Special Considerations in Managing a Patient with Penetrating Trauma Using Gas Permeable Contact Lens

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Introduction

- This case report outlines contact lens management of a patient with iridodialysis, unilateral aphakia and high corneal irregularity as a result of penetrating trauma
- Special considerations in contact lens selection (**Table 1**) and strategies to overcome fitting challenges (**Table 3**) are illustrated
- Hypoxic risk associated with contact lens wear and recommended contact lens parameters in minimizing hypoxic response are discussed

Background

Penetrating trauma can damage many ocular layers: from cornea to retina. Despite the availability of surgical repair, ocular structures can rarely be restored perfectly. Corneal irregularity can result from traumatic lacerations or sutures. Some patients remain aphakic as they do not have the anatomical integrity to support intraocular lens implantation.

Visual rehabilitation for patients with penetrating trauma can be challenging, particularly for the subgroup that has unilateral aphakia and significant corneal irregularity. Aniseikonia renders the use of spectacles intolerable. Aberrations from corneal irregularity are also not addressed by spectacle correction. Comparatively, rigid contact lenses are superior option. This case describes the use of corneal gas permeable (GP) contact lens in managing a patient with aphakia and concomitant severe corneal irregularity with likely endothelial dysfunction , secondary to penetrating trauma.

Case History

In August 2019, a 36-year-old Caucasian man was referred by his optometrist for a contact lens fit.

Chief Complaint

1. Poor vision OD
2. Occasionally experience diplopia when OD turns out.

Ocular History

- 15 years ago, had 2 episodes of penetrating injury OD
- Post-injury, received corneal suturing and was left aphakic
- Currently, (-) optical correction

Medical History

- Unremarkable

Initial Findings

Visual Acuity:

- OD 20/200 (unaided), 20/70 (pinhole)
- OS 20/15 (unaided)

Anterior Segment Significant Findings:

- OD: 1+ MGD, Trace bulbar hyperemia, superior iridodialysis spanning from 9 to 2 o'clock with fibrotic tissue adhering anteriorly to posterior corneal surface and partially obstructing superior pupil, aphakic (**Figure 1 & 2**)
- OS: 1+ MGD

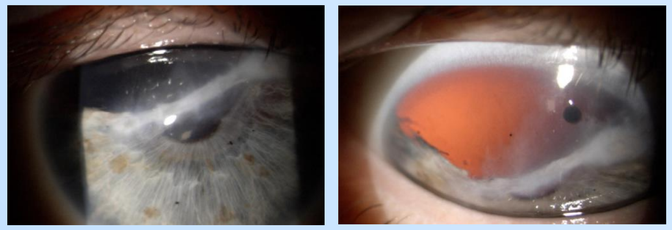

Figure 1: Significant superior iridodialysis OD

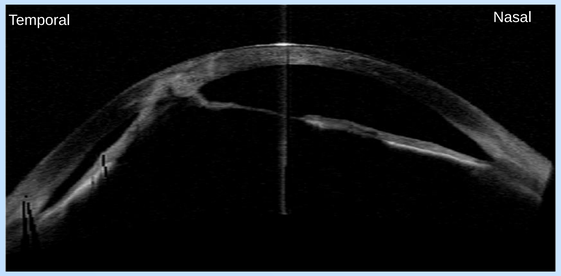

Figure 2: Fibrotic adhesion extending from iridodialysis to corneal endothelium OD

Topography

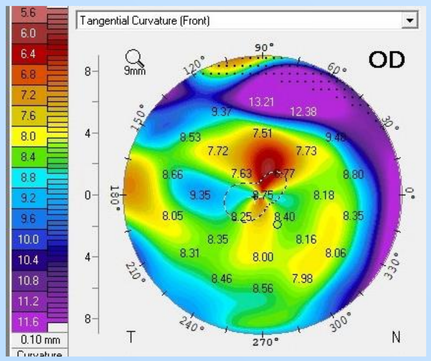

Figure 3: -11.10D of irregular corneal astigmatism OD

IOP, Posterior Segment Findings:

- Within normal limits (assessed by referring optometrist)

Contact Lens Management

Rigid Contact Lens Considerations

Scleral Lens	Corneal GP Lens
Likely more stable fit • High irregular corneal astigmatism	Reduced hypoxic risk • Likely compromised endothelial function • Aphakia/high (+) Rx requiring high central thickness of lens

Table 1: Potential indications for scleral lens versus corneal GP lens

Contact Lens Selection for OD

Lens Name: GP Bitoric **Lab**: Precision Technology

BOZR (mm)	PCR1 (mm)	PCR2(mm)	PCR3(mm)	
8.88/7.35	9.5/7.8	10.3/8.8	11.8/10.0	
BOZD (mm)	**PCW1(mm)**	**PCW2(mm)**	**PCW3(mm)**	**Diameter(mm)**
9.3	0.2	0.2	0.2	10.5
Power			**CT (mm)**	**Material**
+17.75/-7.75X180			0.7	Boston XO_2

Table 2: Parameters of corneal GP lens selected

Visual Acuity

- OD 20/40 with fluctuation (aided with CL)
  20/25 (with over-refraction)

Contact Lens Assessment

- OD: excessive infero-nasal decentration
  adequate vertical movement with blink
  excessive lateral lag
  when centered, aligned with slightly high edge clearance

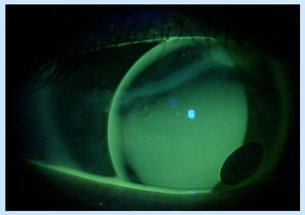

Figure 4a: Corneal GP lens fit with infero-nasal decentration

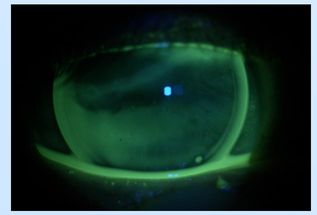

Figure 4b: Fluorescein pattern of corneal GP lens when centered

Fitting Challenges and Troubleshooting

- Challenge: lens decentration and instability
- Troubleshooting:

Method	Description	Outcome
↑ lens diameter	Increased total diameter from 10.5 to 11.2mm	Slight improvement in centration
Piggyback	Trialed with -0.50D Clariti lens	No improvement
↓FOZD	Decrease front optic zone diameter from 9.3 to 8mm	To be assessed

Table 3: Methods employed to improve corneal GP lens fit OD

Discussion

When managing our patient with contact lens, the following factors are considered: potential endothelial dysfunction, aphakia, and high corneal irregularity (**Table 1**). Scleral lens may offer a more stable fit on a highly astigmatic cornea. However, considering our patient's risk of developing hypoxia from scleral lens wear, we ultimately pursued corneal GP lens. Evaluation of hypoxic risk secondary to scleral lens wear is discussed below.

Scleral lens and hypoxia: Scleral lens may have higher hypoxic risk than corneal GP lens. Comparatively, scleral lens has a thicker post-lens tear reservoir, which is thought to be a barrier of oxygen delivery, as an increased hypoxic response is observed with higher tear reservoir (1). To minimize hypoxic response, adequate endothelial health is required and lens thickness should not be excessive. The literature recommends:

1) Endothelial health

- A minimum of 400–700 cell/mm^2 appears necessary for maintaining corneal health and transparency (2)
- Cell density of 1000 cells/mm^2 with high polymegathsim may be a contraindication to SLs, whereas a density of 700 cells/mm2 with a low polymegathsim and at least 50% hexagonal cells may not contraindicate SLs (3)

2) Central lens thickness

- Highest Dk available (>150) lens with a maximal central thickness of 250 um and fitted with a clearance that does not exceed 200um (4)

Our patient:

1) Endothelial health: Endothelial cell count/imaging could not be obtained. However, endothelial dysfunction is suspected considering ocular history and health.

2) Central lens thickness: Lens thickness, measured to be 700um in corneal GP, is likely to be higher in scleral lens design. With this thickness, hypoxic response from scleral lens wear is probable.

Summary

- Considering hypoxic risk, corneal GP lens may be superior to scleral lens in managing aphakic patient with compromised endothelial health
- Consequently, innovative strategies are to be employed to fit corneal GP lens on highly astigmatic cornea

References

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