Scleral Lenses for Severe Corneal Dellen: A Case Report

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INTRODUCTION

Scleral lenses are highly effective in correcting visual function for irregular cornea, such as keratoconus and post-keratoplasty, by covering the anterior surface of the cornea with a tear/fluid layer.

Corneal dellen is a condition in which the peripheral cornea becomes excavated and thin due to localized tear film instability, especially the mucin layer and dehydration. Focal corneal thinning causes an increase in corneal higher-order aberrations and worsening visual function in severe cases. We had experienced the scleral lens fitting for severe corneal dellen, and the patient achieved high satisfaction.

CASE DESCRIPTION

A 56-years-old male with bilateral corneal dellen was presented for contact lens fitting to optimize his vision. His best corrected visual acuity (BCVA) with spectacles was 20/40 for both eyes, and he was in trouble with unstable vision. Both corneas had deep excavation at the nasal cornea, and distinct Descemet's membrane folds at the center *(Figure1, 2)*.

First, soft contact lenses and corneal rigid gas permeable lenses were prescribed. However, the lenses were decentered, and visual acuity was not improved due to severe corneal irregularity. Thus, we tried scleral lenses (SclL) fitting to achieve better centration and eliminate corneal surface irregularity.

Even though visual acuity did not improve, total higher-order aberrations (HOAs) was remarkably decreased, and contrast sensitivity (CS) was improved. He became able to read smoothly and drive safely. He was very satisfied with stable visual functions.

< Exam at pre and post SclL fitting > *: Total HOAs of 4mm

		BCVA (Snellen)	CS (letters)	Corneal HOAs * (μm)	Ocular HOAs * (μm)
OD	Pre	20/40	5	3.795	2.759
	Post	20/40	11	0.109	0.404
OS	Pre	20/40	8	2.036	1.306
	Post	20/40	13	0.177	0.401

< Final SclL parameters >

	Material	Diameter (mm)	BC (mm)	Sag (μm)	Power (D)
OD	Boston XO	16.0	9.95	3000 @ 13mm	+7.5
OS	Boston XO	16.5	9.95	3100 @ 13mm	+7.5

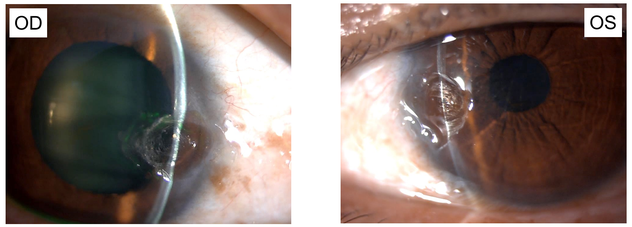

Figure 1. Anterior photos at presentation. Both corneas had deep excavation at the nasal cornea and Descemet's membrane folds at the center.

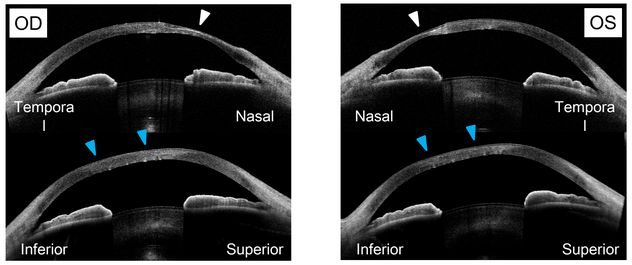

Figure 2. Cross-sectional images measured by anterior segment optical coherence topography (CASIA2). Corneal thickness was decreased at nasal lesion (white arrows), and inferior cornea was flattened (blue arrows).

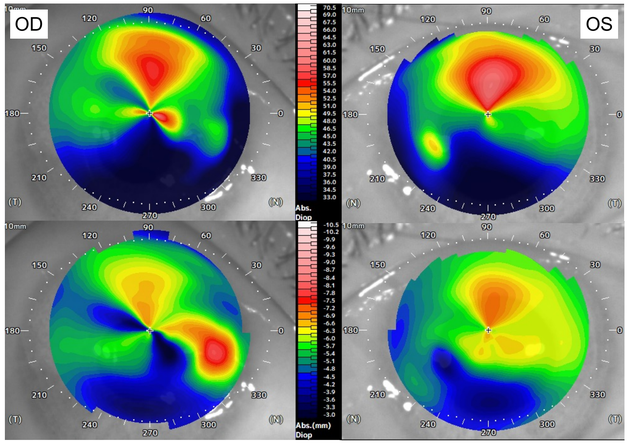

Figure 3. Axial power map of anterior (upper) and posterior (bottom) cornea measured by anterior segment optical coherence topography.

Not only anterior but also posterior cornea surface were flattened in lower part.

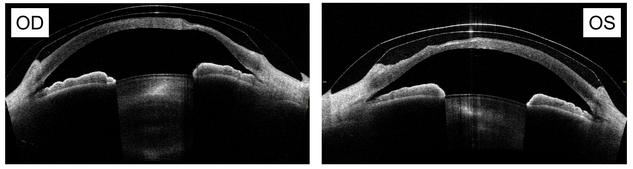

Figure 4. Horizontal cross-sectional images with SclL. Whole corneal surface was covered with fluid layer.

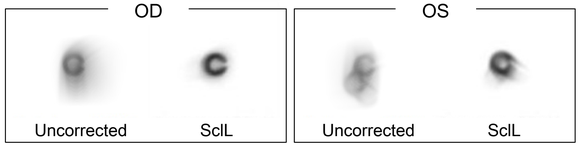

Figure 5. Estimate retinal image simulated by the wavefront analyzer.

Images became clear after wearing SclL.

DISCUSSION

As for keratoconus, it has been reported that SclL reduced corneal total HOAs 48-71% [1,2]. In this case, corneal and ocular total HOAs were decreased by more than 90% and 70% after wearing SclL. So as to the previous studies, SclL fitting for corneal dellen was as effective as that for keratoconus regarding to HOAs.

Basically, SclL cannot reduce HOAs induced by the posterior corneal surface. We used a wavefront analyzer (Topcon KR-1W), composed of a Placido-based corneal topography and a Haltmann-Shack aberrometer, to measure HOAs. Therefore, posterior corneal HOAs were calculated as part of the ocular HOA, not the corneal HOA. This would be the reason why the decrease of ocular HOAs was smaller than that of cornea.

It is known that posterior corneal HOAs are one third to one 6th of anterior corneal HOAs [3,4] and have a smaller impact on visual function [5-7]. Therefore, SclL would be effective even if it did not completely eliminate posterior corneal HOAs. We consider that the patient will benefit from the SclL prescription even if not only the anterior but also the posterior corneal surface have high irregularity.

Even though visual acuity did not improve remarkably, CS measured by the Pelli-Robson chart improved from 5 to 11 letters for the right and 8 to 13 letters for the left. Additionally, the estimated retinal image simulated by the wavefront analyzer became clearer *(Figure 5)*. We considered these findings resulted from the reduction of HOAs, and CS test and aberrometer would be suitable methods to evaluate SclL effectiveness, especially for patients with severe corneal ectasia.

CONCLUSION

SclL fitting was effective as a vision correction for corneal dellen and provided patients with improved visual function and high satisfaction. Patients could benefit from reduction of HOAs even if visual acuity does not improve remarkably. In addition, CS tests and HOA measurements may be useful in clarifying the benefit of SclL for patients whose visual improvement cannot be evaluated by standard visual acuity tests.

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