Bridging the Gap:
A Novel Treatment of Recurrent Corneal Erosion Secondary to Gaping Astigmatic Keratotomy

Adam H.H. Altman, MD
Maj, USAF, MC, FS
Ophthalmology, R2
07 Jan 2020
Disclosures

• No financial disclosures
DoD Disclaimer

• "The views expressed are those of the presenter and do not reflect the official views or policy of the Department of Defense or its Components"
HPI / POH

• 57-year-old F presented to our ophthalmology clinic complaining of sharp pain and photophobia in the left eye.

• POHx:
  • Radial Keratotomy (RK) OU: ~1998
  • Astigmatic Keratotomy (AK) OU: ~1998
  • Recurrent corneal erosions (RCE) OS:
    • Previously treated with bandage contact lenses (BCLs), moxifloxacin, sodium chloride hypertonicity solution, artificial tears, and stromal puncture at varying encounters.
Past History

• Ocular meds: None

• PMHx: None

• PSHx: None

• Soc Hx: None

• Allergies: NKDA

• Fam OHx: None
<table>
<thead>
<tr>
<th></th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCVA</td>
<td>20/40 -&gt; PH 20/20</td>
<td>20/50 -&gt; PH 20/25</td>
</tr>
<tr>
<td>EOM</td>
<td>Full</td>
<td>Full</td>
</tr>
<tr>
<td>Pupils</td>
<td>Reactive, no rAPD</td>
<td>Reactive, no rAPD</td>
</tr>
<tr>
<td>Tp</td>
<td>WNL</td>
<td>WNL</td>
</tr>
<tr>
<td>CVF</td>
<td>Full</td>
<td>Full</td>
</tr>
<tr>
<td></td>
<td>OD</td>
<td>OS</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Ext</td>
<td>No ptosis/proptosis</td>
<td>No ptosis/proptosis</td>
</tr>
<tr>
<td>LLL</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>C/S</td>
<td>W&amp;Q</td>
<td>W&amp;Q</td>
</tr>
<tr>
<td>K</td>
<td>Clear, No haze, 8 RK&amp; 2 AK scars</td>
<td>Erosion over temporal AK w/ gaping of wound, 8 RK and 2 AK scars</td>
</tr>
<tr>
<td>A/C</td>
<td>D&amp;Q</td>
<td>D&amp;Q</td>
</tr>
<tr>
<td>I</td>
<td>R&amp;F</td>
<td>R&amp;F</td>
</tr>
<tr>
<td>L</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>Vit</td>
<td>Clear</td>
<td>Clear</td>
</tr>
</tbody>
</table>
Dilated Fundus Exam

- OD: Disc: C/D 0.30; Vitreous clear; Macula: flat; Vessels: wnl; Periphery: flat 360
- OS: Disc: C/D 0.30; Vitreous clear; Macula: flat; Vessels: wnl; Periphery: flat 360
DDx

- Recurrent Corneal Erosion:
  - Underlying gaping AK
  - Prior Trauma
  - Corneal Dystrophies
- Corneal Abrasion
- Corneal Ulcer
- Corneal Foreign Body
- Dry Eye Syndrome
Initial Treatments

• BCL
• Moxifloxacin
• Sodium Chloride Hypertonicity solution
• Cyclosporine
• Muro
• Anterior Stromal Puncture
Pre-Op: 13 Dec 2018
Pre-Op: 13 Dec 2018
Pre-Op: 13 Dec 2018
Pre-Op: 13 Dec 2018
A New Treatment

- Plan: Corneal suture w/ subsequent CXL
- Procedure:
  - Epi debrided
  - 11-0 suture placed
    - Trace aqueous humor leak noted. Globe stable.
  - CXL w/ Riboflavin and UV light for 30 mins
    - Trace fluid noted
    - Suture removed
    - ReSure and BCL
POD#0: 13 Dec 2018 s/p CXL
POD#0: 13 Dec 2018 s/p CXL
POD#0: 13 Dec 2018 s/p CXL
POD#0: 13 Dec 2018 s/p CXL
POD#0: 13 Dec 2018 s/p CXL
POD#0: 13 Dec 2018 s/p CXL
POD#0: 13 Dec 2018 s/p ReSure
POD#0: 13 Dec 2018 s/p ReSure
POD#0: 13 Dec 2018 s/p ReSure
POD#0: 13 Dec 2018 s/p ReSure
POD#0: 13 Dec 2018 s/p ReSure
POD#0: 13 Dec 2018 s/p ReSure
Post-op regimen

- Vigamox
- Refresh
- Pred Forte
- Oral Vitamin C 500mg BID
POD#1

- Va OS: 20/400 -> PH 20/60-2
- Seidel (-)
- Trace K edema and AC rxn
POD#1

<table>
<thead>
<tr>
<th>POD</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>33/50</td>
<td>175° - 355°</td>
</tr>
<tr>
<td>34/50</td>
<td>171° - 351°</td>
</tr>
<tr>
<td>35/50</td>
<td>167° - 347°</td>
</tr>
<tr>
<td>36/50</td>
<td>163° - 343°</td>
</tr>
<tr>
<td>37/50</td>
<td>159° - 339°</td>
</tr>
</tbody>
</table>

Examination date: 12/14/201
POD#1
POD#1
POD#1

<table>
<thead>
<tr>
<th>36/50</th>
<th>Segment: 163° - 343°</th>
</tr>
</thead>
<tbody>
<tr>
<td>37/50</td>
<td>Segment: 150° - 339°</td>
</tr>
<tr>
<td>38/50</td>
<td>Segment: 155° - 335°</td>
</tr>
<tr>
<td>39/50</td>
<td>Segment: 151° - 331°</td>
</tr>
<tr>
<td>40/50</td>
<td>Segment: 146° - 326°</td>
</tr>
</tbody>
</table>
POW#1: 19 Dec 2018

<table>
<thead>
<tr>
<th>Vision</th>
<th>Segment: 167° - 347°</th>
<th>36/50</th>
<th>36°/50</th>
<th>31/50</th>
<th>36°/50</th>
<th>35°/50</th>
<th>35°/50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
POW#1: 19 Dec 2018
POW#1: 19 Dec 2018
POW#1: 19 Dec 2018
POW#2: 27 Dec 2018

- Complete epithelium closure
POW#2: 27 Dec 2018
POW#2: 27 Dec 2018
POW#2: 27 Dec 2018
POW#2: 27 Dec 2018
POW#2: 27 Dec 2018
POW#4: 11 Jan 2019
POW#4: 11 Jan 2019
POW#6: 30 Jan 2019
POW#6: 30 Jan 2019
POW#6: 30 Jan 2019
POM#2: 20 Feb 2019
POM#2: 20 Feb 2019
POM#2: 20 Feb 2019

<table>
<thead>
<tr>
<th>Value</th>
<th>Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>35/50</td>
<td>167° - 347°</td>
</tr>
<tr>
<td>36/50</td>
<td>163° - 343°</td>
</tr>
<tr>
<td>37/50</td>
<td>159° - 339°</td>
</tr>
<tr>
<td>38/50</td>
<td>155° - 335°</td>
</tr>
<tr>
<td>39/50</td>
<td>151° - 331°</td>
</tr>
</tbody>
</table>
POM#2: 20 Feb 2019
POM#3

- Complete AK closure w/ intact overlying epithelium
- Va OS: 20/40-1 (Initial Va 20/50)
Gaping Keratotomy Wounds: Signs / Sx

**Sx:**
- Pain
- Photophobia
- Glares / halos
- Blurred / fluctuating vision

**Signs:**
- Positive staining w/ fluorescein dye
- Pentacam topography
- Anterior Segment OCT
Gaping Keratotomy Wounds: Etiologies

- **Patient factors:**
  - Underlying collagen vascular diseases (RA, KCS)
  - Post-op ocular massage
  - Movement/Bell reflex during procedure

- **Surgical Technique:**
  - Micro/Macropereforation
  - Inexperience of surgeon
  - Repeat enhancements
  - Crossed incisions
Gaping Keratotomy Wounds w/ RCE: Management

- **Medical:**
  - BCL
  - Muro
  - Cyclosporine

- **Surgical:**
  - Anterior Stromal Puncture
  - Nd:YAG Laser Stromal Puncture
  - Superficial Keratectomy
  - Corneal Suture
Novel Treatment

- Collagen cross-linking
Discussion: Collagen Cross-Linking

• FDA approved:
  • Indications:
    • KCN
    • Post-LASIK ectasia
  • 30 minutes
  • Riboflavin & UV light

• Mechanism:
  • Oxidation triggers release of oxygen free radicals
  • Strengthens chemical bonds between collagen fibrils
Discussion

• Recent uses of CXL:
  • Infectious keratitis
    • Kozobolis V, et al. Cornea 2010
  • Corneal edema:
  • Bullous keratopathy
    • Kozobolis V, et al. Cornea 2010

• Potential use of CXL for gaping AK/RK

• Military relevance
  • Use of CXL for corneal laceration
### S/p CXL

<table>
<thead>
<tr>
<th>Post-op</th>
<th>OS UCVA</th>
<th>OS BCVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>POD #1</td>
<td>20/400 BCL</td>
<td></td>
</tr>
<tr>
<td>POW #1</td>
<td>20/70-1 BCL</td>
<td></td>
</tr>
<tr>
<td>POW #2</td>
<td>20/40 BCL</td>
<td></td>
</tr>
<tr>
<td>POW #4</td>
<td>20/30 BCL</td>
<td></td>
</tr>
<tr>
<td>POW #6</td>
<td>20/50</td>
<td></td>
</tr>
<tr>
<td>POM #2</td>
<td>20/40+2</td>
<td>20/16</td>
</tr>
<tr>
<td>POM #3</td>
<td>20/40-1</td>
<td>20/15-2</td>
</tr>
<tr>
<td>POM #5</td>
<td>20/60</td>
<td>20/20+2</td>
</tr>
<tr>
<td>POY #1</td>
<td>No known RCEs</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion:
Tx of RCE secondary to Gaping AK with CXL

- Numerous treatments
  - BCL, Muro, Corneal suture, Anterior Stromal puncture, Superficial Keratectomy
- Complete resolution remains difficult
  - Varying outcomes
- Treatment continues to improve
  - CXL
Special Thanks

- Dr. Gary Legault
- Dr. Tim Soeken
References


• Lizarrage MT. Radial keratotomy: complications management. EyeWiki 2017; https://eyewiki.aao.org/Radial_keratotomy%3A_complications_management.com


Bridging the Gap: A Novel Application of CXL in Treatment of RCE secondary to Gaping AK

Adam H.H. Altman, MD
Maj, USAF, MC, FS
Ophthalmology, R2
07 Jan 2020

Thank you