achieved a relatively high success rate. In this study, as the subjects were lost to follow-up, they were not included in seeing a success rate for refitting. The third reason for dropout is dissatisfied vision (21.30%). With the lenses, as in previous studies including SCL, the second most common reason is

noted as a vision problem.^[1] In the present study problems, the BCVA with CL was 0.34 ± 0.31 in subjects with the primary reason for poor vision as a reason for dropout. Of these subjects, five subjects underwent surgery for DALK and PK as vision did not improve with CL. The reason for poor vision might be due to scarring, amblyopia, or poor lens fitting.

In the present study, most of the eyes (63/108) were fitted with a conventional gas-permeable corneal lens, and 32/108 were fitted with the Rose-K design of the corneal GP lens. In this practice, optometrists are trained to give options for all types of lenses and explain the advantages and disadvantages of lenses, depending on the stage of the condition. Very rarely, patients might not choose the lens type advised due to the cost factor and, hence, might want to try corneal RGP only, which is the lowest cost of all. The fitting was performed by a well-trained optometrist and with the required protocol for a trial followed. Hence, as discussed in the lapsed study, the process of fitting and practitioner fitting assessment as the reason for poor fitting and reason for dropout is much less.

This study shows that the percentage of dropouts in a CL practice can be less if the practice follows certain protocols for fitting and choice of lens and there are well-trained optometrists available. In this study about the patient-related barrier to RGP lens wear, the author reports a high percentage of lack of awareness about RGP, fear of complications, lack of medical insurance, and hence medical cost and sociocultural beliefs as the main reasons for barriers to RGP lens wear in keratoconus.^[10] The progressive nature of the disease and its associated corneal curvature change might need a change of lens and involves a financial burden to the patient. In the present study, there were only 14.81% of the dropout were of these similar reasons and of which them reported testing locally.

CONCLUSION

Although dropout of CL is much less in irregular corneal conditions, it is important for the practitioner to be updated with alternate and latest modalities of lens choices to satisfy vision-related and comfort-related issues of patients.

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Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-Assisted technology for manuscript preparation

The author(s) confirms that there was no use of Artificial Intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using the AI.

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