

## Assessment Of Factors Affecting Long-Term Usage In Scleral Lens Wearers: A Prospective Study.

Deepak Gupta<sup>1\*</sup>, T. S. Ahluwalia<sup>2</sup>, Vivek Kumar Jain<sup>3</sup>

<sup>1</sup>Research Scholar, Department of Optometry, Nims College of Paramedical Technology, Nims University Rajasthan, Jaipur

<sup>2</sup>Professor, Department of Ophthalmology, NIMS & R, Nims University Rajasthan, Jaipur

<sup>3</sup>Medical Director, ITEK Vision Center, Delhi

### \*Corresponding Author:

Deepak Gupta

Research Scholar, Department of Optometry, Nims College of Paramedical Technology, Nims University Rajasthan, Jaipur

Cite this paper as: Deepak Gupta, T. S. Ahluwalia, Vivek Kumar Jain, (2025) Assessment Of Factors Affecting Long-Term Usage In Scleral Lens Wearers: A Prospective Study... *Journal of Neonatal Surgery*, 14 (26s), 1285-1290.

### ABSTRACT

**Introduction:** To assess factors influencing the long-term usage of scleral lenses among wearers evaluating both subjective experiences and clinical parameters.

**Methods:** A prospective study was conducted on new scleral contact lens wearers. Details of enrolled patients was collected using validated questionnaire. Clinical data including lens parameters (diameter, material), wearing time (hours/day, days/week), and ocular findings (conjunctival redness, corneal staining) were recorded. Statistical analyses were performed to identify significant factors associated with sustained scleral lens usage.

**Results:** The study included 40 study scleral lens wearers with mean age  $42.5 \pm 12.4$  years and predominantly female(60%). longer wearing duration correlated positively with higher satisfaction scores ( $p < 0.001$ ), better lens comfort ( $p = 0.002$ ), and fewer adverse symptoms ( $p = 0.01$ ). Difficulty in lens handling and midday fogging were common challenges impacting long-term use.

**Conclusions:** This study suggested that subjective satisfaction, comfort, and ease of lens handling are critical factors for long-term scleral lens usage.

**Keywords:** Scleral lenses, Long-term usage, Validated questionnaire, Compliance, Comfort, Patient satisfaction

### 1. INTRODUCTION

Scleral contact lenses are wide-diameter, rigid gas-permeable lenses that were developed in the late nineteenth century. They vault over the whole cornea, creating a fluid reservoir between the anterior surface of cornea and posterior surface of the lens. This temporarily regularizes the anterior corneal surface thereby providing comfort, hydration and optimal visual comfort. The Scleral Lens Education Society(SLS) characterized scleral lenses on the basis of fit and its size into corneo-scleral (8-12.5mm), semi-scleral (12.5–15 mm), mini-scleral (15–18 mm), and large scleral lenses (18–25 mm). There is no distinction between the terminologies of the modern scleral lenses. [1]

Scleral lenses are typically thicker (upto 1300 microns central thickness for full scleral lenses) than the corneal rigid gas permeable lenses ( approx to 140- 180 microns) to avoid on eye and handling flexure. Therefore to counteract this increased thickness these days scleral lenses are manufactured from highly permeable materials to maximize oxygen transmission to the cornea. This is particularly important since scleral lenses do not move upon blinking to allow fleshly oxygenated tears to replenish the post lens tear layer.

These days commonly used scleral lenses are **BOSTON XO<sub>2</sub>** corneo-scleral lenses. They have a diameter of 14.5mm and are based on McAsfeer geometry i.e., Multi Curve Aspheric Back Surface. These lenses have high oxygen permeability of 141Dk and are made up of fluoro-silicon acrylate material. All scleral lenses are 'fitted to vault over the entire cornea and land on the sclera. Scleral lenses are typically thicker upto 1300 microns central thickness for full scleral lenses.'<sup>[2-3]</sup>

Initially, the correction of refractive errors, mainly that of irregular astigmatism was the primary indication for scleral lenses. Modern scleral lens designs and their unique fitting characteristics provide the ocular surface with continuous hydration and protection from the shearing forces of the eyelids. These lenses are now indicated in various conditions high astigmatism, corneal ectasias(such as keratoconus, pellucid marginal degeneration, keratoglobus), post corneal surgeries like penetrating keratoplasty, post LASIK ectasias , post C3R, healed corneal scars and other ocular surface diseases like dry eyes. In post

PK cases the scleral contact lens vaults over the cornea which protects the suture area from touch. It is also seen beneficial in rare cases like Stevens and Johnsons syndrome.<sup>[4-5]</sup>

Scleral lenses have become an essential option for patients with irregular corneas, ocular surface disorders, and refractive errors. Their long-term use offers improved visual performance and ocular protection, yet consistent use can be challenged by factors including discomfort, handling difficulties, and ocular adverse effects. Understanding determinants of long-term compliance and sustained wear is essential for optimizing patient outcomes. Prior studies suggest subjective experiences significantly influence lens retention, but comprehensive assessments in scleral lens populations remain limited. <sup>[6-8]</sup>

This study aims to fill this gap by exploring factors influencing the long-term usage of scleral lenses among wearers evaluating both subjective experiences and clinical parameters.

### Ideal Vault Clearance Between Lens & Cornea

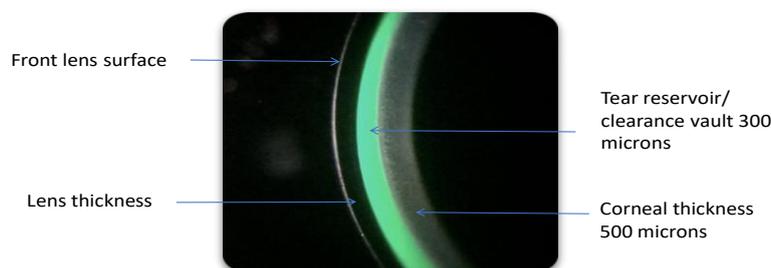


Figure: Ideal Vault clearance between lens & Cornea

## 2. MATERIALS & METHODS:

### Study Design and Participants:

An observational prospective study was conducted among new scleral lens wearers of age 18 years to 48 years in Delhi, India.

### Selection criteria of patients:

#### Inclusion criteria:

Individuals requiring scleral contact lenses

Age between 18 years to 48 years, both gender

Corneal scar with high astigmatism

Dry Eyes, Corneal irregularities such as Keratoconus, PMD (Pellucid marginal degeneration)

After uncomplicated PK/RK/C3R for refractive error correction and and visual rehabilitation

#### Exclusion Criteria:

Patients hesitant or reluctant about scleral contact lens use.

Patients who wouldn't turn up for regular followups.

Patients with any active infection or allergic eyes.

Subjects with ocular comorbidities precluding lens wear.

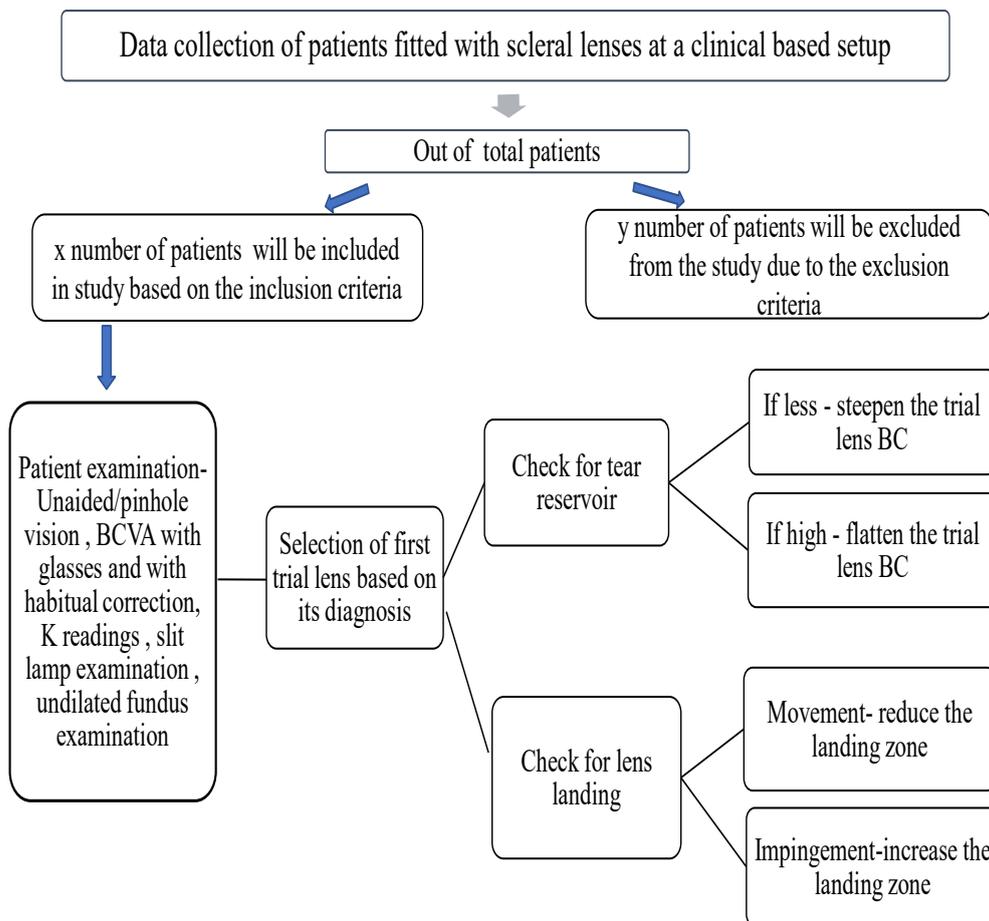
Incomplete data were excluded.

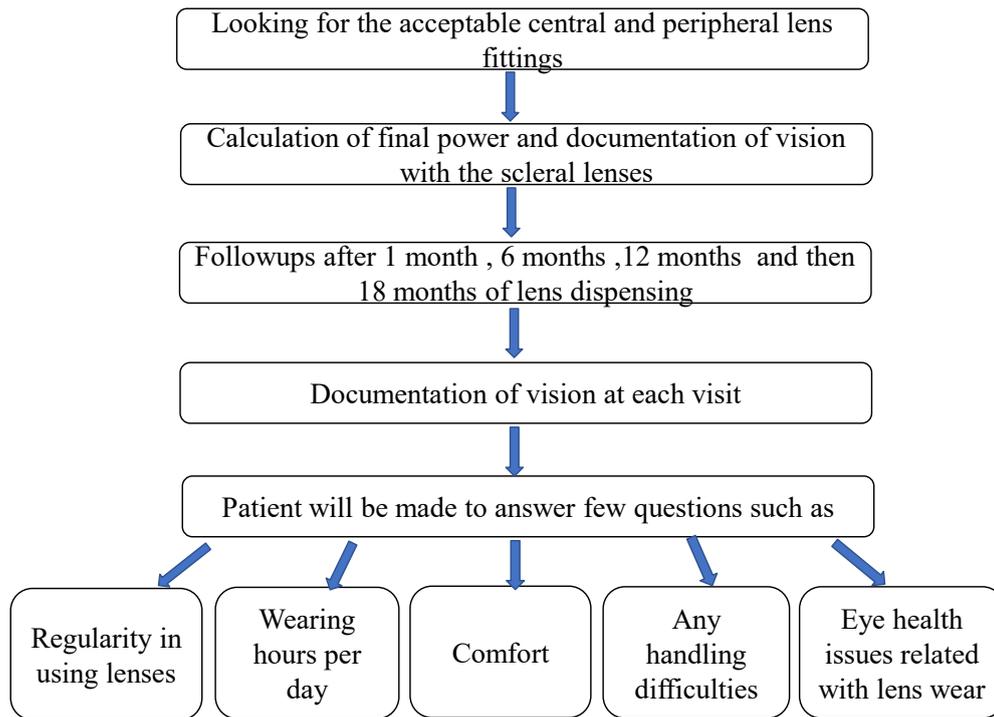
## 3. METHODOLOGY:

In this prospective study, 43 patients requiring scleral contact lenses were enrolled considering inclusion and exclusion

criteria. Each patient was prescribed with scleral contact lens **BOSTON XO<sub>2</sub>** after clinical evaluation. These Corneo- scleral lenses with diameter of 14.5mm, Fluoro Silicon Acrylate & Multi Curve Aspheric Back Surface. Filling of structured validated questionnaire and clinical evaluation was done on each follow up visit. Clinical evaluation including lens parameters (diameter, material), wearing time (hours/day, days/week), and ocular findings (conjunctival redness, corneal staining) and questionnaire included visual satisfaction, comfort, handling ease, ocular surface symptoms, and overall lens wear experience. On follow up out of 43 scleral lens patients, 3 (7.5%) were discontinued due to discomfort and adaptation issues.

## STUDY FLOW CHART





**Fig 2: Flow chart of Study**

**Statistical Analysis:**

Descriptive statistics summarized participant characteristics and questionnaire scores. Correlation analyses and logistic regression identified factors significantly associated with sustained lens wear (>2 years). A p-value <0.05 was considered statistically significant.

**4. RESULTS**

**Participant Characteristics:**

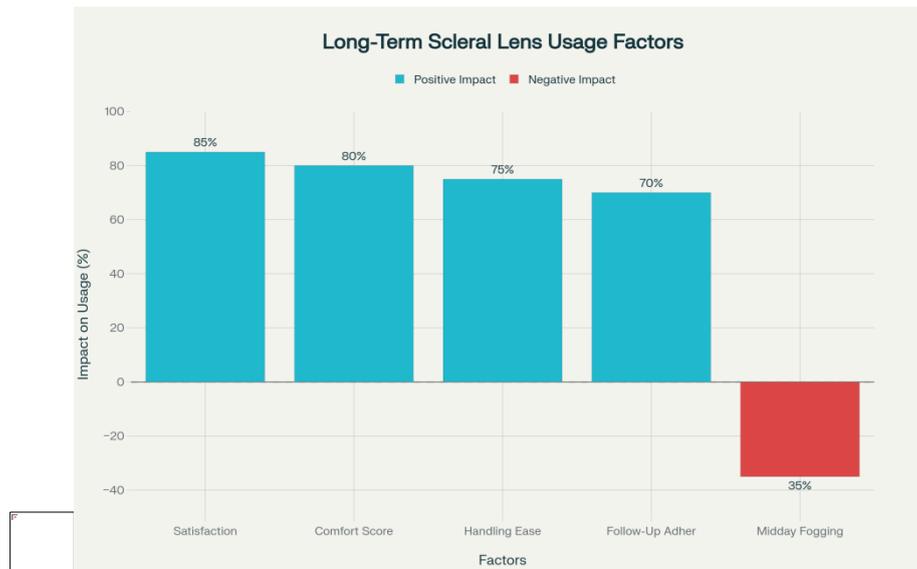
The study included 40 study patients with mean age  $42.5 \pm 12.4$  years and predominantly female (60%).

**Subjective Findings:**

The average wearing time was  $8 \pm 2.5$  hours/day and  $5.5 \pm 1.2$  days/week. The indications for prescribing scleral lens included keratoconus (65%), ocular surface disease (20%), and refractive errors (15%). High satisfaction (mean score 4.2/5) and comfort (4.0/5) were reported among study subjects.

**Clinical Findings:**

Common symptoms like dryness and redness negatively impacted usage duration. Main challenges reported by them were lens handling difficulty (25%) and midday fogging (30%). Visual quality scores were higher among keratoconus patients using scleral lenses. No significant associations were found with demographic factors or lens parameters.



**Figure3 : Positive predictors and negative predictors of longer Usage**

**Factors Affecting Long-Term Use:**

Positive predictors of longer usage included higher comfort and satisfaction scores ( $p < 0.001$ ), ease of lens insertion and removal ( $p = 0.003$ ), and regular follow-up care adherence ( $p = 0.01$ ).

**5. DISCUSSION**

This study highlights subjective patient factors—particularly comfort, satisfaction, and handling ease—as key determinants of long-term scleral lens wear. These results echo findings in rigid gas-permeable lens studies where subjective experience outweighed biometric parameters in compliance.

In this study findings highest satisfaction with mean score 4.2/5 and comfort 4.0/5 were reported overall. Main challenges reported included lens handling difficulty (25%) and midday fogging (30%). Visual quality scores were higher among keratoconus patients using scleral lenses. Studies reported that scleral lenses were more beneficial in patients with corneal irregularities than in patients with healthy corneas. The correct lens insertion and its removal time was also found to be reduced gradually over a period of one year. Improper handling and discomfort were the main reasons for dropout.<sup>[9]</sup>

Some studies stated corneal changes following short term wear of mini- scleral lenses and observed that there was small amount of flattening of the anterior corneal surface following short term mini scleral lens wear whereas rebound thinning and flattening of the posterior surface was evident after the 3 hour recovery period following lens removal. Also there was no evidence of either central or peripheral corneal oedema following 3 hours of lens wear.<sup>[10,11]</sup>

It is generally safe but may have some unique physiological responses demonstrating the practitioner’s need to be constantly aware. Practitioners should know how to properly assess on-eye scleral lens fitting and assess the common physiological responses for better and faster eye care.<sup>[12-14]</sup>

**6. CONCLUSION**

This study suggested that subjective satisfaction, comfort, and ease of lens handling are critical factors for long-term scleral lens usage. Clinicians should focus on optimizing comfort, addressing handling challenges, and maintaining follow-up to enhance wearer retention and satisfaction in lens users.

**REFERENCES**

- [1] Michaud L, Lipson M, Kramer E, Walker M. The official guide to scleral lens terminology. *Contact Lens and Anterior Eye*. 2020 Dec 1;43(6):529-34.
- [2] Barnett M, Courey C, Fadel D, Lee K, Michaud L, Montani G, Van Der Worp E et al. Bcla clear-scleral lenses. *Contact Lens and Anterior Eye*. 2021 Apr 1;44(2):270-88
- [3] Severinsky B, Behrman S, Frucht-Pery J, Solomon A. Scleral contact lenses for visual rehabilitation after penetrating keratoplasty: long term outcomes. *Contact Lens and Anterior Eye*. 2014 Jun 1;37(3):196-202
- [4] Barnett M, Lien V, Li JY, Durbin-Johnson B, Mannis MJ. Use of scleral lenses and miniscleral lenses after

- penetrating keratoplasty. *Eye & Contact Lens*. 2016 May 1;42(3):185-9.
- [5] Schornack M, Nau C, Nau A, Harthan J, Fogt J, Shorter E. Visual and physiological outcomes of scleral lens wear. *Contact Lens and Anterior Eye*. 2019 Feb 1;42(1):3-8.
- [6] Macedo-de-Araújo RJ, van der Worp E, González-Méijome JM. A one-year prospective study on scleral lens wear success. *Contact Lens and Anterior Eye*. 2020 Dec 1;43(6):553-61.
- [7] Otchere H, Jones LW, Sorbara L. Effect of time on scleral lens settling and change in corneal clearance. *Optometry and Vision Science*. 2017 Sep 1;94(9):908-13.
- [8] Macedo-de-Araújo RJ, Fadel D, Barnett M. How Can We Best Measure the Performance of Scleral Lenses? Current Insights. *Clinical Optometry*. 2022 Apr 7:47-65.
- [9] Schornack, M. M., Fogt, J., Nau, A., Nau, C. B., Harthan, J. S., Cao, D., & Shorter, E. (2021). Scleral Lens Prescription and Management Practices: Emerging Consensus. *Contact Lens & Anterior eye : The Journal of the British Contact Lens Association*, 46(1), 101501. <https://doi.org/10.1016/j.clae.2021.101501>
- [10] López-de la Rosa, A., Martín-Montañez, V., López-Miguel, A., Fernández, I., Calonge, M., González-Méijome, J. M., & González-García, M. J. (2017). Ocular response to environmental variations in contact lens wearers. *Ophthalmic & physiological optics : the journal of the British College of Ophthalmic Opticians (Optometrists)*, 37(1), 60–70. <https://doi.org/10.1111/opo.12338>
- [11] Macedo-de-Araújo, R. J., Faria-Ribeiro, M., McAlinden, C., van der Worp, E., & González-Méijome, J. M. (2020). Optical Quality and Visual Performance for One Year in a Sample of Scleral Lens Wearers. *Optometry and vision science : official publication of the American Academy of Optometry*, 97(9), 775–789. <https://doi.org/10.1097/OPX.0000000000001570>
- [12] Vincent SJ, Alonso-Caneiro D, Collins MJ. Corneal changes following short-term miniscleral contact lens wear. *Contact Lens and Anterior Eye*. 2014 Dec 1;37(6):461-8.
- [13] Romero-Jiménez M, Flores-Rodríguez P. Utility of a semi-scleral contact lens design in the management of the irregular cornea. *Contact Lens and Anterior Eye*. 2013 Jun 1;36(3):146-50.
- [14] Michaud L, Van Der Worp E, Brazeau D, Warde R, Giasson CJ. Predicting estimates of oxygen transmissibility for scleral lenses. *Contact Lens and Anterior Eye*. 2012 Dec 1;35(6):266-7
-