Corneal Wedge Resection and Limbal Relaxing Incisions: An Unconventional Approach to High Corneal Astigmatism Secondary to Herpes Zoster Ophthalmicus

Corneal wedge resection and limbal relaxing incisions are two distinct surgical procedures that have the potential to permanently reduce or eliminate large amounts of corneal astigmatism, whether performed independently or in conjunction. Although conventional methods to managing astigmatism typically rely on refractive correction via spectacles or contact lenses, there are limits to the optical quality, as well as visual and physical comfort of these devices in the context of irregular or exaggerated corneal topography. Additionally, some patients may not be able to tolerate prolonged contact lens wear for various reasons. It is therefore imperative to consider surgical routes in patients with stable pathologically-induced corneal astigmatism who have been treated unsuccessfully with traditional therapies.

I. Case Presentation

Patient Demographics: 75-year-old white male

Chief Complaint: Rigid gas permeable contact lens awareness and discomfort after one hour of wear OD.

History of Present Illness: Discomfort is ongoing despite being refit several times and complying with proper lens wear and care. The lenses are worn to manage a high amount of corneal astigmatism OD following recurrent unilateral episodes of herpes zoster keratouveitis

Ocular History
- Non-exudative AMD OU
- Keratoconjunctivitis sicca OU
- Pseudophakia with PCIOL OD
- Mild age-related cataract OS
- Inferior visual field defect secondary to possible old superior BRVO OS

Medical History
- Systemic hypertension
- Hypercholesterolemia
- Coronary artery disease
- Benign prostate hyperplasia

Medications
- Restasis OU
- Preserved artificial tears OU
- Preservision AREDs 2 formula vitamins
- Trazodone
- Isosorbide
- Hydrochlorothiazide
- Losartan
- Simvastatin
- Aspirin 81 mg
- Tamsulosin
II. Pertinent Findings

- Habitual RGP Rx
  - OD: Boston EO 7.2B C./+1.00/9.0DIA
  - OS: Boston EO 7.7B C./+4.25/9.0DIA
- BCVA (with RGP): OD: 20/40-, OS: 20/25+
- Pupils: PERRL, (-) RAPD
- EOMs: Full
- Anterior segment findings
  - faint corneal scar superonasal OD, clear cornea OS
  - decreased tear meniscus OU
- Topography reveals up to 15.88D corneal astigmatism OD
- Contact lens assessment
  - Inferior-nasally decentered with excessive movement and heavy against-the-rule NaFl staining pattern OD.
  - Lid attached, aligned fit with adequate movement and tear exchange OS.
- Posterior segment findings
  - PCIOL clear/centered OD, mild nuclear sclerotic cataract OS
  - Mild macular pigmentary changes and hard drusen OD>OS

III. Differential Diagnosis

While in this case, the patient presented with an established diagnosis and etiology for his acquired corneal astigmatism, there are several other conditions which may lead to non-uniform corneal steepening or flattening. Acquired irregular astigmatism may be induced by corneal scarring, pannus or ectasia (keratoconus, pellucid marginal degeneration, or Terrien’s marginal degeneration). Surgical causes include cataract extraction, corneal transplants, and refractive surgeries such as radial keratotomy. While some these conditions are better-suited for treatment with specialty contact lenses, others may benefit more from surgical intervention.

The patient was successfully treated for herpes zoster ophthalmicus (HZO), which manifested as a keratoscleritis. Because of an initial delay in diagnosis and proper treatment, it resulted in corneal inflammation and subsequent peripheral scarring, which altered corneal topography and induced high astigmatism. Since half of scleritis cases are caused by an underlying systemic disease, a thorough work-up is indicated to rule out a life-threatening etiology. Potential causes include rheumatoid arthritis, Wegener granulomatosis, systemic lupus erythematosus, polyarteritis nodosa, inflammatory bowel disease, syphilis, gout, tuberculosis, Lyme disease, sarcoidosis, hypertension, and parasitic infection.

Below are this patient’s lab results compared to demographic-specific reference ranges, each of which rule out other possible etiologies for scleritis, as discussed above:

<table>
<thead>
<tr>
<th>Patient Lab Results</th>
<th>Reference Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP: within normal range</td>
<td>0-10mg/dL</td>
</tr>
<tr>
<td>ESR = 5</td>
<td>&lt;20mm/hr</td>
</tr>
<tr>
<td>RPR: non-reactive</td>
<td>non-reactive</td>
</tr>
<tr>
<td>ANA: negative</td>
<td>negative by ELISA</td>
</tr>
<tr>
<td>C-ANCA = 1:20</td>
<td>≤ 1:20</td>
</tr>
<tr>
<td>P-ANCA = 1:20</td>
<td>≤ 1:20</td>
</tr>
<tr>
<td>RF = 1:20</td>
<td>&lt;1:16</td>
</tr>
<tr>
<td>CT scan: negative</td>
<td>negative</td>
</tr>
</tbody>
</table>
IV. Diagnosis and Discussion

Due to the nature of the astigmatism, the patient was intolerant of the RGP lens edge interaction with the cornea. Increasing the lens diameter or considering other modalities such as hybrid, piggyback, or scleral lenses may have conceivably improved comfort, however the patient had little desire to try other lens options and instead decided to pursue corneal surgery to correct the astigmatism and address the scarring. His co-managing ophthalmologists decided to perform a corneal wedge resection and subsequent limbal relaxing incisions on the right eye.

Corneal wedge resection (CWR) is a procedure that results in removal of approximately 1.0 mm of mid-peripheral corneal tissue. The incisions are made to the depth of Bowman’s layer circumferential to the flat astigmatic meridian, which effectively shortens and steepens the cornea along this axis, correcting ~ 1D for each 0.1 mm of tissue removed. Sutures are placed and removed at 1 month intervals (no sooner than 6 months post-operatively) to allow for proper healing and for control over resultant astigmatic correction.

Limbal relaxing incision (LRI) is designed to add length to the cornea, and is made circumferentially along the steepest corneal meridian 0.5 mm inside of the limbus and may correct up to 3 D of astigmatism. The procedure is typically performed concurrently with strategic corneal incision locations during cataract surgery to correct residual astigmatism that the IOL may not account for. It may also be performed independently under other circumstances, or in conjunction with CWR, as it is in this case.

V. Treatment and Management

It is of utmost priority to ensure there is low chance of recurrence of HZO before considering surgical intervention. Following successful treatment with topical pred forte and oral valacyclovir 1000mg BID, the patient remained stable for five years. After it was determined to be safe to proceed, CWR and LRI were performed on the right eye on the same day. The procedures were tolerated well, but as CWR is sometimes unpredictable by nature, the patient’s most recent topography demonstrates a small amount of residual corneal astigmatism. He is scheduled for a second LRI in September 2015. Depending on the final outcome, scleral lenses may be considered for improved comfort if needed.

VI. Conclusion

Although slightly unconventional, corneal wedge resection can be a long-term beneficial solution to eliminate large amounts of corneal astigmatism in the context of contact lens intolerance. It may correct up to 10D in a single procedure. Similarly, limbal relaxing incision is a quick and relatively safe, less-invasive procedure that may correct a smaller amount of astigmatism with better predicted and controlled outcomes. These procedures may be a viable option when visual acuity is not yet poor enough for a corneal transplant, but the patient is unable to adapt to or tolerate optical corrective devices such as contact lenses or spectacles.

VII. Graphics to be Included

- Topography (pre-operative and post-operative)
- Illustration of CWR technique
- Illustration of LRI technique
- Anterior segment photos

VIII. References


