Multifocal Scleral Contact Lens Management of an Aphakic Glaucoma Patient Following Tube Shunt Surgery

Heidi G. Miller, O.D.
Southern California College of Optometry at Marshall B. Ketchum University

Abstract

BACKGROUND: Aphakic patients requiring refractive correction and lens stability may benefit from multifocal scleral contact lenses. In aphakic glaucoma cases involving tube shunts, close monitoring is imperative due to the risk of ocular infection and erosion.

CASE REPORT: A 14-year-old Caucasian male with a past history of bilateral aphakia, primary open angle glaucoma, failed trabeculotomy in the left eye, and bilateral tube shunts presented for a scleral contact lens fitting. His chief complaint was difficulty playing sports with progressive addition spectacle lenses and intolerant to corneal gas permeable (GP) contact lenses. Our goal was to provide functional and stable vision while catering to the patient’s needs using multifocal scleral lens options.

CONCLUSION: Scleral contact lenses can be a viable option for managing aphakic patients, especially in cases where corneal gas permeable lenses are not tolerated. With careful fitting and close monitoring, aphakic glaucoma patients with a history of tube shunt surgery can benefit from options provided with scleral lenses.

Background

Infantile cataracts are one of the major contributors to visual impairment in children. Following cataract surgery, contact lenses continue to be a highly effective option in the management of pediatric aphakia. Despite improvement in extraction methods, glaucoma continues to be the most common sight-threatening post-operative complication. The etiology of aphakic glaucoma is still unclear; however, most cases take the form of open-angle glaucoma. In aphakic glaucoma cases involving tube shunts and contact lenses, close monitoring is imperative due to risk of ocular infection and erosion. A case in which multifocal scleral contact lenses are prescribed for an aphakic patient following tube shunt surgery is presented here.

Case Report

Case History

A 14-year-old Caucasian male was referred to the University Eye Center in December 2013 for a bilateral scleral contact lens fitting. At the initial evaluation, the patient complained of difficulty playing sports with progressive addition spectacle lenses. He was requesting scleral contact lenses for playing volleyball. This patient wore corneal GP contact lenses until the age of 5 but discontinued due to lens intolerance and visual instability. Since then, he has only worn a spectacle correction. His ocular history is remarkable for bilateral aphakia, primary open angle glaucoma, and strabismus. Ocular surgical history includes complex infantile cataract surgery in both eyes, bilateral Baerveldt implants, trabeculotomy in the left eye, and pupil surgery in the left eye. Family ocular and medical history is unremarkable.
Medical history is remarkable for seasonal allergies. His current medications include Azopt and Latanoprost.

**Examination/Testing Procedures**

Best corrected spectacle visual acuity in the right eye (OD) and left eye (OS):

- **OD:** +9.25 DS (20/20) +3.00 Add (RS25)
- **OS:** +11.50 DS (20/20-2) +3.00 Add (RS20-3)
- **OU:** Distance: (20/15-1) Near: (RS20)

Upon examination, bilateral temporal corneal cataract extraction scars were observed. Also, mild conjunctival entrapment was evident in the left eye following cataract surgery. There was mild asymmetry in pupillary response observed in inferior portion of the left pupil as a result from the pupil surgery. A tube shunt was visible at 12 o'clock in both eyes, although more evident in the left eye. The right eye exhibited mild anterior vitreous prolapse with suspended pigment in the anterior chamber. Corneal topography revealed a relatively spherical and regular corneal surface in both eyes. (Figure 1)

![Figure 1: Patient’s topography (axial map)](image)

**Contact Lens Fitting/Follow Up**

**Scleral Contact Lens Fitting Process**

Initial scleral lens fitting was performed using corneal topography data and diagnostic lens fluorescein pattern interpretation. Using a diagnostic fitting set, both eyes were fit with a Jupiter Scleral™ lens (Essilor). Standard scleral lenses were finalized prior to ordering the multifocal lens design. The following initial parameters were ordered:
The over-refraction was incorporated in the new power for both eyes. The limbal curve was steepened along with lengthening the limbal curve width to allow greater limbal clearance. Both the landing and edge curve were shortened in order to maintain a 15.2B overall diameter.

At the dispense appointment, the visual acuity with lenses on was 20/30-2/+2 in the right eye and 20/20-2 in the left eye. With an over-refraction of +0.50DS in the right eye, the patient could see 20/25-2. The left eye had an over-refraction of plano. There was approximately 180 microns of central clearance in the right eye and 220 microns in the left eye. Limbal clearance was adequate in all quadrants except thinned nasally in both eyes. There was mid peripheral blanching of several vessels nasally and temporally, with the left eye having more blanching than the right eye. No flexure was observed with these lenses. All observations were made after letting the lens settle for approximately 20 minutes.

The patient was instructed on insertion and removal and lens care was reviewed. The patient was scheduled to return wearing the lenses two weeks after dispense. The patient returned for several follow-up visits. Small adjustments were made at each visit in order to provide the best lens fitting relationship and comfortable vision. The center thickness of each ordered lens was verified prior to each visit. The follow-up visits and changes are summarized below.

Follow Up Visit #1:

<table>
<thead>
<tr>
<th>Essilor</th>
<th>Diameter</th>
<th>BCR</th>
<th>Power</th>
<th>Remaining Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jupiter Scleral</td>
<td>15.2 B</td>
<td>8.06</td>
<td>+11.50</td>
<td>8.26 x 1.7/ 8.5x1.0/12.75 x 0.3/ 14.25x 0.3/ 8.6ozd /0.67</td>
</tr>
<tr>
<td>Jupiter Scleral</td>
<td>15.2 B</td>
<td>8.06</td>
<td>+15.63</td>
<td>8.26 x 1.7/ 8.5x1.0/12.75 x 0.3/ 14.25x 0.3/ 8.6ozd /0.80</td>
</tr>
</tbody>
</table>

Visual Acuity:
OD: 20/25-1  OS: 20/20-1

Parameters Changed From Previous Lens:
OD: The base curve radius was steepened by one diopter to provide additional central clearance. The over-refraction was incorporated into the new power.
OU: The limbal curve was steepened to provide adequate limbal clearance.

Fitting Relationship: (Observations after 20 minute settling period)
There was approximately 220 microns of central clearance in both eyes at this visit. Limbal clearance was adequate in all quadrants. The right eye showed mild edge lift from 10 to 12 o’clock with the superior edge encroaching the superior limbus due to mild lens drop. The left eye continued to have mid-peripheral blanching of several vessels nasally and temporally with mild lens drop. No impingement on tube shunt noted.
Intermediate and near vision were trialed using +1.75DS and +2.50DS loose lenses over scleral contact lenses. The patient was quite satisfied with vision at both distances. Due to adequate lens fit, a Jupiter Plus multifocal scleral lens design was ordered. Small changes were made to address blanching in both eyes.

Follow-Up Visit #2:

<table>
<thead>
<tr>
<th>Essilor</th>
<th>Diameter</th>
<th>BCR</th>
<th>Power</th>
<th>Remaining Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jupiter Plus</td>
<td>15.4 B</td>
<td>7.87</td>
<td>+11.00</td>
<td>8.07 x 1.7/ 8.3x1.0/12.75 x 0.4/ 14.25x 0.3/ 8.6ozd /0.65</td>
</tr>
<tr>
<td>Jupiter Plus</td>
<td>15.4 B</td>
<td>8.06</td>
<td>+15.63</td>
<td>8.26 x 1.7/ 8.3x1.0/13.50 x 0.4/ 14.75x 0.3/ 8.6ozd /0.75</td>
</tr>
</tbody>
</table>

**Visual Acuity:**
OD: 20/20-3   RS 70
OS: 20/20-3   RS 70
OU: 20/20-3   RS 60

Parameters Changed From Previous Lens:
OD: The center thickness was reduced to minimize weight of lens and avoid lens drop.
OS: The landing and edge curve were flattened to eliminate any blanching of blood vessels.
OU: The overall diameter was increased to lengthen the landing curve width to distribute weight of lens evenly across the sclera.

Fitting Relationship: (Observations after 20 minute settling period)
Both eyes demonstrated adequate central clearance of approximately 400 microns. The lenses provided adequate limbal clearance in all quadrants and good scleral alignment. No impingement on tube shunt noted. Minimal flexure of 0.25D was noted in both eyes.

Due to complaints of image ghosting, modified monovision was trialed using a multifocal scleral lens in the left eye and standard spherical design in the right eye. With an over-refraction of -0.25DS in the right eye and +0.75DS in the left eye, binocular visual acuity at distance was 20/20-1 and RS 50 at near. The patient reported that image ghosting had decreased tremendously. At this visit, it was determined that modified monovision using one multifocal scleral lens may be the best option for patient adaptation.

Follow Up Visit #3:

<table>
<thead>
<tr>
<th>Essilor</th>
<th>Diameter</th>
<th>BCR</th>
<th>Power</th>
<th>Remaining Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jupiter Scleral</td>
<td>15.4 B</td>
<td>7.87</td>
<td>+10.75</td>
<td>8.07 x 1.7/ 8.3x1.0/12.75 x 0.4/ 14.25x 0.3/ 8.6ozd /0.55</td>
</tr>
<tr>
<td>Jupiter Plus</td>
<td>15.4 B</td>
<td>8.06</td>
<td>+16.38</td>
<td>8.26 x 1.7/ 8.3x1.0/13.50 x 0.4/ 14.75x 0.3/ 8.6ozd /0.79</td>
</tr>
</tbody>
</table>

**Visual Acuity:**
OD: 20/25-1   RS 100
OS: 20/20+1   RS 100
OU: 20/20+1   RS 80
Parameters Changed From Previous Lens:
OU: The over-refraction was incorporated into new power.

Fitting Relationship: (Observations after 20 minute settling period)
Both eyes demonstrated adequate central clearance of approximately 200 microns in the right eye and 260 microns in the left eye. The lenses provided adequate limbal clearance in all quadrants and good scleral alignment. Mild impingement was noted temporally in left eye. No impingement on tube shunt noted. Flexure of 0.50D was noted in both eyes.

Distance vision was adequate in both eyes with the left eye having sharper distance vision. Maximum plus was trialed at distance for both eyes. Due to reduced near vision, the right eye was biased for near vision and additional plus was incorporated to only the right eye’s lens power. Also scleral junctions were thickened to help with lens flexure.

Final Outcome

After a few additional follow-up visits, contact lens powers and parameters were finalized. During these visits, the overall diameter of the left eye was increased to lengthen the edge curve width allowing a greater distribution of lens weight across the sclera. Also, the landing and edge curves in both eyes were flattened to help with the blanching noted. The limbal curve was flattened in the left eye. The final lenses prescribed consisted of a spherical single vision scleral GP lens for intermediate vision in the right eye and a multifocal scleral GP lens in the left eye.

<table>
<thead>
<tr>
<th>Essilor</th>
<th>Diameter</th>
<th>BCR</th>
<th>Power</th>
<th>Remaining Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jupiter Scleral</td>
<td>15.4 B</td>
<td>7.87</td>
<td>+12.00</td>
<td>8.07 x 1.7/ 8.3 x 1.0/13.50 x 0.4/ 14.75 x 0.3/ 8.6 ozd /0.55</td>
</tr>
<tr>
<td>Jupiter Plus</td>
<td>15.4 B</td>
<td>8.06</td>
<td>+16.38</td>
<td>8.26 x 1.7/ 8.4 x 1.0/15.00 x 0.4/ 15.25 x 0.4/ 8.6 ozd /0.79</td>
</tr>
</tbody>
</table>

Visual Acuity:
OD: 20/30+  (Intermediate eye)
OS: 20/20-2  (Distance & Near eye)
OU: 20/20-1 RS 20

Fitting Relationship: (Observations after 20 minute settling period)
Both eyes demonstrated adequate central clearance of approximately 260 to 300 microns. The lenses provided adequate limbal clearance in all quadrants and good scleral alignment. (Figures 2 – 4) Areas of mild compression upon removal was noted in both eyes; however, no discomfort was reported. In addition, no impingement on tube shunt was noted.

A one month progress follow-up was scheduled to re-assess visual acuity, lens fitting relationship, and check intraocular pressure due to patient’s glaucoma.
Discussion

Scleral contact lenses can be a viable option for managing aphakic patients, especially in cases where corneal GP lenses are not well-tolerated. Aphakic patients requiring refractive correction and lens stability for extracurricular activities may benefit from multifocal scleral contact lenses. Due to my familiarity with the Jupiter Scleral lens, the Essilor Jupiter Plus multifocal scleral lens was chosen for this aphakic patient.
The Essilor Jupiter Plus scleral lens is a center-distance multifocal lens design. This lens provides an intermediate near add allowing for computer range work. The lens is available in diameters up to 16.6mm. As multifocal scleral lenses fit like a typical scleral lens, a standard scleral diagnostic fitting set can be used. As with any scleral contact lens, it is important to avoid complications such as limbal staining, impingement, compression, blanching, and conjunctival hooing. In this case, scleral contact lenses provided sharp, stable vision, and enhanced comfort. Custom soft multifocal contact lenses would also be a viable option; however, GP contact lenses provide enhanced optical quality and do not absorb ocular medications.

Tube shunts in aphakic glaucoma cases create greater complexity in contact lens fitting and management due to the risk of ocular infection and erosion. In contrast to trabeculectomy performed at the superior limbus, aqueous tube shunts have a posteriorly placed episcleral bleb-promoting explant allowing for contact lens wear. (Figure 5) With no signs of conjunctival erosion or irregularities, there was no contraindication for scleral contact lens wear for this patient. Scleral lenses are designed to be fit without movement; therefore, risk of infection due to mechanical injury is low. With careful fitting, patient education, and close follow-up care, aphakic glaucoma patients with a history of tube shunt surgery can benefit from scleral lens wear.

Figure 5: Baerveldt tube implant (courtesy of oculocam.com)
Acknowledgements

Thank you to Dr. Tim Edrington for his mentorship and clinical expertise!

References