

Treatment and Management of Recurrent Corneal Erosions

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Risk Factors

#1 cause: ~45-64% cases are from prior corneal abrasion or trauma

#2 cause: ~19-29% cases have epithelial basement membrane dystrophy or map-dot-fingerprint

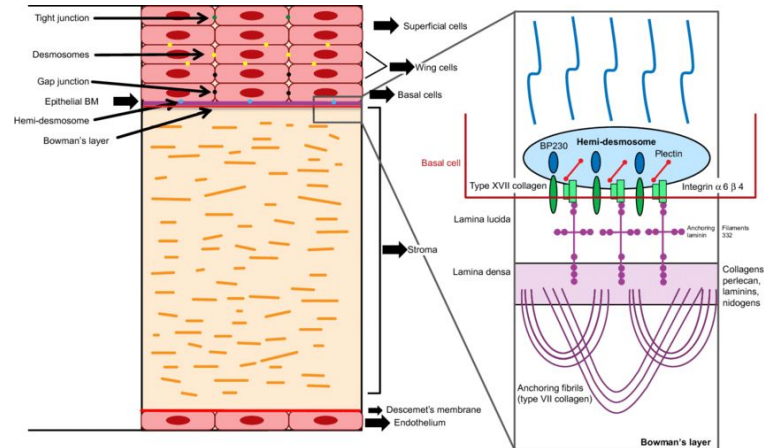
- **~10% of those with EBMD develop RCE**
- **~15% of the population have EBMD**

Other risk factors:

- Corneal dystrophies and degenerations
- Floppy eyelid syndrome
- Prior corneal surgery, LASIK
- Dry eye
- Diabetes
- Blepharitis
- Ocular rosacea

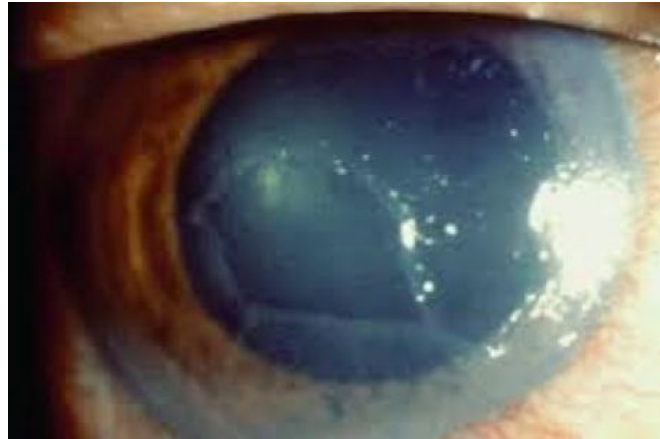
Pathophysiology

- Epithelial layer: superficial cells, wing cells, and basal cells which contain hemi-desmosomes anchored to the epithelial basement membrane
- The corneal epithelial extracellular adhesion complex is composed of hemidesmosomes, various types of collagen, fibronectin and laminin
- Inflammation disrupts the epithelial basement membrane and weakens the hemidesmosome connections.



Pathophysiology

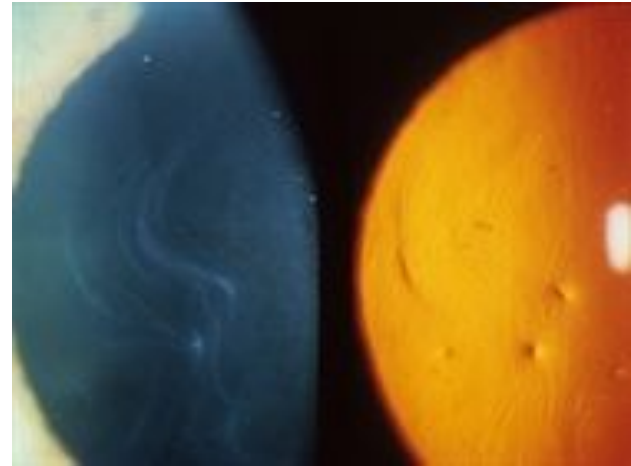
- RCE: Upregulated MMP-2 and MMP-9 cleaves collagen, fibronectin and laminin which further weakens epithelial adhesion
- Nocturnal drying of cornea causes adhesion between tarsal conjunctiva and corneal epithelium
- Often upon awakening, the shearing force pulls the epithelium from the epithelial basement membrane



Signs

- Conjunctival Injection
 - Epithelial defects
 - NaFl staining
 - EBMD: small corneal cysts, map-like lines, negative staining
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- Microform erosions: last as little as 30 minutes, healed epithelium on exam, test with sponge for epithelial adhesion
 - Macroform erosions: lasts days, larger epithelial defects, more severe symptoms

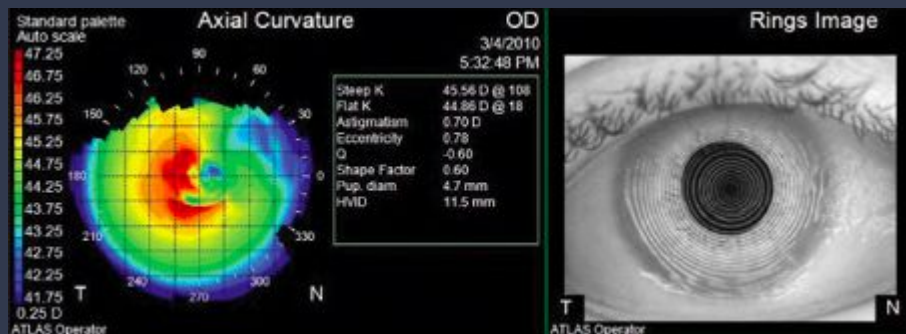
Retroillumination can help highlight corneal abnormalities



Friedman 2013

Topography

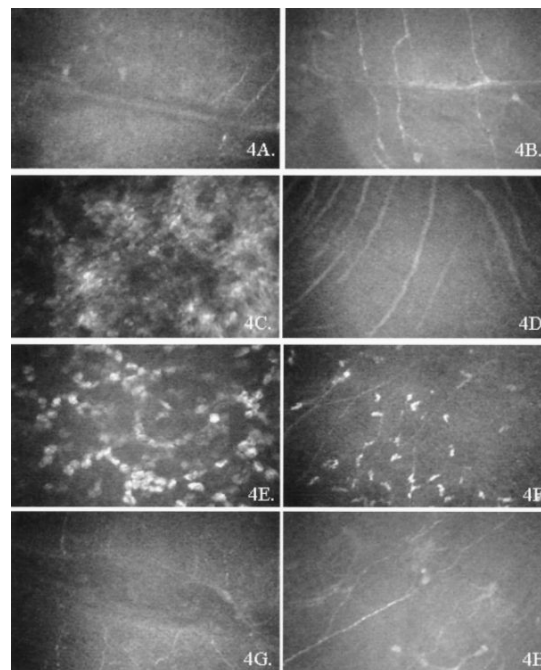
EBMD: irregular mires and focal asymmetric steep areas



ICD 10: H18.59
CPT: 92025

Confocal microscopy

Higher resolution and 10x the magnification of a slit lamp



Anderson (2010), Rosenberg, et al. (2000), Miller, et al. (2019)

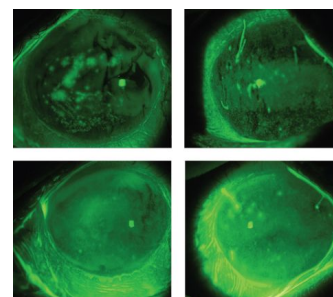
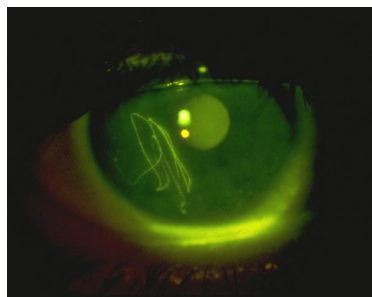
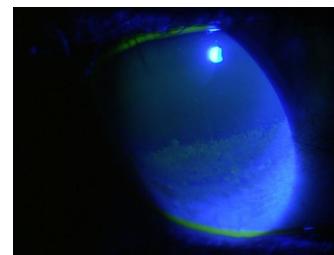
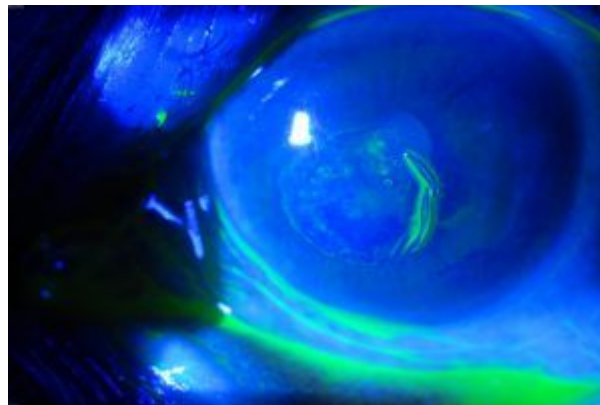
Symptoms

- Sharp, unilateral pain lasting minutes to hours
- Usually noticed upon awakening
- Foreign body sensation
- Redness
- Photophobia
- Blurred vision
- Tearing

Differential Diagnoses

- HSV epithelial keratitis
- Exposure keratopathy
- Neurotrophic keratitis
- Conjunctival foreign body
- Dry eye disease
- Infectious keratitis
- Ocular graft vs. host disease

Recurrent Corneal Erosion



Treatment While Healing

- **Acute pain:** preservative free artificial tears, lubricating ointment, topical cycloplegics, NSAIDs, bandage contact lens
- Lubrication is KEY
- Topical antibiotic: ciprofloxacin qid or Tobradex qid
- Bandage contact lens: initial f/u in 2 days, can wear for up to 3 months changing the lens every 2 weeks
- Amniotic membrane



Amniotic Membrane

Clinical Benefits

- Facilitates re-epithelialization
- Maintains normal epithelial phenotype
- Reduces inflammation
- Impedes angiogenesis and scarring

Other pathologies

- KCS
- SPK
- HSV
- HZO
- Exposure keratitis
- Neurotrophic keratitis
- Corneal edema, ulcers, and abrasions
- Corneal degenerations: Salzmann's nodular, EBMD
- Corneal transplant
- Post-infectious keratitis
- Filamentary keratitis
- Photokeratitis
- Chemical burn
- Bullous keratopathy
- SJS

Amniotic Membrane Composition

- Innermost layer of placenta next to fetus, 20-50 um thick
- Procured in sterile environment during cesarean section and cleaned with salt solution containing antibiotics
- Collagen IV, V, VII, laminin and fibronectin - majority of these are also found in the conjunctiva and cornea
- The amniotic membrane also suppresses fibroblasts and inflammatory cytokines

General Application

- Anesthetic then antibiotic steroid drop
- Remove loose epithelium, cellular debris or exudates from base of defect (Weckcel sponge or Algier brush work well!)
- Apply graft
 - Insert epithelial side of amniotic membrane UP
- Apply bandage contact lens if dehydrated
- Rx broad spectrum topical antibiotic for 1-2 weeks then topical steroids for 6-8 weeks including taper
- Follow-up in 4-7 days

BILLING: CPT code 65778

- About \$1,400 reimbursement by Medicare

Cryopreserved Amniotic Membrane

- Preserved by slow freezing without ice formation
- Retains matrix components like hyaluronic acid, growth factors, fibronectin, and collagen
- Stored in freezer and thawed for about 5-10 minutes at room temperature
- Requires tape tarsorrhaphy



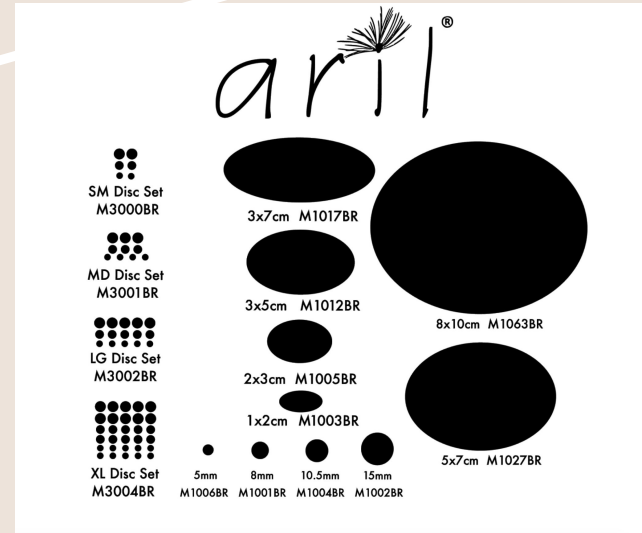
Prokera/Prokera Slim

- Thermoplastic ring stored in glycerol with ciprofloxacin and amphotericin B
- Slim is more comfortable



Dehydrated Amniotic Membrane

- Preserved using vacuum with low temperature heat to retain devitalized cellular components, kept at room temperature and rehydrated
- Advantages: stored dry at room temperature, no tarsorrhaphy required, comfortable with bandage CL, minimal visual interference, low cost



Ambiodisk

- Purion process preserved
 - Proprietary process
 - Gently separates placental tissues and then dehydrates in a way that preserves healing elements.
- Packaged and stored at room temperature for up to 5 years.
- 9mm, 12mm, 15mm sizes



The future of corneal surface regeneration?

- In vitro expansion of limbal epithelial cells using amniotic membranes as a carrier or substrate
- Schwab et al. earlier showed with similar technique of cultured limbal transplantation in 19 eyes (18 patients) 75% success with ocular surface destruction with no complications.
- Small amount of limbal tissue harvested from uninvolved eye
- AMX topical application of AM extracts
 - Not FDA regulated but distributed by a few different companies in the US including Biotissue/Tissue Tech Inc, Ocular Science Inc, and Regener-Eyes
- Currently no studies on which type of extraction technique is best, standardized assay, comparison with autologous blood products

Treatment for Recurrent/Severe Cases

- **60% will have recurrent symptoms**
- Systemic tetracyclines (Doxycycline 50mg bid x 20 months) and topical steroids (TID x 2-3 weeks)
 - MMP-9 downregulates production of lipase and prevents breakdown of collagen and hemi-desmosomes
- Treat underlying lid disease like MGD and blepharitis with traditional therapies of hot compresses, lid hygiene, and oral omega 3 supplements
 - MGD causes increase in lipase which creates toxic fatty acids, compromise healing of epithelial membranes
- Topical hypertonic gtts/ung - Muro 128 ung qhs and 2 gtt solution qam for 6-12 months
 - Osmotic gradient promotes adhesion by absorbing fluid from epithelium
- Punctal plugs - lubrication is KEY!
- Blood serum eye drops containing growth factors and cytokines
 - Autologous serum: patient donates blood which is centrifuged to extract serum and then diluted
 - Can be very expensive for 2-3 month supply

Surgical Interventions

Diamond burr polishing

- Pros: LOWEST recurrence rate, in office
- Cons: longer recovery, corneal haze
- Bowman's polished, removes basement membrane, faster re-epithelialization
- Steroids can reduce corneal haze

Steps: proparacaine, mild pressure with sponge or golf spud to remove loose epithelium, Alger brush with diamond burr tip to smooth corneal surface and remove uneven basement membrane, mild pressure with broad strokes, again use moistened sponge, instill antibiotic and NSAID, apply BCL or AM



Surgical Interventions

- Epithelial debridement
 - Cellulose sponge, blunt spatula remove 7-10mm for central epithelium, BCL applied, topical antibiotic and steroid
 - Little evidence for recurrence prevention
- Anterior stromal puncture
 - Success rate 80%, low cost,
 - Best procedure for peripheral RCE outside the visual axis - can scar
 - Topical anesthesia, piece cornea in affected areas with bent 25-27 gauge needle, 0.5 mm apart, promotes adhesions



Surgical Interventions

- Alcohol delamination
 - Removes epithelium and smooths Bowman's
 - Anesthesia, dilute 20% alcohol for 40 sec, alcohol removed with sponge and irrigated with sterile saline, loose epith peeled with spatula to expose Bowman's
- Excimer laser phototherapeutic keratectomy
 - Central RCE, preserved corneal transparency
 - Can be combined with PRK, costly, possible astigmatic and hyperopic shift
 - **Corneal haze was slightly more common in PTK patients (35.7%) than in diamond burr polishing patients (25.9%)**
- PRK for refractive surgery

Summary of Recurrent Corneal Erosions

- Lubrication is KEY!
 - Think preservative free drops every few hours and ointment at night
- Antibiotic coverage and steroid to help reduce inflammation
 - TobraDex TID is easy and convenient for the patient
- Bandage contact lenses are cheap and provide many benefits including reducing pain
- Amniotic membranes are very effective and always a great option to offer your patient
- Diamond burr polishing is the most effective intervention at reducing recurrence rate
- We have so many tools in our belt for RCE - if one doesn't work, try another!