

Introduction

Modern scleral contact lenses are rigid gas permeable lenses with an overall diameter of the lens larger than the horizontal visible iris diameter by approximately 6mm.¹⁻³ The use of scleral lenses is becoming one of the current standard nonsurgical management for primary corneal ectasia, namely, keratoconus.

The primary goal in fitting a scleral lens is to ensure there is adequate post-lens thickness between the lens and the entire cornea, including the limbus area. While the ideal lens-cornea fitting relationship for the central 3-5mm of the lens is well established, there remains a lack of general consensus amongst contact lens practitioner how to lens should interact with peripheral cornea system, where the limbal stem cells reside.⁴ Furthermore, manufacturer fitting guides for each sclera lens products can vary in recommendations for limbal clearance. In all, the impact of varying limbal clearance in scleral lens wear has on the success of clinical performance of scleral lens is not well understood.

The purpose of this study was to investigate changes in the subjective satisfaction with comfort and ocular injection in keratoconic subjects before and after two weeks of scleral lens wear with varying limbal clearance (LC).

Methods

11 keratoconic subjects (all male, mean age of 38.5 ± 13.5 years, Range 24.0 to 67.0 years) were fitted bilaterally with two sets of scleral contact lenses (ZenLens™, Alder Optical, 16.0mm in diameter) with an initial central corneal clearance ranging between 220 and 280 μm , varying in LC with a difference of 50 μm (randomly selected). Lens material was the Boston XO (Dk = 100.).

The assessment of subjective comfort was measured by means of a questionnaire inquiring on overall comfort, dryness, and burning.

Bulbar and limbal hyperemia in nasal and temporal quadrants were assessed using an automatic grading function of the Oculus Keratograph 5®.

Results

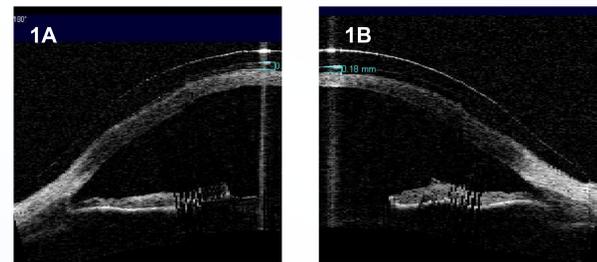


Figure 1A (Left). Anterior segment scans of sclera lens fit with low LC.
Figure 1B (Right). Anterior segment scans of sclera lens fit with high LC.

Table 1. Lens parameters and Fitting Characteristics of 22 scleral lens fits with low LC and 22 scleral fits with high LC.

Lens Parameter	Low LC	High LC
BOZR (mm)	7.77 ± 0.49	7.76 ± 0.48
Sag Depth (mm)	4.58 ± 0.27	4.59 ± 0.27
LD (mm)	16.0	16.0
CL Power	-2.46 ± 4.26	-2.28 ± 4.20
Fitting Characteristics		
Central Corneal Clearance (μm)	183.68 ± 63.86	204.74 ± 94.78
Limbal Clearance (μm)		
BCVA with CL (6/)	6.9 ± 0.75	7.12 ± 0.83
Limbal Clearance	-9.00	-3.50

Low and High LC fitted using the same central lens-cornea fitting relationship demonstrated in Figures 1 A and B, respectively. The final lens parameters for all scleral lens fits are listed in Table 1, along with the best corrected visual acuities and fitting characteristics with the study lenses

Comfort:

For low and high LC, the subjective reports for comfort, absence of dryness, and absence of burning sensation are represented in Figures 1A-C. Scleral lenses with higher LC were generally graded with higher scores for subjective assessment (77.8% of 22 eyes for comfort, 44.4% for no dryness, 66.7% for no burning) ($p < 0.01$, $p = 0.107$, $p = 0.086$)

Hyperemia:

Results from conjunctival hyperemia are represented in Figure 2 according to JENVIS scale. There was no statistically significant difference in hyperemia in the limbal and bulbar regions observed subsequent to scleral lens wear of low and high LC ($p = 0.67$ for nasal limbal area, $p = 0.27$ for temporal limbal area, $p = 0.87$ for nasal bulbar area, $p = 0.48$ for temporal bulbar area). Figures 3A and B demonstrate hyperemia associated sclera lens wear with low and high LC, respectively.

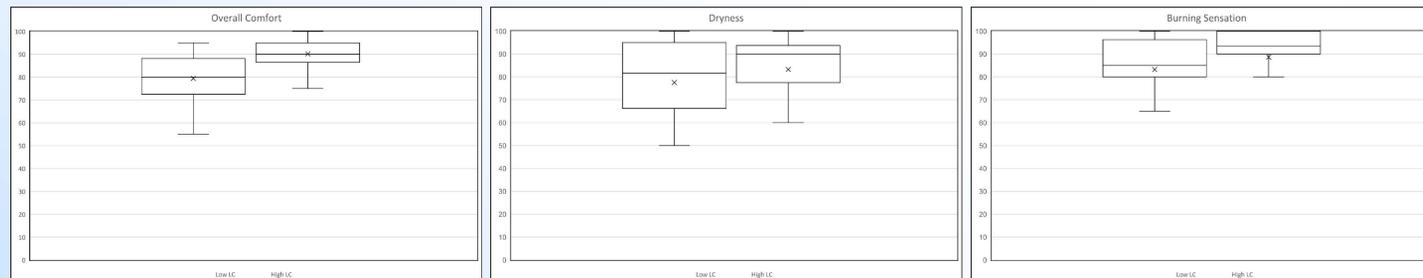


Figure 2A (Left), 2B (Center), 2C (Right). Distribution of subjective reports of overall comfort, dryness (0 = very dry, 100 = not dry at all), and burning sensation (0 = severe burning, 100 = no burning) after 2 weeks of wearing scleral lenses with low and high LC.

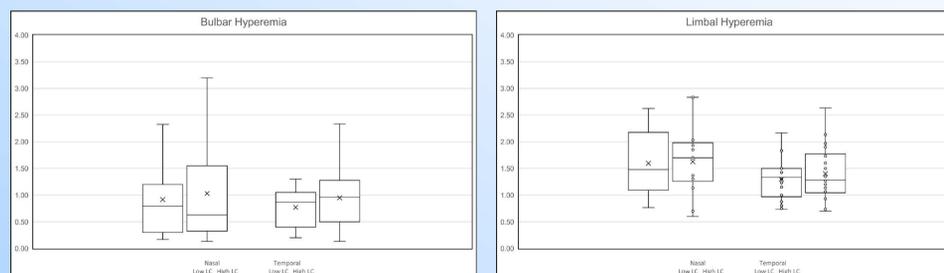


Figure 3A (Left), 3B (Right). Distribution of bulbar (3A) and limbal (3B) hyperemia measured after 2 weeks of wearing scleral lenses with low and high LC.

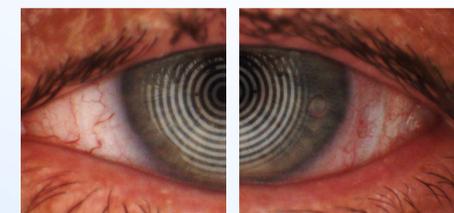


Figure 4A (Left), 4B (Right). Bulbar and limbal hyperemia measured after 2 weeks of wearing scleral lenses with low (4A) and high (4B) LC.

Discussion

- ❖ In this study, sclera lens fits with higher LC were reported to provide greater comfort for keratoconic scleral lens wearers. This may be due to the association between low LC and tight lens syndrome and greater negative pressure in post-lens tear film, which can result in photophobia, epiphora, or ocular irritation.⁵⁻⁶
- ❖ Limbal and conjunctival hyperemia is one the most common complications associated with scleral lens wear.¹ Injection is indicative of ocular distress associated with scleral wear⁷. Inclusive to the ocular surface as a result of mechanical irritation, toxicity may lead to influence the blood vessels on the ocular surface.⁷
- ❖ In this study, sclera fits with high LC were associated with greater degree of limbal and bulbar hyperemia. High LC may be associated with hypoxia or hypercapnia which has been reported to result in limbal redness in silicone hydrogel wear⁷. Other researchers have found a strong relationship between peripheral lens oxygen transmissibility and induced limbal redness as graded using a decimalized scale.⁸

Conclusion

Subjective comfort and absence of ocular sequelae are crucial in assessing the clinical performance of sclera lenses. Limbal clearance may play an important role in subjective performance in scleral lenses, but does not impact degree of hyperemia in either the limbal and bulbar regions. The association between the injection and an inflammatory etiology is currently being studied.

References

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Disclosures

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