

Clinical & Refractive Optometry is pleased to present this continuing education (CE) article by Dr. Ron Melton and Dr. Randall Thomas entitled **Recurrent Corneal Erosion/Anterior Stromal Puncture**. In order to obtain 2-hours of COPE-approved CE credit, please refer to page 54 for complete instructions.

Recurrent Corneal Erosion/ Anterior Stromal Puncture

Ron Melton, OD; Randall Thomas, OD

SUBJECTIVE

A 28-year-old Caucasian female presented with pain, photophobia, and tearing to the OS upon awakening this morning. The pain so continued throughout the course of the day. Three years ago, the patient had a corneal abrasion to the left eye that was caused by her toddler's sharp finger nail. Subsequently, she had two episodes of breakdown to the left cornea that were treated by pressure patching by an eye doctor in her previous hometown. In both cases it took several days for the left eye pain to resolve. The patient has no family history of eye problems, and no known drug allergies. She is taking birth control pills and has no known drug allergies.

OBJECTIVE

- Visual acuity (VA) uncorrected: OD 6/6 (20/20); OS 6/9 (20/30)
- Gross observation: mild edema to the left upper lid
- Conjunctiva: grade 2 injection OS
- Cornea: OS inferior epithelial breakdown with surrounding loose and irregular surface tissue (3 x 4 mm) with mild fluorescein uptake outlining the area of involved epithelium
- Anterior chamber: deep and quiet OU
- Tension by applanation: 16/16 mm Hg at 4:00 pm

ASSESSMENT

- Recurrent corneal erosion (RCE) OS

PLAN

- The patient was counseled regarding the nature of RCE and the treatment options available. She was tired of the pain and debilitation created by this condition and wanted to take care of the problem once and for all.

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- The anterior stromal puncture (ASP) procedure was performed using a pre-bent 25-gauge needle after the instillation of 1 gtt of proparacaine 0.5% (Figs. 1, 2). Approximately 50 small micropunctures were made down to the superficial 1/3 of the corneal stroma in the involved area, extending approximately 1 mm beyond the area of loose epithelium.
- The OS was cyclopleged with cyclopentolate hydrochloride (Cyclogyl) 1%, a gtt of ketorolac tromethamine 0.4% (Acular LS), and a gtt of the fluoroquinolone moxifloxacin 0.5% (Vigamox) was instilled, and a disposable silicone hydrogyl contact lens was placed on the eye.
- The patient was prescribed Acular LS 1 gtt q.i.d. OS and Vigamox 1 gtt q.i.d. OS. It was recommended she use the analgesic she normally uses for pain if needed.
- A follow-up visit was scheduled in 1 day.

Follow-up day 1

- The area of corneal involvement showed a 50% improvement in the erosion with the micropuncture defects healing nicely.
- The patient was instructed to continue with the bandage contact lens, the Acular LS, and Vigamox as before, with a follow-up visit scheduled in 2 more days.

Follow-up day 3

- The corneal epithelium had completely filled in with only minimal edema and poor wetting seen as the involved area.
- The bandage contact lens was removed and the patient was instructed to use transiently-preserved artificial tears at least q.i.d. OS and artificial tears gel every night OS over the next month.

Follow-up 1 month

- The corneal surface OS showed no evidence of defect, with the area where the micropunctures were performed having healed.
- There was only minimal microscopic evidence of stromal microscars remaining.
- It was recommended that the patient continue the transiently-preserved artificial tears q.i.d. OU long term and have annual ocular health examinations.

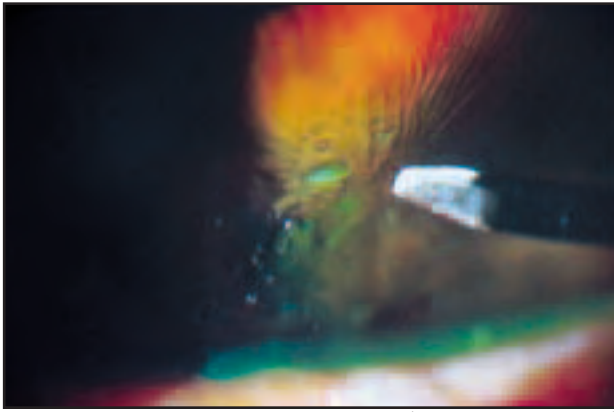


Fig. 1 The anterior stromal puncture procedure (epithelial reinforcement) is being performed on the patient with a 25-gauge needle with a bent tip. Note that enough force is exerted to the involved area that there is accompanying wrinkling to the surrounding epithelial tissue.

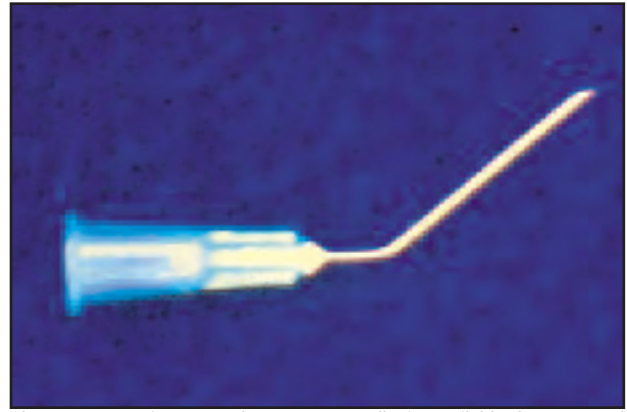


Fig. 2 An anterior stromal puncture needle is available from several companies.

Comments: This patient represents a classic case of a RCE. The previous history of a corneal abrasion from a sharp fingernail and the recurrent episodes of corneal breakdown are pathognomonic features of RCE. Symptoms of pain, photophobia, and tearing are common in patients with this condition. The localized area of irregular corneal epithelium that stains lightly is also usually observed.

There are several treatment options available for RCE. The aggressiveness of the treatment depends on the severity of the corneal erosion and the frequency of recurrences. In this case, the patient had gone through the initial injury and two recurrent episodes. By this time most patients are seeking anything that will cure the recurrent problem. Typically, after the initial episode and one breakdown, it would be advisable to offer the anterior stromal puncture procedure as an option that in most cases prevents further recurrences. The procedure is simple, quick, safe, and effective in eliminating the recurrent events. The recent medical approach of the steroid eye drops and doxycycline therapy could also be offered as an option for the patient.

General Observations

- RCE can occur spontaneously secondary to epithelial basement membrane dystrophy (EBMD), or subsequent to prior corneal trauma where the epithelial basement membrane sustained damage. This latter expression can occur days, weeks, months, or years following the original trauma.
- The most common patient history is one of sharp pain, either during sleep, or immediately upon awakening. The acute pain can be transient, lasting

only seconds or minutes, or it may persist a few hours. Patients who commonly present have had acute pain for a few hours. Depending on the time delay and the severity of the erosion, the clinical findings can be negative, or demonstrate a pinpoint epithelial defect, or a mottled-splotchy defect, or a frank erosion/abrasion.

- There is a myriad of therapeutic approaches that can be used, depending upon the temporal sequence (i.e., initial or recurrent event), and the severity of the clinical presentation. Such therapies include artificial tear lubrication, hypertonic preparations (5% NaCl solution and/or ointment), cycloplegia, pressure patching, therapeutic/bandage soft contact lenses, debridement, anterior stromal puncture, or a combination of these.
- The basement membrane is produced by the basal epithelial cells, and it generally takes about 8 weeks for a defect in this membrane to be repaired. Once the integrity of this membrane has been breached, aggressive therapeutic maneuvers should be undertaken for about 8 weeks. Initially, or certainly by the second erosive episode, the technique of anterior stromal puncture should be considered, since it has been shown to be a permanent fix in the vast majority of patients. This is accomplished with a small-gauge sterile needle whose tip has been microbent so as to limit the depth of puncture to the anterior 1/4 of the cornea. Bausch & Lomb Surgical and other manufacturers also make a commercially available needle product for this purpose. Anterior stromal puncture is easily accomplished at the slit lamp following topical anesthesia, and it takes less

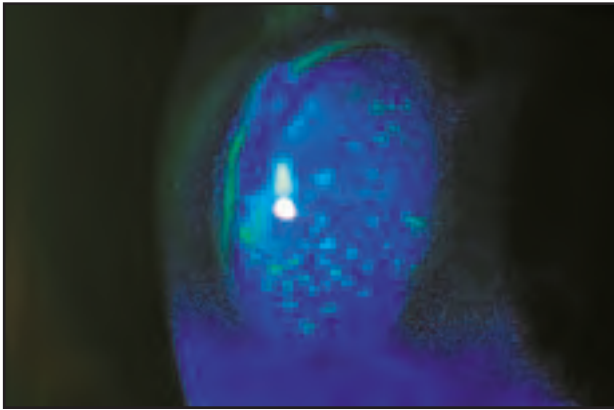


Fig. 3 This patient had a history of a painful bullous keratopathy and is undergoing anterior stromal puncture. Approximately 25% of the micro-punctures have been performed (shown by fluorescein dye).

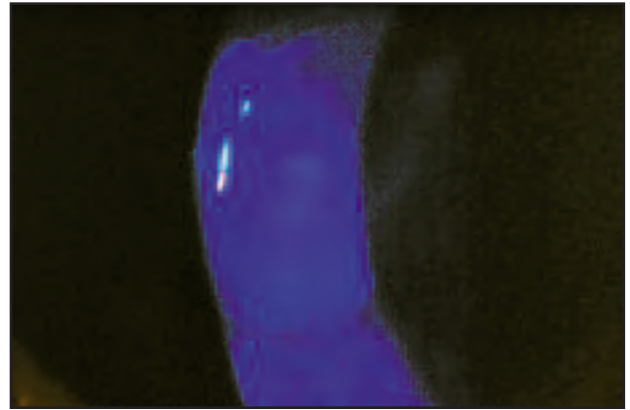


Fig. 4 At the patient's 1-week follow-up visit after the anterior stromal puncture procedure, there is no evidence of epithelial breakdown, and the patient was not experiencing any pain.

than one minute to perform. There is no discomfort to the patient. The procedure can be done with or without intact epithelium. It can be done in all corneal areas, including the visual axis. Be sure to extend the micropunctures slightly beyond the frank epithelial defect.

- As an important side note, some corneal specialists are renaming the anterior stromal puncture procedure and calling it “epithelial reinforcement.” This is a much more patient-friendly terminology. A patient may get very uncomfortable with the thought of having their eye “punctured.” Instead, the technical phrase of “reinforcement” carries with it a much more positive message than does “puncture.”
- Anterior stromal puncture has also been recommended for the treatment of painful bullous keratopathy. With bullous keratopathy, patients get epithelial bullae secondary to endothelial decompensation with resultant stromal edema. This is often painful with patients going on to penetrating keratoplasty. Peter Laibson, MD at Will’s Eye Hospital in Philadelphia, advocates anterior stromal puncture as the treatment of choice for painful bullous keratopathy when corneal transplantation is not a clinical option (Figs. 3, 4).
- The medical literature also supports anterior stromal puncture in cases of advanced anterior basement membrane dystrophy that causes secondary RCE. This would include the procedure being performed in the visual axis, if necessary (Figs. 5-7).
- Long-term management and prevention centers around nocturnal lubrication and advising patients not to rub their eyes, especially upon awakening. Patient education is important because of the potentially chronic nature of this condition.

- In the June 2001 issue of the American Journal of Ophthalmology, D. Dursun et al reported on combination medical therapy for a case series of seven eyes with RCE that were unresponsive to traditional therapies (i.e., patching, bandage contact lenses, cycloplegia, artificial tears and ointments, hypertonic saline, and topical antibiotics). It has been postulated that matrix metalloproteinases can degrade the epithelial attachment complexes, thus hindering renormalization of tissues following cutting types of corneal injuries resulting from fingernails, paper cuts, etc.
- Corticosteroids and the tetracyclines have been shown to decrease the activity of metalloproteinases. Therefore, these seven patients with recalcitrant erosion were rationally treated with doxycycline 50 mg b.i.d., p.o., and a potent steroid (our choice would be loteprednol etabonate [Lotemax]) 2 or 3 times a day for three weeks. All seven patients healed within two to ten days, and the doxycycline was continued for two months. There were no recurrences over a mean follow-up period of twenty-two months. Because these medicines have varying degrees of anti-inflammatory properties, the therapeutic effects may be shared between inhibition of metalloproteinase activity, and inflammatory actions.
- Of note, since corticosteroids can inhibit collagen synthesis, they should be used with caution if the corneal stroma is pathologically thin.
- Interestingly, about 15% of patients with RCE have ocular rosacea, so this could be a predisposing factor in this subset of patients.
- We have embraced anterior stromal micropuncture as our procedure of choice at the second RCE episode. We still manage the initial erosion by traditional

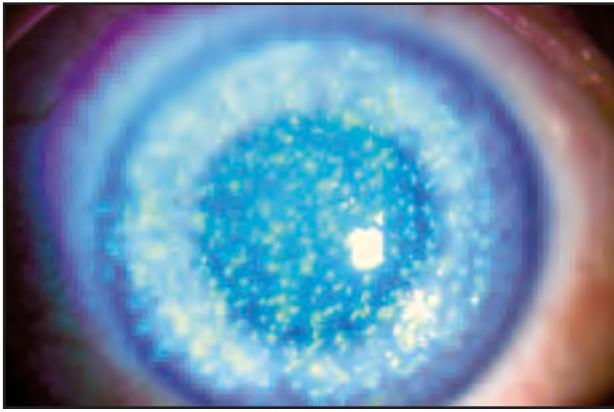


Fig. 5 A pan-corneal anterior stromal puncture procedure was just performed in the patient's cornea, after a long history of RCE secondary to advanced anterior basement membrane dystrophy. Note that the procedure was also performed in the visual axis. (Photo courtesy of Roy S. Rubinfeld, MD)

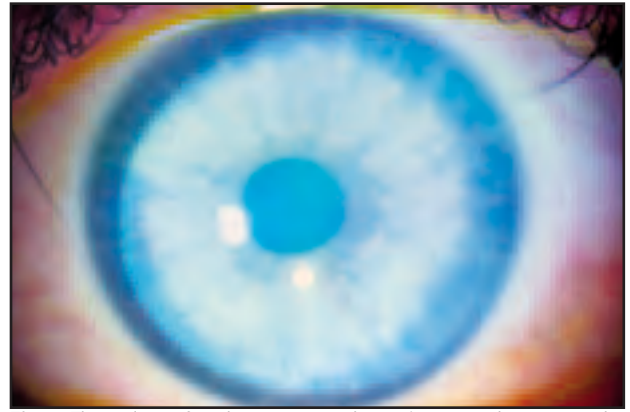


Fig. 6 Three days after the pan-corneal anterior stromal puncture, the cornea had re-epithelialized. (Photo courtesy of Roy S. Rubinfeld, MD)

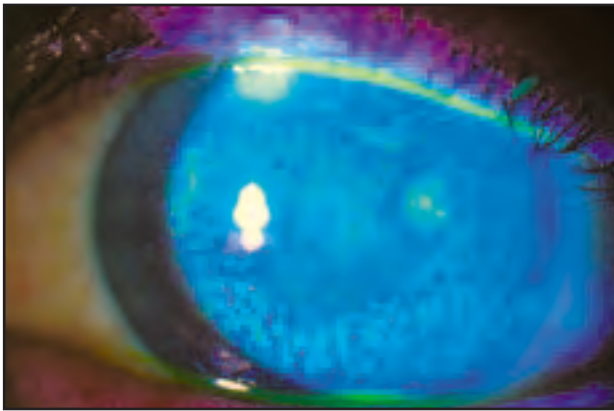


Fig. 7 This patient has advanced anterior basement membrane dystrophy with secondary RCE. She is a candidate for the pan-corneal anterior stromal puncture procedure.

means. It is interesting that ASP was not performed on any of these seven eyes prior to referral to a medical center cornea service. This causes us to

wonder if these seven patients would have been healed if ASP had been done, and therefore, perhaps they might have avoided an unnecessary referral.

- The bottom line appears that there may be two good approaches to patients with problematic RCE. ASP or the medical therapy as outlined above. We will probably try both therapies on selected patients over the next several months to try and get a more definitive feel for which approach best serves most patients, most of the time. We do have good experience with ASP, and have been pleased with its performance. □

Disclaimer: Not every detail of every case is discussed, rather the key clinical findings are described. For example, if nothing is said about the corneal status, you should assume that the cornea is normal, etc. When vision is recorded, it should be assumed to be best corrected or pinholed. Regarding therapy, we show how we treated the particular case. Given that medicine is an art, as well as a science, therapy will — and often does — vary with each unique patient presentation depending on severity, known drug allergies, prior treatment, response to therapy, etc.



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QUESTIONNAIRE

Recurrent Corneal Erosion/Anterior Stromal Puncture

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1. Which one of the following statements is **FALSE**?
 - The patient presented with photophobia
 - The patient had no history of eye problems
 - The patient presented with tearing to the OS
 - The patient's pain was intermittent during the day
2. In this case, which one of the following statements is **TRUE**?
 - The patient's uncorrected visual acuity was OU 6/6 (20/20)
 - Upon examination, the patient showed mild edema to the left upper lid
 - Tension by applanation was 15/15 mm Hg at 4:00 pm
 - Cornea OS showed no irregularity
3. Which of the following statements regarding the patient's history is **FALSE**?
 - She had a previous corneal abrasion to the left eye
 - She had two subsequent episodes of breakdown to the left cornea
 - She has no known drug allergies
 - None of the above
4. Which of the following statements describing treatment is **FALSE**?
 - Anterior stromal puncture (ASP) was performed
 - In this case, little force was needed, therefore wrinkling to the surrounding epithelial tissue did not occur
 - 1 gtt of proparacaine 0.5% was instilled prior to puncture
 - The puncture was performed using a pre-bent 25-gauge needle

5. Which of the following treatment measures was **NOT** undertaken?
 - Cycloplege of OS with cyclopentolate hydrochloride (Cyclogyl) 1%
 - Naproxen sodium 500 mg b.i.d. for pain relief
 - 1 gtt of ketorolac tromethamine 0.4% (Acular LS)
 - 1 gtt of fluoroquinolone moxifloxacin 0.5% (Vigamox)

6. Which of the following does **NOT** describe the treatment follow-up?
 - At follow-up day 1, the area of corneal involvement showed 50% improvement in the erosion
 - Follow-up day 3 showed minimal edema
 - The bandage contact lens was discontinued at follow-up day one
 - Transiently-preserved artificial tears at least q.i.d. OS were prescribed at follow-up day 3

7. In cases of recurrent corneal erosion (RCE), the following statement is **TRUE**:
 - Pain, photophobia and tearing are characteristic of the condition
 - Mild fluorescein uptake in the localized area of involved epithelium is typical
 - Previous history of corneal abrasion and corneal breakdown are pathognomonic features
 - All of the above

8. Which of the following statements is **TRUE**?
 - Several treatment options are available, depending on the severity of the case
 - ASP is usually reserved for patients with multiple injury episodes
 - Puncture procedure is effective on a per-episode basis, but is not known to prevent recurrences
 - ASP is associated with a high complication rate

9. Which one of the following describes the occurrence of this condition?
 - Prior corneal trauma in which the epithelial basement membrane is damaged
 - Spontaneous occurrence secondary to epithelial basement membrane dystrophy
 - Damage to the epithelial basement membrane can manifest even years following the original trauma
 - All of the above

10. ASP has been recommended for which of the following conditions?
 - Painful bullous keratopathy
 - Advanced anterior basement membrane dystrophy causing secondary RCE
 - Painful bullous keratopathy when corneal transplantation is not a clinical option
 - All of the above

11. Clinical findings can be varied. Which of the following is a finding with RCE?
 - Frank erosion/abrasion
 - Mottled-splotchy defect
 - Pinpoint epithelial defect
 - All of the above

12. Which of the following statements is **FALSE**?
 - Basement membrane defects typically take about 3 months to be repaired
 - At the first or second erosive episode, ASP should be considered
 - Puncture procedure is undertaken with topical anesthesia
 - Puncture procedure can be done with or without intact epithelium

13. Identify the issue critical to long-term management and prevention of RCE:
 - Advising patients not to rub their eyes, especially upon awakening
 - Nocturnal lubrication
 - Follow-up visits as prescribed by physician
 - All of the above

14. Which of the following treatments is **NOT** recommended for RCE?
- Bandage contact lenses
 - Hypertonic saline
 - Topical antibiotics
 - None of the above
15. Identify the **FALSE** statement regarding treatment:
- Matrix metalloproteinases can degrade the epithelial attachment complexes
 - Corticosteroids and tetracyclines have been shown to decrease the activity of metalloproteinases
 - Corticosteroids can inhibit collagen synthesis
 - Both doxycycline and Lotemax have shown predictable, reproducible degrees of anti-inflammatory effect
16. Which of the following may be a predisposing factor for RCE?
- Ocular rosacea in patients with pathologically thin corneal stroma
 - Genetic predisposition to compromised anterior basement membrane dystrophy
 - Increasing age
 - Fair-haired individuals with sensitive skin
17. Which of the following statements is **TRUE** regarding the ASP procedure?
- The procedure can be done only with an intact epithelium
 - The procedure takes a few hours to perform
 - The procedure is effective in eliminating recurrent events
 - None of the above
18. Which of the following statements is **FALSE**?
- Anterior stromal procedure can be done in all corneal areas, including the visual axis
 - Some corneal specialists are renaming the procedure “epithelial reconstruction”
 - Micropunctures should extend slightly beyond the frank epithelial defect
 - ASP needles are manufactured by several companies
19. Identify the **FALSE** statement regarding follow-up in this case:
- At follow-up day 1, the patient was instructed to continue use of Acular LS and Vigamox
 - At follow-up day 3, the patient was instructed to use artificial tears gel every night OS over the next month
 - At follow-up 1 month, the corneal surface OS showed no evidence of defect
 - At follow-up 1 month, there was no evidence of stromal microscars
20. Which of the following statements is **FALSE**?
- The basement membrane is produced by the basal epithelial cells
 - Once the integrity of the basement membrane has been breached, aggressive therapeutic measures should be undertaken for about 8 weeks
 - ASP is a permanent solution in the majority of patients
 - None of the above